2
GJBX-154 '79

AERIAL RADIOMETRIC AND MAGNETIC SURVEY:

MILLETT

NATIONAL TOPOGRAPHIC MAP,
NEVADA

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO
UNDER SMALL BUSINESS ADMINISTRATION SUBCONTRACT NO. SB0308(a) 77-C-508

WITH
GEO-LIFE, A JOINT VENTURE
BETWEEN
HIGH LIFE HELICOPTERS, INC.
PUYALLUP, WASHINGTON
AND
GEODATA INTERNATIONAL, INC.
DALLAS, TEXAS

✓ **Geodata International, inc.**

7035 JOHN W. CARPENTER FREEWAY • DALLAS, TEXAS 75247
(214) 630-1600 • TWX: 910-861-4359

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

The following pages are an exact
representation of what is in the original
document folder.

LEGAL NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

AERIAL RADIOMETRIC AND MAGNETIC SURVEY
MILLETT NATIONAL TOPOGRAPHIC MAP
NEVADA

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO
UNDER SMALL BUSINESS ADMINISTRATION SUBCONTRACT NO. SB0308(a)77-C-508

WITH
GEO-LIFE, A JOINT VENTURE
BETWEEN
HIGH LIFE HELICOPTERS, INC.
PUYALLUP, WASHINGTON
AND
GEODATA INTERNATIONAL, INC.
DALLAS, TEXAS

Geodata International, Inc.
7035 John W. Carpenter Freeway
Dallas, Texas 75247

TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION	
A.	General	1
	1. Area Surveyed	}
	2. Summary of the Location, Geology and Physiography of the Millett Map Sheet	
B.	Operational Program	4
II	GEODATA AIRBORNE SYSTEM	7
A.	General	7
B.	Flight Recovery Methods	13
C.	Data Reduction	14
D.	Data Presentation	19
III	GEOLOGY OF THE SURVEYED AREA	21
A.	Location and General Physiography	21
B.	Geology	21
C.	Radioactive Mineral Prospects and Production for the Millett Map Sheet Area	27
D.	Description of Geologic Units of the Millett Geologic Map Sheet	29
IV	RESULTS OF DATA ANALYSIS	45
A.	Geologic Base Maps	45
B.	National Gamma Ray Map Series (NGRMS)	45
C.	Radiometric Stacked Profiles	45
D.	Magnetic Stacked Profile Data	46
E.	Magnetic Tapes and Listings	47
F.	Statistical and Geologically-Created Deviations in Resultant Data	47
G.	Frequency Distributions of Data for Each Geologic Type	54
H.	Microfiche Reproduction of the Single Record Reduced and Averaged Record Data	54
I.	Test Lines	54
J.	Altitude and Ground Speed Histograms	54
K.	Anomalous Data Determined from Examination of Profile Line Data	54
	1. Analysis of Histograms	55
	2. Interpretation of Radioactivity Data	55
	3. Summary and Recommendations	63

APPENDIX	TITLE	PAGE
I.	Frequency Distribution of Radiation Data as a Function of Geologic Unit	
II.	Description of Magnetic Tapes and Listings	
	A. Description of Magnetic Tapes	AII-1
	B. Description of Listings	AII-13
	Single Record Reduced Data Listings	AII-15
	Averaged Record Data Listings	AII-16
III.	Production Summary	

DISCLAIMER
This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION STATEMENT OF THIS REPORT
CB

LIST OF ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1.	Index Map Showing Area Surveyed	2
2.	NTMS Indicating Flight Line Location	3
3.	Data Flow Diagram	5
4.	Sikorsky S-58T	8
5.	Aerospatiale Lama Helicopter	9
6.	Functional Block Diagram	10
7.	Functional Block Diagram	11
8.	Typical End-of-Flight Line Dual Spectral Plot	12
9.	Computer Presentation of Typical Map Line	15
10.	Typical Map Line Showing Statistical Deviations	15

(List of Tables Cont'd.)

<u>Table</u>	<u>Title</u>	<u>Page</u>
10.	Statistical Summary of Radioactivity Anomalies by Geologic Unit	59
AI-1	Summary of Average and Standard Deviation Values for the NTMS as a Function of Geologic Unit	AI-1
AIII-1	Test Line Results	AIII-
AIII-2	Average Lama I Speed and Altitude Determined from Data of Appendix II	AIII-
AIII-3	Diurnal Corrections to Map Line Data	AIII-

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
1.	Geologic Unit Average Value as a Function of Map Line for ^{208}Tl (Counts/Second)	48
2.	Geologic Unit Average Value as a Function of Map Line for ^{214}Bi (Counts/Second)	49
3.	Geologic Unit Average Value as a Function of Map Line for ^{40}K (Counts/Second)	50
4.	Geologic Unit Average Value as a Function of Map Line for $^{214}\text{Bi}/^{208}\text{Tl}$ (Times 100)	51
5.	Geologic Unit Average Value as a Function of Map Line $^{214}\text{Bi}/^{40}\text{K}$ (Times 1000)	52
6.	Geologic Unit Average Value as a Function of Map Line $^{208}\text{Tl}/^{40}\text{K}$ (Times 1000)	53
7.	Geologic Units with Significant Variations from Unimodal Distributions, Based on the Analysis of the ^{208}Tl Histograms	56
8.	Summary of Anomalies	57
9.	Radioactivity Anomalies per Geologic Map Unit	58

SECTION I

INTRODUCTION

A. GENERAL

1. Area Surveyed

Geo-Life, a joint venture between High Life Helicopters, Inc., Puyallup, Washington, and Geodata International, Inc., Dallas, Texas., conducted an airborne gamma ray and total magnetic field survey during the periods October 19 through October 26, 1977 and August 10 through October 11, 1978. The survey covered a region of the state of Nevada identified as the Millett National Topographic Map NJ11-2. The specific area of this report as outlined on Figure 1 was surveyed from an aircraft using large-volume radiation detectors with associated airborne electronic equipment. Each map line was flown in an east-west direction with an average length of 106.6 miles, and each tie line was flown in a north-south direction with an average length of 69 miles. Map lines and tie lines were surveyed using a Lama helicopter and a S-58t Sikorsky helicopter.

The Millett NTMS report describes the program, results, flight line profile data, and statistical analysis results.

2. Summary of the Location, Geology and Physiography of the Millett Map Sheet

The area of the Millett Topographic Map Sheet is in central Nevada between latitudes 39° and 40° north and longitudes 116° and 118° west. It includes parts of Churchill, northern Nye, Eureka, Lander and Mineral counties. The survey area is located within the limits of the Basin and Range Physiographic Province. A series of mountain ranges separated by alluvial valleys trend north-northeastward across the region. The oldest igneous, metamorphic and sedimentary rocks of Paleozoic and Mesozoic age are exposed in the mountain ranges; whereas, the alluvium and unconsolidated valley fill is of Late Tertiary or Quaternary age. The area has a complex tectonic history, having been affected by at least four major orogenic episodes and several minor ones. Several orogenies disturbed the area during the Paleozoic and Mesozoic. The most important of these pre-Cenozoic disturbances were the Antler Orogeny of Late Devonian and Early Mississippian times, and the Sonoma Orogeny of Late Permian and Early Triassic times. However, it was the Late Cenozoic block faulting which was responsible for the development of the basin and range topography.

Radioactive mineral prospects are scattered throughout the survey area. The prospects occur in a variety of rock types of differing ages. Local structural features and intrusive bodies are of particular importance in determining the location of the prospects. The greatest concentration of prospects and claims is in the vicinity of the Austin Pluton in Lander County. The Apex Mine is Nevada's largest producer of uranium ore. Monazite concentrations are also reported in Lander County.

Fig. 1. Index Map Showing Area Surveyed

Figure 2. NTMS Indicating Flight Line Location

The airborne data gathered were reduced using ground-based computer facilities to give the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units indicated from the developed geologic map. Results of analyses of these field data are presented as profile plots of the gamma radiation and earth's magnetic field. The surveyed area of Figure 1, which indicates latitude/longitude position, has been based according to the National Topographic Map Series (NTMS) which covers the United States with 1° latitude/2° longitude sheets. The topographic maps have a scale of approximately 1 inch = 4 miles. Each final base map is an overlay of the NTMS base map from which certain geographic data have been transposed, and includes the available geologic data. Each final anomaly map has the surveyed flight lines superpositioned with the standard deviations of each fifth data point relative to the average value within each geologic unit as determined for each NTMS map. These anomaly maps are identified as National Gamma Ray Map Series maps (NGRMS).

The magnetic data tapes containing (1) raw data tape, (2) the single record reduced data, (3) the statistical analysis data, and (4) the magnetic field data, are converted to the EBCDIC format and retained for filing within the USDOE permanent data bank.

This report also contains a discussion of the area surveyed, and includes all single record reduced data and averaged record data listings on MICROFICHE.

SECTION II

THE GEODATA AIRBORNE SYSTEM

A. GENERAL

The Millett NTMS was surveyed using two different helicopters; part being surveyed using Sikorsky S-58T shown in Figure 4, and part using an Aerospatiale Lama shown in Figure 5. The functional block diagram for the equipment in the S-58T is shown in Figure 6 and that for the Lama is shown in Figure 7. Seven (7) 11½" dia. by 4" thick NaI(Tl) detectors are used with the S-58T to measure the spectral gamma ray intensity at an aircraft elevation of about 400 feet above the earth's surface. Six (6) of these seven (7) detectors are positioned to measure the gamma rays from the earth's surface (from 4π solid angle). The seventh detector is mounted, partially shielded, to monitor ²¹⁴Pb radiation incoming from the upper 2π solid angle.

Each detector has a volume of 415.5 cubic inches. Six detectors give a total volume for measurement of 4π solid angle data of 2493 cubic inches, or a V/v = 20.0 allows an aircraft speed of 124.7 mph (V = detector, volume, in.³; v = aircraft speed, mph.)

The system block diagram of Figure 6 shows the center of the system to be the Canberra 7000 multichannel pulse height analyzer system. The six-detector data are accumulated for each one-second data integration period in a matter giving no dead-time for read out onto magnetic tapes. A single magnetic tape recorder is used recording total spectral data (LDT). Analog presentation of the total gamma count intensity, magnetic and altitude data are plotted onto multitrack paper as data are gathered allowing immediate examination for data quality. A spectral presentation giving the sum of all one-second data sets is created by the ground-based computer for each flight line (EOFL) as quality control, Figure 8. The spectral data from both the unshielded and shielded detector arrays are normally accumulated each 1.0 second. Data from the shielded detector are used to determine the concentration of the atmospheric ²¹⁴Pb which allows calculation of the surface-emanated ²¹⁴Pb values before altitude corrections. All data are then corrected to a constant aircraft altitude above the surface of 400 feet. A highly accurate radar altimeter, the Collins ALT-50 system, makes measurement during each second. Automatic digital gain calibration of the six-detector and one-detector systems is accomplished by stabilizing on the ⁴⁰K photopeak data.

Similarly, the Lama airborne system contains eight (8) 4" x 16" long NaI(Tl) detectors which are used to measure spectrally the surface-emitted gamma ray intensity at an aircraft elevation of about 400 feet above the earth's surface. Two (2) 4" x 4" x 10" long NaI(Tl) detectors, which are largely shielded from the surface radiation, are used to measure the atmospheric ²¹⁴Pb radiation.

Two detector packages, each containing four of the eight 16" long detectors and each with 1,024 cu.in. NaI(Tl), are used to measure

Figure 4. Sikorsky S-58T Helicopter N47246.

Figure 5. Aerospatiale Lama Helicopter

Figure 6. Functional Block Diagram

Fig. 7. Functional Block Diagram

Figure 8. Typical End-of-Flight Line Spectral Plot

gamma radiation from the surface. The total detector volume is 2,048 cu.in., and $V/v = 20.0$ at an aircraft speed of 102.4 mph, (V = detector volume, in.³; v = aircraft speed, mph).

The system block diagram of Figure 7 shows the center of the system to be the Digital Equipment Corporation LSI-11 computer system. The 2,048 cu.in., 4π solid angle, detector data are accumulated for each one-second data integration period in a manner giving no readout dead-time onto magnetic tape. A single magnetic tape is used to record total spectral data and all peripheral data. Analog presentation of the total gamma ray intensity, magnetic field and altitude data are plotted onto multitrack paper as data are gathered allowing immediate examination for data quality. A spectral presentation giving the sum of all one-second data sets is created by the ground-based computer similar to that for the S-58T for each flight line (EOFL) as quality control, Figure 8. Spectral data from the un-shielded (4π) detector array are accumulated each 1.0 second, and spectral data from the shielded (2π) detector array are accumulated each 10.0 seconds. Data from the shielded detector are used to determine the concentration of atmospheric ^{214}Bi values before altitude corrections. All data are then corrected to a constant aircraft altitude above the surface of 400 feet. A highly accurate radar altimeter, the Collins ALT-50 system, makes measurement during each second. Automatic digital gain calibration of the detector arrays is accomplished by stabilizing on the ^{208}Tl photopeak by placing the 2.615 MeV photopeak into channel 224.

A proton precession magnetometer having an 0.25 gamma readout resolution and less than ± 2.0 gamma noise envelope is also sampled once per second providing a measurement of the total intensity of the earth's magnetic field. The sensor is carried as a "bird" on a 100 foot cable to minimize the magnetic effects of the helicopter. A permanent record of flight location is also made using 35mm film which records a continuous recoverable track with 20% overlap-frame at an elevation of 400 feet. Position data from the Global Navigation encoding of latitude and longitude is placed on magnetic tape each second. The record number-of-the-day along the flight line is displayed during flight and key locations are marked on the flight map with their appropriate record number.

The attenuation of gamma radiation is calculated using equations accounting for air density and uses experimentally determined values for mass attenuation coefficients. The energy region 3 MeV and greater is used to allow cosmic events to be removed from the data in the energy range 0 - 3 MeV. Energy resolution of the ^{137}Cs 662.0 keV photopeak was 9.5% or better for each detector. The system resolution was 10.5%.

The airborne equipment has three basic operating modes: (1) CALIBRATE, which allows proper gain calibrations of the radiation detectors to be set; (2) OPERATE, which allows data to be received, reduced and recorded, and (3) PLAYBACK, which allows the operator to examine the newly acquired data.

B. FLIGHT RECOVERY METHODS

Visually recorded data and photographically recorded data have been used to locate the flight line position. The Global Navigation

GNS-500A is used to maintain the aircraft in flight line with the latitude and longitude data being recorded on magnetic tape to assist in flight line location. These lines have been positioned by many locations as function of record numbers. These data are computer plotted giving the flight path as a line of dots, each "dot" representing every fifth record location, and each "circle" represents every 50th record location. Figure 9 indicates the computer plot of a typical map line. These data are then transferred to form the flight line base shown in Figure 2. Location points used to position the flight line at least every 10 miles are shown on the flight line map as an "X" through each point.

C. DATA REDUCTION

The processing flow chart representative of the work performed for this survey is shown in Figure 3. The original field data tapes contain the various tag words, 4π spectral and 2π spectral data for each one second along the flight line. The REFORM program sums the proper energy intervals of the spectra for each second and produces a trailer record for each line which contains the accumulated 4π and 2π spectra for the line. The CDTCT is a data certification program which is run immediately upon receipt of the field data tapes and produces the EOFL spectral plots, Figure 8. The program identification and function are given below:

PROGRAM	FUNCTION
REFORM FIXMOD	Produce energy group sums and EOFL spectra Primary processing for matrix reduction, BIAIR computation, live times, background and altitude correction.
STACK	Flight path recovery to produce plots of actual paths at a scale of 1:250,000
DOPTAP	Single record processing with latitude/ longitude, IGRF and single point statistical adequacy computation. Produces microfiche.
MMPLT	Averaged record processing with averaged statistical adequacy computation. Produces radiometric stacked profiles plot tapes.
GNDMRG	Merges aircraft magnetometer and ground magnetometer in proper time sequence and transfers temperature, pressure and altitude information
RMPLT	Produces tapes for magnetometer stacked profile plots.
GEOLOG	Produces averaged value microfiche with geology and plot tape for standard deviation "dot plots" related to geologic type
HISTO, MERGE and SRT1	Programs preliminary to obtaining the histograms as a function of geologic type for the entire area.
DMPLT	Produces plot tape for the area histograms

Figure 9. Computer Presentation of Typical Map Line

Figure 10. Typical Map Line Showing Statistical Deviations

As stated in the above list of program functions, the FIXMOD program performs the primary processes for determining the reported eTh, eU and K counting rate associated with the earth's surface as measured at 400 feet above the surface. For this reason, the analytical work of this program is described in more detail below.

Each one second of 4 π spectral data is summed by the REFORM program according to the following energy intervals:

(For the S-58T)

Cosmic:	3.0	MeV and greater
²⁰⁸ Tl photopeak:	2.410	to 2.796 MeV
²¹⁴ Bi photopeak:	1.05	to 1.322 plus 1.638 to 2.410 MeV
⁴⁰ K photopeak:	1.322	to 1.638 MeV

(For the Lama)

Cosmic:	3.0	MeV and greater
²⁰⁸ Tl photopeak:	2.410	to 2.796 MeV
²¹⁴ Bi photopeak:	1.660	to 1.860 MeV
⁴⁰ K photopeak:	1.357	to 1.556 MeV

In general, these raw sums contain counts not only from ground sources, but also from aircraft background and atmospheric radioactivity. To determine the counts in the energy intervals which are caused only by the isotope associated with the interval, a 4 x 4 matrix method is used. This matrix may be formed through the use of a standard cosmic spectrum, plus the Walker Field Pad determinations of α , β , γ , and f , or from four standard spectra representing respectively cosmic, thorium, uranium, and potassium pure spectra at a 400 foot altitude.

This matrix multiplication is represented by:

$$\begin{bmatrix} A_{11} & A_{12} & A_{13} & A_{14} \\ A_{21} & A_{22} & A_{23} & A_{24} \\ A_{31} & A_{32} & A_{33} & A_{34} \\ A_{41} & A_{42} & A_{43} & A_{44} \end{bmatrix} \begin{bmatrix} \text{COS} \\ \text{TL} \\ \text{BI} \\ \text{K} \end{bmatrix} = \begin{bmatrix} \text{MCOS} \\ \text{MTL} \\ \text{MBI} \\ \text{MK} \end{bmatrix}$$

where the A_{ij} are the elements of the 4 x 4 matrix; the column matrix on the left represents the four raw data sums and the column matrix on the right is the counts in each energy interval caused only by the indicated

isotope. These matrix result counts are for the measured live time. To obtain the counts per second, it is necessary to divide by the live time, LTC1, thus:

$$\begin{aligned} \text{MCOS/LTC1} &= \text{COS1} \\ \text{MTL/LTC1} &= \text{TL1} \\ \text{MBI/LTC1} &= \text{BI1} \\ \text{MK/LTC1} &= \text{K1} \end{aligned}$$

The TL1, BI2 and K1 counts per second contain the aircraft associated backgrounds caused by thorium, uranium and ⁴⁰K. Geodata has determined these backgrounds for this installation to be 5.5 S-58T/2.53 Lama counts per second in the ²⁰⁸Tl energy interval due to background ²⁰⁸Tl, 5.0 S-58T/2.08 Lama counts per second in the ²¹⁴Bi energy intervals due to background ²¹⁴Bi, and 27.7 S-58T/3.67 Lama counts per second in the ⁴⁰K interval due to background ⁴⁰K. For this work, the background counting rates were determined by high altitude flights free from atmospheric ²¹⁴Bi. The backgrounds are checked during the survey by observing counting rates over large water bodies under the flight path.

These backgrounds are subtracted from the above determined count rate values where B_T , B_U , B_K for the S-58T and Lama are respectively 5.5, 5.0, 27.7 c/s and 2.53, 2.08, 3.67 c/s.

$$\overline{\text{TL1}} = \text{TL1} - B_T$$

$$\overline{\text{BI1}} = \text{BI1} - B_U$$

$$\overline{\text{K1}} = \text{K1} - B_K$$

The $\overline{\text{BI1}}$ value contains counts caused by atmospheric ²¹⁴Bi which must be subtracted before altitude correction is applied. The 2 π crystal data are used to determine the magnitude of the count to be subtracted. Since the predominant variable source affecting the 2 π crystal is the atmospheric ²¹⁴Bi, it is possible to utilize most of the spectrum in the BIAIR determination, and thereby produce some improvement in the statistical error. The energy range used for the 2 π crystal is from 1.05 to 2.79 MeV. Within this range, the aircraft background, B , has been determined as 9.84 c/s (S-58T) and 3.11 c/s (Lama), and the 2 π cosmic count greater than 3.0 MeV must be multiplied by 1.607 (S-58T) and 1.897 (Lama) to determine the cosmic count in the 1.05 to 2.79 MeV range.

The atmospheric ²¹⁴Bi (BIAIR) associated with the unshielded detector array is determined using the shielded detector by the relation:

$$\text{BIAIR} = \frac{G(X) \cdot [\text{VA} - \text{VB} - (k_1 \overline{\text{TL1}} + k_2 \overline{\text{BI1}} + k_3 \overline{\text{K1}})]}{(1 - k_2 G(X))}$$

where: $G(X)$ is the relationship between the 4 π and 2 π detector measurement solid angle and the column change of the detector arrays.

VA is the total count, 2 π , ch (91-239), c/s; k_1, k_2, k_3 are constant correction factors for the penetration/spill of the surface-emanated radiation.

$\overline{\text{TL1}}, \overline{\text{BI1}}, \overline{\text{K1}}$ are results of data reduction, 4 π , c/s

VB is 1.607 COS2 (S-58T) and 1.897 COS2 (Lama), COS2 is the 2 π cosmic count, 3.0-6.0 MeV, c/sec.

The final ²¹⁴Bi counting rate caused by surface sources is then

$$\text{BISUR} = \overline{\text{BI1}} - \text{BIAIR}$$

The quantities $\overline{\text{TL1}}, \text{BISUR}$ and $\overline{\text{K1}}$ are then corrected to an equivalent counting rate at 400 feet through the equations indicated below:

$$\text{TLS} = \overline{\text{TL1}} \cdot e^{-\mu_1 (400 - \frac{\rho}{\rho_0} x)}$$

$$\text{BIS} = \text{BISUR} \cdot e^{-\mu_2 (400 - \frac{\rho}{\rho_0} x)}$$

$$\text{KS} = \overline{\text{K1}} \cdot e^{-\mu_3 (400 - \frac{\rho}{\rho_0} x)}$$

where:

TLS, BIS, KS = respective counting rates at 400 feet caused by surface sources

ρ = air density

ρ_0 = .001293 gm/cc, air density

μ_1, μ_2, μ_3 = respective linear attenuation coefficients

x = aircraft height above the surface in feet

Following data reduction, average values for each radiation variable and variable ratios are plotted for each flight line to demonstrate the consistency of average values and that a smooth flow of results continues from day to day and from start to finish of each day. Quality control on the eU (BIAIR) in the atmosphere is also monitored through examination of data acquired over water with the requirement being that near-zero intensities for BIS should exist. (Sect. IV E.)

Each profile has a latitude or longitude degree line to give accurate surface location of all data.

Magnetic field data are determined at the crossings of the tie line and map line data, and the corrections for the diurnal variations are determined. Any heading errors have previously been removed from all data. The magnetic field data are then IGRF corrected to give the residual magnetic field.

SECTION III.

D. DATA PRESENTATION

The surveyed area was positioned geographically to completely cover the specific National Topographic Map. Each topographic map has been used as the flight base and sufficient geographical and 15' location information has been shown. The flight line pattern has been superpositioned onto these created base maps where the standard deviation levels for each independent variable and each ratio of these variables have been plotted (NGRMS) based on the data contained within the total map area. Every fifth data point along each map line has its standard deviation value shown at the location of that value. Therefore, there are six NGRMS sheets which indicate the location and magnitude of anomalous data, Figure 10.

The multivariable map line profile, which represents all variables as a function of their latitude and longitude location for each line, is presented at a scale of 1:500,000. Each profile presents:

1. Aircraft altitude above the surface
2. eTh (^{208}Tl from ^{232}Th decay series)
3. eU (^{214}Bi from ^{238}U decay series)
4. K (^{40}K from natural potassium)
5. BIAIR (atmospheric ^{21}Bi)
6. Residual magnetic field
7. Gross count (greater than 400 keV)
8. eU/eTh ($^{214}\text{Bi}/^{208}\text{Tl}$) ratio
9. eU/K ($^{214}\text{Bi}/^{40}\text{K}$) ratio
10. eTh/K ($^{208}\text{Tl}/^{40}\text{K}$) ratio
11. Geologic data including aircraft flight path

The residual magnetic field map line profile, which represents five variables as a function of their latitude and longitude location for each line, plus geologic data at a scale of 1:500,000 is presented as:

1. Aircraft altitude
2. Atmospheric temperature
3. Atmospheric pressure
4. Residual magnetic field data
5. Magnetic field base line station data
6. Geological data including aircraft flight path

The output of these various computations supplies, beyond two profile sets, the following data:

- o Histograms of the radiation data distribution within each geologic unit.
- o Histograms of the average velocity distribution for each one-second record for each map and tie line.
- o Histograms of the average altitude distribution for each one-second record for each map and tie line.

- o Tables giving the average radiation concentration of each geologic unit for each flight line.
- o Set of maps showing the standard deviation data as a function of location and radiation variable.

These types of presentation will be explained in this report.

GEOLOGY OF THE SURVEYED AREA

A. LOCATION AND GENERAL PHYSIOGRAPHY

An airborne gamma ray and magnetic survey was conducted over the land area of the Millett Sheet of the National Topographic Map Series - 1:250,000 (N.T.M.S. 1955). The Millett Sheet covers part of central Nevada between latitudes 39° and 40° north and longitudes 116° and 118° west. The area includes parts of Churchill, Nye, Eureka, Lander and Mineral counties.

The geologic map and the ensuing geologic description and explanation of the surveyed area is based primarily on the published bulletins of the Nevada Bureau of Mines, with accompanying maps; in particular the bulletins and maps of Mineral County (Steward and McKee, 1977), and Eureka County (Roberts, Montgomery and Lehner, 1967), and a Preliminary Geologic Map of northern Nye County, at a scale of 1:200,000 (Klein-hempl and Ziony, 1967).

B. Geology

Introduction

The survey area is located within the limits of the Basin and Range Physiographic Province (Fenneman, 1931). A series of mountain ranges separated by alluvial valleys trend north-northeastward across the area. From west to east the ranges are the Clan Alpine Mountains, Desatoya Mountains, New Pass Range, Augusta Mountains, Shoshone Mountains, Toiyabe Range, Toquima Range, Simpson Park Mountains, Monitor Range, Antelope Range, Sulphur Spring Range, and the Fish Creek Range.

The oldest igneous, metamorphic and sedimentary rocks of Paleozoic and Mesozoic age are exposed in the mountain ranges; whereas, the alluvium and unconsolidated valley fill is of Late Tertiary or Quaternary age.

The surveyed area has a complex tectonic history. It has been affected by at least four major orogenic episodes and by several minor ones. Several orogenies disturbed the area during Paleozoic and Mesozoic eras. The most important were the Antler Orogeny of Late Devonian to Early Mississippian times, and the Sonoma Orogeny of Late Permian and Early Triassic times. A series of orogenic disturbances occurred during the Jurassic and Cretaceous. However, it was the Late Cenozoic block faulting which was responsible for the development of the present physiography (Steward and McKee, 1977).

Precambrian Era

Although central Nevada has been tectonically active since Precambrian time, the absence of Precambrian rocks has left no record of the Precambrian crustal movements within the surveyed area.

Paleozoic Era

Early Paleozoic history of the area is associated with the development of a north to south trending geosyncline: miogeosynclinal environments existed to the east; whereas eugeosynclinal conditions prevailed to the west.

The miogeosyncline was a depocenter of predominantly limestone and dolomitic rocks with minor shale and quartzite: the miogeosynclinal rocks are known to be at least 15,000 feet thick, and are referred to as the Carbonate, or Eastern Assemblage. Rocks of the Carbonate Assemblage underlie most of the eastern part of the surveyed area and crop out as windows in central Eureka and Lander counties. The rocks are Cambrian to Early Mississippian in age. A section in the Eureka area is 90 percent limestone and dolomite, 8 percent shale and 2 percent quartzite.

In the eugeosyncline, Lower Paleozoic strata consist of chert, clastic sedimentary rocks and intercalated volcanic and pyroclastic rocks. The eugeosynclinal rocks, which are at least 50,000 feet thick, are known as the Siliceous and Volcanic, or Western, Assemblage. The formations of the Western Assemblage are Cambrian to Devonian in age.

A third assemblage of Early Paleozoic rocks which is transitional in lithology between the Eastern and Western assemblages is termed the Transitional Assemblage. It represents geologic facies transitional between miogeosynclinal and eugeosynclinal environments.

Minor interruptions in deposition occurred during the Early and Middle Paleozoic. These interruptions are documented by unconformities, the most important of which occurs at the base of the Middle Ordovician Eureka Quartzite. As much as 3,500 feet of strata were removed by erosion along this unconformity. Roberts and others (1965) relate the erosion to considerable uplift within the geosyncline and delimit an east-west structure known as the Cortez-Uinta Axis (Roberts and others, 1965).

The Antler Orogeny disrupted the Middle Paleozoic pattern of sedimentation, and started a new cycle that was characterized by coarse clastics distributed both eastward and westward from the orogenic belt. Clastic units of Late Devonian age interlayered with Western Assemblage rocks represent the earliest orogenic deposits derived from local western sources (Stewart and McKee, 1977).

In Early Mississippian time the Roberts Mountain Thrust Plate moved eastward and southeastward, bringing volcanic and siliceous rocks of the Western Assemblage over the Carbonate Assemblage. Deformation of both assemblages occurred and suggest that folding, which accompanied the early part of the orogeny, became more accentuated during the thrusting (Stewart and McKee, 1977).

In Eureka and Lander counties the Eastern and Transitional assemblages that comprise the lower plate are exposed in windows through the upper plate. Gilluly and Gates (1965) suggest that between 5 and 10 miles of thrusting must have occurred to explain the pattern of carbonate exposures in the Shoshone Range.

Windows of carbonate rocks are aligned in northwestern trending belts. These exposures were formed by doming of the Roberts Mountains Thrust during the Antler Orogeny. The doming of the plate was further accentuated by Late Mesozoic and Early Tertiary deformation, and by intrusion of igneous rocks.

Subsequent to the emergence of the Antler Orogenic Belt, clastic debris was transported eastward into the adjacent sea. Early sediments deposited in the basin were shales, sands and conglomerates of the Chainman Shale (Roberts and Lehner, 1955; Brew, 1963) and of the Tonka Formation (Dott, 1955). Emergence continued so that coarse sand and gravels were deposited in the upper Chainman and Diamond Peak formations (Stewart and McKee, 1977).

By Middle Pennsylvanian time the orogenic belt was sufficiently eroded to allow encroachment of the sea and the deposition of the coarse clastics. Pennsylvanian (?) aged siliceous and volcanic rocks of the Havallah Sequence were formed in a geosyncline to the west of the orogenic belt (Roberts, 1964). These rocks were later emplaced within the surveyed area by tectonic transport along the Golconda Thrust, during Late Permian and Early Triassic times (Siberling, 1972).

The Golconda Thrust was the most impressive result of the Sonoma Orogeny. Folding and faulting of the Havallah Sequence in the New Pass Range, prior to the deposition of the Triassic aged Augusta Formation, is related to the Sonoma Orogeny. The orogeny contributed clastic rocks to the upper sections of the Carbon Ridge and Garden Valley formations (Roberts, Montgomery and Lehner, 1967).

Mesozoic

The earliest deposits of Triassic age in the surveyed area occur in Churchill and Lander counties. They are coarse, clastic rocks derived from local uplifts within the region of the Sonoma Orogeny. The major unit is a conglomerate which occurs in the lower part of the Triassic Sequence of the New Pass Range.

The Middle and Upper Triassic rocks consist mainly of limestone and are called the Augusta Sequence. The rocks of the Augusta Sequence crop out in the Mount Lewis area of the Shoshone Range, the Augusta Mountains, the New Pass Range, and in the Toiyabe Range. The Augusta Sequence includes the Favret Formation, the Panther Canyon Formation, the Augusta Mountain Formation, the Cane Spring Formation, and the Osobb Formation (Muller, Ferguson and Roberts, 1951). An undifferentiated unit of the Augusta Sequence is mapped by Stewart and McKee (1977) in the Toiyabe Range. The Augusta Sequence is only mildly disturbed compared to the Paleozoic strata.

Mesozoic events following deposition of the Augusta Sequence are not well known in the central portion of the area. However, in Western Churchill County marine deposition continued into the Middle Jurassic.

The Lower and Middle Jurassic aged rocks consists of a calcareous siltstone and limestone, quartz arenite, and a limestone and marble unit. All three units crop out in the Clan Alpine Mountains.

An orogeny, which began in the Early Jurassic, caused a major withdrawal of the sea. During the orogeny, lava and tuff breccia were extruded and a gabbroic lopolith intruded. Part of the lopolith (Speed, 1962) is exposed in the Clan Alpine Mountains. The complex contains highly differentiated facies near the periphery of the body and more homogeneous gabbro in the interior. Layered rocks near the margins include picrite, olivine gabbro, hornblende, gabbro and anorthosite (Stewart and McKee, 1977).

Intrusive rocks of known Mesozoic age in the western part of the surveyed area are mainly plutonic, and are similar in composition to those of the Sierra Nevada Batholith. The rocks are, generally, porphyritic quartz monzonites and granodiorites. The larger plutons are composed of several facies of granitic rock, and are cut by alaskite or diorite dikes. Contact metamorphism occurs around the periphery of the plutons but is difficult to distinguish when the bodies intrude the siliceous rocks of the Western Assemblage (Stewart and McKee, 1977). The largest plutons are in the central part of the Toiyabe Range near Austin. On the Western side of this range, granitic rock is exposed over an area of about 20 square miles; whereas, on the eastern side, the exposure is almost 40 square miles. Other major plutons include: the Aiken Creek and Carseley Creek plutons, the Clipper Gap Pluton and the Ravenswood Pluton. The latter is of Late Cretaceous age (Stewart & McKee, 1977).

Intrusive rocks in Eureka County are Jurassic, Cretaceous and Tertiary in age, and are not differentiated on the map sheet (Robert, Montgomery and Lehner, 1967). A large pluton that forms Whistler Mountain is composed of muscovite alaskite (Merriam and Anderson, 1942). A second intrusive body that cuts through Wood Cone Peak, in the Fish Creek Range, is composed of granodiorite porphyry.

Cenozoic

Tertiary rocks in the surveyed area are mostly volcanic. Intrusive and sedimentary rocks are less common. No record of the earliest Tertiary time is preserved, and it may be assumed that the area was being eroded. The interval during which erosion predominated continued for about 30 million years (Stewart and McKee, 1977).

Volcanic activity characterized by dacite to andesite lava flows began almost synchronously over much of eastern and central Lander County. The andesite and dacite flows cover a total area of about 200 square miles, more than half of which is in the northern Toquima Range and southern Simpson Park Mountains. Generally, the local lava flows extend over areas of less than ten square miles (Stewart and McKee, 1977).

Following the andesite and dacite flows, rhyolite to quartz-latitude ash flow tuffs spread across much of the surveyed area, during Early Oligocene to Early Miocene time. Some tuffaceous sedimentary rocks, rhyolite flows, and intrusive rocks occur with the ash flow tuffs. The tuffs were derived from several vents, but only a few have been recognized.

In Lander County, the tuffs have been differentiated into the Caetano, Edward Creek, Bates Mountain, New Pass tuffs, an unnamed crystal-poor ash flow tuff, and the Toiyabe Quartz Latite Tuff. (Stewart and McKee, 1977).

The Bates Mountain Tuff is the most widespread. It crops-out in a belt extending northwestward from the Toquima Range across the Toiyabe and central Shoshone ranges to the southern part of the Simpson Park Mountains.

A crystal poor ash flow tuff is concentrated in the Central Desatoya Mountains. In Lander and Churchill counties this tuff is estimated to cover about 90 square miles (Stewart and McKee, 1977).

In general, the age of the tuffs decreases from east to west across Lander County. To the east, in Eureka County, the Tertiary volcanic map units are undivided with respect to age, or composition, despite the fact that substantial parts of the Monitor, Fish Creek, Simpson Park and Roberts mountains have surface exposures (Stewart and McKee, 1977).

However, in the Simpson Park Mountains, within Eureka County, radiometric analysis of biotite, from the auto-brecciated rhyolite, gives a Late Oligocene or Early Eocene date. Underlying the rhyolite is a mass of hypersthene and andesite flow breccia. In the Roberts Mountains, Merriam and Anderson (1942) recognized a sequence of rhyolitic tuff and breccia overlain by andesitic lavas, which in turn were overlain by flows of quartz latite. In one locale, a pyroxene andesite flow overlies the quartz latite. All these rocks are assumed to be of Tertiary age.

A unit known as the Older Volcanic Rocks of Tertiary Age is the basal unit in Churchill County. Wherever it is recognized, it either rests on pre-Tertiary rocks, or is overlain by younger volcanics. The Older Volcanics are exposed in the Clan Alpine and Augusta Mountains. The unit in the Clan Alpine Mountains is an Oligocene aged andesite tuff breccia, with fluviatile interlayers of andesitic debris.

The most widespread volcanic formation in Churchill County is a rhyolite to rhyodacite unit. It includes flows, welded tuffs, tuffs and some intrusive bodies. Interlayered with these volcanic rocks are some sedimentary units that are, generally, too thin to be shown separately. These sedimentary layers, commonly, contain large amounts of admixed volcanic material, and include both lacustrine and fluviatile deposits.

The rhyolite unit rests unconformably on pre-Tertiary rocks at some locations in the Clan Alpine, New Pass and Augusta mountains. The unit is widespread in the Clan Alpine and New Pass mountains. Two units are recognized in the Clan Alpine Mountains: the lower unit is a densely welded rhyolite and rhyodacite tuff; the upper unit has an abundance of quartz phenocrysts and a higher ratio of sanidine.

In the Desatoya Mountains, a thick sequence of rhyodacite welded tuff lies unconformably on the Miocene aged sediments, and are overlain, unconformably, by a thick sequence of welded quartz-latitude tuffs of Late Miocene age.

Along the northwestern front of the Desatoya Mountains, there is a unit of older sedimentary rocks. Included in the unit are the Middlegate and Monarch Mill formations of Axelrod (1956). These are, probably, of Miocene age and rest on, or interfinger with, tuffs of the rhyolite/rhyodacite units.

Sedimentary rocks occur at a variety of levels in the Tertiary column of Lander County. Most are younger than the ash-flow tuffs, and are tuffaceous, ranging from ash-bearing siltstone, sandstone and conglomerate to air fall vitric tuffs. The deposits were formed in lacustrine environments in local basins, and are characterized by abrupt facies change. Correlation of individual units within a single basin is difficult, and between basins is impossible (Stewart and McKee, 1977).

In the Simpson Park Mountains, thick deposits of poorly sorted gravels occur over broad areas. The gravels are composed of pebbles, and boulders of Paleozoic origin, welded tuffs and quartz monzonite. They are probably of Pliocene or, possibly, Miocene age.

Basin and Range structure, consisting of block-faulted mountain ranges, probably began to form in the Late Miocene or Early Pliocene. Late Miocene and Early Pliocene tuffaceous sediments, which lie unconformably on deformed older Tertiary rocks, record the first evidence of tectonism that led to the Basin and Range structures. The outcrop pattern of these sedimentary rocks suggests that they formed in elongate north to south basins, which were predecessors of the present-day basins. Basin and Range structures continued to develop into the

Quaternary, and movement along faults has been recorded in historic times in Churchill County (Stewart and McKee, 1977).

The basin structures are extensive throughout the surveyed area, and, generally, have similar names to those of the neighboring ranges. The basins are filled with unconsolidated Quaternary deposits, which are variously defined, and mapped, in each county report.

In Lander County, Older Quaternary Alluvium is mapped along the lower slopes of the mountains, and towards the periphery of the basins. They consist of unconsolidated, dissected gravels and sand. Similar deposits are mapped in Churchill and Eureka counties, many of which are alluvial fans, or pediment gravels (Willden and Speed, 1974).

Younger alluvium covers the valley floors. In Diamond Valley, for example, the younger alluvium covers the entire floor. Poorly sorted sands and gravels predominate in the upper parts of the stream channels, but finer sands and silts occupy most of the lower parts of the stream channels. In the basins, fine silt and clay predominate (Roberts, Montgomery and Lehner, 1967).

In Eureka and Lander counties, certain playa lake deposits are differentiated, and mapped separately, from the younger alluvial deposits; whereas, in Churchill County, this particular differentiation is not made. Playa deposits, generally, are fine silts and clays, with local sand and gravel lenses.

C. RADIOACTIVE MINERAL PROSPECTS AND PRODUCTION FOR THE MILLETT MAP SHEET AREA

Churchill County

Lignite beds with less than 0.1 percent uranium bearing minerals are located in a Miocene aged section to the west of the Gold Trail Group (Staatz and Bauer, 1954) in the southern half of the Desatoya Mountains.

Eureka County

The Lucky Boy Mines in the Fish Creek Range have ore bodies rich in silver, lead and arsenic which occur in a vertical shear zone in the Eureka Quartzite. Anomalous radioactivity is found in altered areas, probably associated with the shear zone (Garside, 1973).

Northern Nye County

Three prospects occur in the southern Shoshone Mountains. Two are known to occur in the Bonita Canyon Formation (Bonham 1970), and may be related to volcanic processes. These are the Dottie Lee Claim and the Hazel E Prospect. The Idle Wild Claims is reported to occur at the base of a welded tuff, near a two foot clay bed.

Four radioactive occurrences are reported in the Lodi Mining District. The anomalous radioactivity is associated with precious and base metals in quartz veins, in shear zones in granodiorite and along

intrusive contact with shales and limestones. They are respectively; (i) the Smuggler Mine, (ii) the Illinois Mine, (iii) the Wonder Girl Prospect, and (iv) the "66" claim.

The Ultra Mining Co. Group on the western flanks of the Monitor Range has very slightly anomalous radioactivity associated with altered zones, joints and fractures in extrusive volcanic rocks. Iron and manganese oxides are reported (Garside, 1973).

Lander County

Uranium deposits in the vicinity of Austin are often near the contact of a Mesozoic granitic intrusion into Paleozoic rocks. Some prospects occur in fractures in the pluton. The mineralized zone often extends into the surrounding Cambrian and Ordovician rocks. The fracture zones resemble dikes, and are principally finely divided sericite and vein quartz. The fracture zones served as conduits for supergene uraniferous solutions. They are 5 to 50 feet wide and several thousand feet long and dip from 50° N to nearly vertical (Sharp, 1956).

The Apex Mine is Nevada's largest producer. Select samples contain up to 6 percent U_3O_8 . Ore bodies grade as high as 0.5 percent U_3O_8 . Uranium mineralization occurs in and near the contact of the porphyritic quartz monzonite stock with the metamorphosed shales and quartzites of the Gold Hill Formation. Uraninite and Coffinite are localized by bedding plane faults, small folds, transverse fractures and crushed shaly beds along altered, apatite bearing aplitic dikes or intrusive contact areas.

Most of the ore is secondary, occurring along faults in the quartzites and shales, but also in the aplite dikes and quartz monzonite. Autunite, meta-autunite, torbernite and meta-torbernite are present. Some of the crystals have centers of uraninite and coffinite (Garside, 1973).

Autunite and anomalous radioactivity occur along a fracture zone in the quartz monzonite in the El Dorado Claim.

Limited production of ore occurred from the Low Boy Mine in 1959. It is a contact zone of granodiorite and the Vinini Formation. An alaskite dike was intruded near or along the Mesozoic-Paleozoic contact. Most of the ore was mined from the Vinini Formation near the contact. Secondary radioactive minerals occur as coatings along the fractures (autunite and meta-autunite) (Garside, 1973).

The F. Escobar Claims occur along the northern side of the Simpson Park Canyon. Radioactivity is associated with an iron oxide stained fault-breccia zone in the Vinini Formation near a contact with Jurassic granitic rocks. Autunite and meta-torbernite are reported (Garside, 1973).

Several Lander County radioactive occurrences occur in the Tertiary sediments along the Reese River Valley. Many are concentrated near the Steiner Ranch. More than 200 claims were staked there during the 1950's.

No surface mineralization is present at most of the claims. Additionally there are similar scattered localities between the Steiner Ranch area and Austin and one locality (Dacie Creek) in the Fish Creek Mountains southwest of Battle Mountain.

The Boon Uranium Claims occur at the mouth of Boone Creek. Autunite is found along fracture planes in a thin chert bed. The chert lies in a sequence of well bedded, horizontal waterlaid Tertiary tuffs.

In the Birch Creek area, of the Toiyabe Range, Lovering (1954) reports a monazite-bearing placer deposit.

D. DESCRIPTION OF GEOLOGIC UNITS OF THE MILLETT GEOLOGIC MAP SHEET

Paleozoic

Cambrian

Gsc: Scott Canyon Formation

A Lower or Middle Cambrian formation consisting of chert, shale and argillite, with subordinate greenstone flows, pillow lavas and pyroclastic rocks. The formation is part of the Siliceous and Volcanic Assemblage, and lies above the Roberts Mountains Thrust Fault.

Gq: Quartzite and Subordinate Shale

A Lower or Middle Cambrian quartzite, with minor shale, and a ledge forming limestone at the top. The unit is part of the Carbonate and Transitional assemblages below the Roberts Mountains and Eastside thrust faults.

Gs: Shwin Formation

A Middle Cambrian formation of argillite, phyllite, greenstone, slate and limestone. The unit belongs to the Carbonate and Transitional assemblages.

Gh: Harmony Formation

A Middle and Upper Cambrian formation with micaceous sandstone, arkose, shale and subordinate calcareous shale and limestone; the unit is part of the Siliceous and Volcanic Assemblage, and lies above the Roberts Mountains Thrust Fault.

Gha: Hamburg Dolomite

This is a unit of massive dolomite that occurs in the Carbonate Assemblage, below the Roberts Mountains Thrust Fault.

Gcc: Crane Canyon Sequence

A sequence (Means, 1962) of laminated limestone and subordinate black shale. It is a Middle to Upper Cambrian sequence, but may include strata of Ordovician age. It is part of the Carbonate Assemblage.

Gu: Sedimentary Rocks Undivided

The unit is of Middle and Upper Cambrian age, and includes in ascending order, the Prospect Mountain Quartzite, Pioche Shale, Eldorado Dolomite, Geddes Limestone, Secret Canyon Shale, Hamburg Dolomite, Dunderberg Shale and the Windfall Formation. The unit is part of the Carbonate Assemblage, and is mapped in Eureka County.

Ggh: Gold Hill Formation

A Cambrian aged quartzite with subordinate amounts of shale and limestone, mapped in northern Nye County.

Cambrian and Ordovician

OGbc: Broad Canyon Sequence

This is a phyllite and slate unit with microlaminated limestone. It is mapped below the Eastside Thrust in the Toiyabe Range, and is part of the Transitional Assemblage.

Ordovician

Op₁;Op₂: Pogonip Group

The Pogonip group of Lower and Middle Ordovician age includes the Goodwin Limestone, Ninemile Formation and Antelope Valley Limestone. It is part of the Carbonate Assemblage. It is mapped Op₁ in Eureka County and Op₂ in northern Nye County.

Ocw: Clipper Canyon, Willow Canyon and Pinecone Sequences

The unit consists of chert, siltstone and volcanic rocks and belongs to the Siliceous and Volcanic Assemblage. It is mapped in northern Nye County.

Ou: Sedimentary Rocks, Undivided

A Middle Ordovician unit that includes the Pogonip Group, Eureka Quartzite and Hanson Creek Formation.

Oe₁;Oe₂: Eureka Quartzite

A Middle Ordovician aged quartzite that is part of the Carbonate Assemblage. Oe₁ is mapped in Eureka County; Oe₂ is mapped in northern Nye County.

01: Limestone and Subordinate Shale, Dolomite and Quartzite

The unit consists of the Goodwin Limestone, Ninemile Formation, Antelope Valley Limestone, and strata equivalent to the Hanson Creek Formation. It is part of the Carbonate and Transitional assemblages in Lander County.

Ov₁;Ov₂: Valmy Formation

The Valmy Formation consists of chert, vitreous quartzite, and subordinate greenstone, pillow lavas and shale. It is part of the Siliceous and Volcanic assemblages, above the Roberts Mountains Thrust Fault. It is mapped Ov₁ in Lander County and Ov₂ in Eureka County.

Ovi: Vinini Formation

The Vinini Formation consists of chert and shale, sparse limestone, quartzite and greenstone. It is part of the Siliceous and Volcanic assemblages, above the Roberts Mountains Thrust Fault.

Oa: Antelope Valley Limestone

This is a massive cliff forming limestone in Landers County and is part of the Carbonate Assemblage.

Ohc;Oh: Hanson Creek Formation

A Middle and Upper Ordovician Formation consisting of dolomite and platy limestone. It is part of the Carbonate Assemblage. It is mapped Oh in Eureka County and Ohe in northern Nye County.

Ordovician and Silurian

SOeu: Sedimentary Rocks Undivided

The unit, which is part of the Carbonate Assemblage, is mapped in the Mahogany Hills and includes the Hanson Creek and Roberts Mountains formations and the Lone Mountain Dolomite.

SOwu: Sedimentary Rocks Undivided

A Siliceous and Volcanic Assemblage unit, which is mapped in the Simpson Park Mountains. It is in part equivalent to the Valmy and Vinini formations.

Silurian

Se: Elder Sandstone

A feldspathic sandstone, with minor amounts of thin-bedded chert and shale, which is part of the upper section of the Siliceous and Volcanic Assemblage.

S1: Lone Mountain Dolomite

A unit of dolomite, it is an upper part of the eastern, Carbonate Assemblage, and is mapped in Eureka County only.

Silurian and Devonian

DSrm: Roberts Mountain Formation

The Roberts Mountains Formation consists of platy, silty, limestone, with minor dolomite in the upper section and limestone with lenses and interbedded chert in the basal section. It is part of the Carbonate Assemblage.

DSwu: Sedimentary Rocks Undivided

A unit of undivided Devonian and Silurian sedimentary rocks.

Devonian

D1: Limestone

A thick bedded to massive limestone with subordinate silty limestone. It is part of the Carbonate Assemblage.

Ds: Slaven Chert

A predominantly chert unit with sparse siltstone. The unit is of Middle and Upper Devonian age, and is part of the Siliceous and Volcanic Assemblage.

Dn: Nevada Formation

A limestone and shaly limestone in west Eureka County; it is predominantly dolomite in the eastern part of Eureka County. In ascending order the members are: The Beacon Peak Dolomite, the Oxyoke Canyon Sandstone, the Sentinel Mountain Dolomite, the Woodpecker Limestone and the Bay State Dolomite. It is part of the Carbonate Assemblage.

Deu: Sedimentary Rocks Undivided

A unit of undivided carbonate sedimentary rocks which includes the Nevada Formation. It is mapped in Eureka County.

Dtm: Tor and McMonnigal Limestone

A limestone unit (Kay, 1960) mapped in northern Nye County and part of the Carbonate Assemblage.

Dc: Siliceous Siltstone

A unit of the Siliceous and Volcanic Assemblage in the Cockalorum Wash area of northern Nye County.

Dd: Devils Gate Limestone

The Devils Gate Limestone consists of two members, the upper member has interlayered dolomite and dolomitic limestone with limestone predominant. The unit is Middle and Late Devonian in age, and is the uppermost unit of the pre-Antler Orogeny Carbonate Assemblage in Eureka County.

Devonian and Mississippian

MDp: Pilot Shale

A unit of shale which is the uppermost unit of the Transitional Assemblage in Lander County.

Mississippian

Mc: Chainman Shale

A Late Mississippian Shale with a few sandstone interbeds. It is the lowermost unit in the Overlap Assemblage of Eureka County.

Md: Diamond Peak Formation

A formation of predominantly siltstone, sandstone and conglomerate with lesser amounts of claystone and limestone. It is part of the Overlap Assemblage.

Mu: Sedimentary Rocks Undivided

The unit includes the Chainman and Diamond Peak formations and may include the base of the Mississippian Joanna Limestone.

Pennsylvanian

1Pe: Ely Limestone

The Ely Limestone is a cherty limestone unit of eastern Eureka County. It is part of the Overlap Assemblage.

Pennsylvanian and Permian

PIPB: Brock Canyon Formation

The Brock Canyon Formation consists of four units: (i) a conglomerate; comprised of quartzite, chert pebbles, arenite and dolomite; (ii) a dolomitic unit of quartzite and cherty dolomite; (iii) a claystone unit with minor siltstone; (iv) an arkose unit. It may be Pennsylvanian to Mesozoic in age.

PIPa: Antler Sequence

The Antler Sequence consists of the following units, in ascending order: the Battle Formation, a conglomerate with minor sandstone, shale and limestone, of Middle Pennsylvanian age; the Antler Peak Limestone, an upper Pennsylvanian unit; and the Upper Permian Ednes Mountain Formation, of calcareous sandstone with conglomerate and limestone. The unit lies below the Golconda Thrust Fault.

PlPh;lPp;PlPu: Havallah Sequence

The Havallah Formation, PlPh, is a Middle Pennsylvanian and Lower Permian unit comprised of shale, sandstone (quartzite), chert, limestone and conglomerate.

The Pumpernickel Formation (lPp) is a Pennsylvanian aged unit of chert, siltstone, greenstone, flows and pyroclastics.

The Havallah and Pumpernickel formations undivided are mapped as PlPu.

All units lie above the Golconda Thrust Fault.

Permian

Pp1;Pp2: Pablo Formation | Pp1 Mapped in Lander County; Pp2 Mapped in northern Nye County.

The Pablo Formation consists of altered and silicified andesite and dacite flows, sparse chert and conglomerate.

Pg: Garden Valley Formation

The Garden Valley Formation consists of a limestone member, overlain by a unit of conglomerate and carbonaceous shale and sandstone, overlain by a siliceous conglomerate, overlain by a unit of shale and conglomerate. The formation is part of the Overlap Assemblage.

Pc: Carbon Ridge Formation

The Carbon Ridge Formation is mostly a sandy limestone, with sandstone at the base. It is part of the Overlap Assemblage.

Pzc: Chert, Clastic and Volcanic Rocks

The age of the unit is unknown, but may be Pennsylvanian or Permian. The unit occurs in the New Pass Mountains, and consists of interbedded chert, silicified mudstone, siltstone, sandstone, conglomerate and greenstone.

Paleozoic and Mesozoic

Paleozoic and Triassic

TrPzsv: Sedimentary and Volcanic Rocks

The unit consists of slightly metamorphosed siltstone, sandstone, conglomerate and siliceous volcanic rock in the New Pass Mountains.

Mesozoic

Triassic

Trk: Koipato Formation

A Lower Triassic aged unit comprised of felsite.

Trc1;Trc2;Trc3: Conglomerate

Lower and Middle Triassic units consisting of conglomerate with siltstone and tuff at the base. Trc1, is mapped in Churchill County; Trc2 is mapped in Lander County; Trc3 is mapped in northern Nye County.

Trf: Favret Formation

A thin bedded limestone, with interbedded calcareous shale and siltstone.

Tra1Tra2: Augusta Mountain Formation

A massive limestone, with sparse dolomite, shale and conglomerate. The limestone is generally bioclastic. Tra1 is mapped in Lander County; Tra2 is mapped in Churchill County.

Trls: Limestone, Conglomerate and Shale in the Toiyabe Range

A unit of limestone, conglomerate and shale in the Toiyabe Range that is the temporal equivalent of the Augusta Mountain Formation.

Trcs: Cane Spring Formation

An Upper Triassic unit of limestone, dolomite, shale and conglomerate.

Tro1;Tro2: Osobb Formation

The unit is a quartz sandstone, with minor amounts of limestone, shale and conglomerate; Tro1 is mapped in Lander County; Tro2 is mapped in Churchill County.

Trld: Limestone and Dolomite

It is carbonate unit mapped in Churchill County; the unit is of Upper Triassic age.

lrs;lrsu;lrsi;lrsi: Shale and Siltstone

Trs is a unit of undivided shale, sand and siltstone, in the Clan Alpine area.

Trsu is a sub-unit, with thirty to fifty percent intercalated limestone and dolomite.

Trsi is an intermediate sub-unit, which contains more than ninety percent siltstone and mudstone and ten percent sandstone, limestone and conglomerate.

Trsl is a lower sub-unit. It contains seventy to eighty percent siltstone and twenty to thirty percent sandstone.

Triassic-Jurassic

JTrmv: Metavolcanic Rocks

A metavolcanic rock unit, which is mapped in the Desatoya Range in Churchill County.

Jurassic

Ja: Quartz Arenite

This is a Middle Jurassic quartz arenite with a basal limestone and conglomerate.

Jv: Mafic Volcanic Rocks

Basaltic and lapilli tuffs form this unit in the northern Stillwater Range of Churchill County.

Jg: Gabbroic Rocks

A large complex of gabbroic rocks form a lopolith in the northern parts of the Stillwater Range and in the Clan Alpine Mountains. It includes anorthosite and albitite. It is mapped in Churchill County.

Jgr: Granitic Rocks

This Jurassic aged unit contains mostly quartz monzonite and is mapped in Lander County.

Cretaceous

Kn;Knc: Newark Canyon Formation

Silt, shale, sandstone and grit predominate, but conglomerate and fresh-water limestone are also present. It is mapped as Kn in Eureka County and Knc in northern Nye County.

Kg1;Kg2;Kg3: Granitic Rocks

Cretaceous units composed of granitic rock. They include quartz monzonite and granodiorite; Kg1 is mapped in Lander County, Kg2 is mapped in Churchill County, Kg3 is mapped in northern Nye County.

Mesozoic - Cenozoic

Jurassic - Tertiary

TJg: Granitic Rocks

The unit consists mostly of quartz monzonite and granodiorite.

Cretaceous - Tertiary

Tkc: Conglomerate

A conglomerate of Cretaceous to Tertiary age, which is mapped in northern Nye County.

ir: Intrusive Rocks

This unit includes Jurassic, Cretaceous and Tertiary rocks.

Cenozoic

Tertiary

Oligocene

Tov; Tob: Older Volcanic Rocks

Tov is an undivided unit of volcanic rock, which is mainly basalt and andesite.

Tob is mapped in the Stillwater Range, and consists of basalt and andesite.

Toa; Tol: Volcanic Flows

The units consists predominantly of andesite (Toa) and latite (Tol) flows.

Tvl: Lower Volcanic Sequence

The lower Volcanic Sequence is a pumice-rich welded ash flow tuff in the northern Shoshone Mountains. The composition varies from rhyolite to andesite flows. It is mapped in northern Nye County.

Twa; Ta₁ Ts₆: Volcanic Rocks

Twa is mostly a crystal-rich welded ash-flow tuff mapped in northern Nye County.

Ts₆ is a unit of tuffaceous and clastic sedimentary rock mapped in northern Nye county.

Ta₁ consists of andesite flows mapped in northern Nye County.

Tvm: Middle Volcanic Sequence

This is chiefly a lithic rich air fall tuff which includes rhyolite flows in the Shoshone Mountains, and conglomerate in the Toiyabe Range of northern Nye County.

Ts₁: Tuffaceous Sedimentary Rocks

Ts₁ is the earliest of the Oligocene aged tuffaceous sedimentary rock units in the southeastern part of Lander County.

Tad₁: Andesite to Dacite Flows, Flow Breccia and Hypabyssal Rock

Tad₁ is a volcanic unit of flows, flow breccia and some hypabyssal rocks of andesite to dacite composition. It is mapped in Lander County.

Tth: Hall Creek Tuff

The Hall Creek Tuff of southeastern Lander County is a massive ash flow tuff and tuff breccia.

Twt₁: Crystal-Poor Ash Flow Tuff

This is a crystal-poor ash flow tuff mapped in Lander County.

Twt₂: Volcanic and Intrusive Rocks

Twt₂ is a unit of rhyolite flows, local ash flows, flow breccias and intrusive rocks. The unit is mapped in Lander County.

Tdi: Porphyritic Dacite to Quartz Latite Intrusive Rocks

This is a unit of porphyritic dacite to quartz-latite intrusive rock.

Tc: Caetano Tuff

The Caetano Tuff is a crystal rich quartz latite ash-flow tuff, mapped in Lander County.

Twt₃: Ash-Flow Tuff

This unit includes three different ash-flow sheets. One is a strongly eutaxitic unit that contains lithic fragments, another is a crystal poor tuff. It is mapped in Lander County.

Ts₂: Tuffaceous Sedimentary Rocks

An Oligocene aged unit of tuffaceous sedimentary rocks mapped in Lander County.

Twt: Ash-Flow Tuff

This ash flow tuff includes biotite that is 30.8 million years old (K-Ar methods). The unit is mapped in southeastern Lander County.

Oligocene or Miocene

Tts: Crystal-Poor Rhyolite Ash Flow

This unit includes two ash flow tuffs and some tuffaceous sedimentary rocks.

Tmc: Tuffs of Moores Creek

The unit includes welded ash flows tuffs, air fall and water laid tuffs. It is located in northern Nye County.

TwIb: Ash Flow Tuff

Unit is mapped in northern Nye County.

Twtu: Undifferentiated Ash Flow Tuffs

The unit probably contains some Edwards Creek Tuff (Tec) and McCoy Mine Tuff (Ttm) as well as some older tuffaceous sedimentary rocks (Ts₂). It is mapped in Lander County.

Tec: Edwards Creek Tuff

This is a crystal-poor to moderately crystal-rich rhyolite ash-flow tuff. It has several cooling units. It is mapped in Lander County.

Ttm: McCoy Mine Tuff

This is a crystal rich biotite bearing quartz-latite ash flow tuff mapped in Lander County.

Twt₄: Crystal-Poor Rhyolite Ash-Flow Tuff

This crystal-poor rhyolitic ash-flow tuff includes a zone of vitrophyre and probably some intrusive rocks. It is mapped in Lander County.

Tsh: Shingle Pass Tuff

The Shingle Pass Tuff is a crystal-poor welded ash flow tuff which includes tuffaceous sediments at its base. It is mapped in northern Nye County.

Miocene

Tmd: Meadow Creek Tuff

This unit is a composite of welded and non-welded ash flow tuffs. It is mapped in northern Nye County.

Tr₂; Tri; Tru; Tq₁; Trd; Tr₁: Rhyolite to Rhyodacite

Tr₂ is a unit of extrusive rhyolite flows, tuffs and welded tuffs; the unit is mapped in Churchill County.

Tri is a subunit of rhyolitic intrusive bodies.

Tru is mapped only in the Desatoya Range and is the uppermost rhyolite subunit.

Tq₁ is a quartz latite sub-unit.

Trd is a sub-unit of rhyodacite.

Tr₁ is a lower rhyolite subunit mapped in the Desatoya Range.

Tos: Older Sedimentary Rocks

A unit which is mapped in eastern Churchill County and consists of older sedimentary rocks. The most abundant rock type is mudstone.

Twt_{5b}; Twt_{5a}: Crystal Rich Ash Flow Tuffs

Twt_{5a} is a crystal rich biotite tuff. Twt_{5b} is a slightly older crystal-rich tuff. Both are mapped in Lander County.

Tbm: Bates Mountain Tuff

The Bates Mountain Tuff is a crystal poor rhyolite ash-flow tuff. It is mapped in Lander County.

Tn: New Pass Tuff

The New Pass tuff is a crystal-rich rhyolite ash flow tuff. The unit is mapped in Lander County.

Twt₆; Ts₃: Crystal-Poor Rhyolite Ash Flow Tuff

Twt₆ is a unit of crystal-poor rhyolite ash flow tuff. Ts₃ is a unit of tuffaceous sedimentary rock.

Both units are mapped in Lander County.

Tt: Toiyabe Quartz Latite

The Toiyabe Quartz Latite is a crystal-rich ash flow tuff.

Tr₁: Rhyolite Intrusive Rock

This is a unit of rhyolite intrusive rock with minor quartz porphyry and felsite intrusives in southeastern Lander County.

Twt₇: Ash Flow Tuff

Twt₇ is a unit of moderately crystal-rich ash flow tuff mapped in Lander County.

Td₁: Volcanic and Intrusive Rocks

A unit of dacite and andesite lava flows and intrusive rocks. It includes some tuffs and tuffaceous sedimentary rocks locally. It is mapped in Lander County.

Ts₅: Tuffaceous Sedimentary Rocks

Ts₅ includes some non-welded ash flow tuff and air-fall tuff within the tuffaceous sedimentary unit. It is mapped in Lander County.

Ti: Intrusive Rocks

This unit includes intrusive bodies of rhyolite, dacite, andesite and basalt composition and is mapped in Lander County.

Tad₂: Andesite or Dacite Flows and Intrusive Rocks

A unit which includes both intrusive and flow rocks of andesitic and dacitic composition. It is mapped in Lander County.

Tv: Undifferentiated Volcanic Rocks in the Southern Toiyabe Range

This is a unit of undifferentiated volcanic rocks in the southern Toiyabe Range, Lander County.

Tb: Basaltic Flows and Intrusive Rocks

Tb consists of both flow and intrusive bodies of basaltic composition in the southeastern part of Lander County.

Miocene and Pliocene

Td₂; Tdi: Dacite Rocks

Td is a unit of principally dacite flows, whereas Tdi is a unit composed mainly of dacitic intrusive bodies. It is mapped in southeastern Churchill County.

Tyr: Younger Rhyolite

Tyr is mapped in northern Nye County and consists of rhyolite in domes, plugs and flows. It is mapped in northern Nye County.

Pliocene

Tys: Younger Sedimentary Rocks of Churchill County

A unit of sedimentary rocks mapped in eastern Churchill County and consisting mainly of lacustrine and fluvial deposits.

Tyb; Ta₂; Tai: Younger Basalt and Andesite

Tyb consists of both basaltic and andesitic flows whereas Ta₂ is composed mainly of andesitic flows and Tai of andesitic intrusive bodies. The units are mapped in Churchill County.

Tvi: Intermediate Volcanic Rock

Tvi is chiefly rhyodacitic and andesitic flows, tuffs and breccia. It is mapped in northeastern Mineral County.

Tvf: Felsic Volcanic Rocks

This unit which is mapped in northeastern Mineral County consists primarily of rhyolite and quartz latite crystal welded tuff.

Tertiary Undivided

Tvu: Tertiary Volcanic Rocks Undivided

Tvu is mapped in Eureka County and is widespread. The rocks range from basaltic to rhyolitic flows, tuffs and breccias.

Tg: Tertiary Gravels

The gravels are mapped in Eureka County and are a heterogeneous mixture of pebbles and boulders of Paleozoic age, welded tuffs and quartz monzonite. They are probably of Pliocene age or possibly Miocene.

Tertiary and Quaternary

QTad:

A unit consisting chiefly of andesite and dacite flows of uncertain age and mapped in Lander County.

QTb₁: Basalt and Olivine Basalt Lava Flows

Basaltic lava flows which are mapped in Lander County.

QTVu: Cenozoic Volcanic Rocks

Cenozoic volcanic rocks are undivided and mapped as one unit in Eureka County. They include a variety of lithologies.

QTSu: Cenozoic Sedimentary Rocks

Pliocene and Pleistocene lacustrine deposits including tuffaceous sandstone and siltstone are interbedded with conglomerate. Subordinate types are vitric tuff and ash, diatomite, limestone and calcareous shale. It is mapped in Eureka County.

QTM: Mafic Volcanic Rocks

The unit is mapped in Mineral County and is composed mainly of Quaternary flows that are in part trachybasalt and latite.

QTb₂: Basalt and Andesite

A Pliocene-Pleistocene unit of basalt and andesite mapped in northern Nye County.

Quaternary

Pleistocene

Qal₁: Alluvium

Chiefly valley fill, but includes older gravel, slope wash and Pleistocene lake beds. It is mapped in Mineral County.

Qa1₂: Alluvium

Fan and stream gravels flanking mountains and grading into sand and silt in valleys. It includes terrace deposits, and is mapped in northern Nye County

Qoa₁: Older Alluvium

Older Alluvial deposits have been mapped locally in Lander County. The deposits consist of unconsolidated, dissected gravels and sands

Qoa₂: Older Alluvium

The unit consists of alluvial fans that flank the mountain ranges. The unit is mapped in Eureka County.

Qoa₃: Older Alluvium

A unit of dissected alluvial fans; landslides and in some areas pediment gravels which is mapped in Churchill County.

Qog: Older Gravels

A unit of older terrace gravels mapped in Churchill County.

Qp₃: Pediment Gravels

A unit composed of pediment gravels which is mapped in Churchill County.

Qb: Basalt and Basaltic Sediments

A unit of basalt and basaltic sediments which is mapped in Churchill County.

Qs₃: Dune Sand

A unit of dune sand mapped in Churchill County.

Qya: Younger Alluvium

The unit is composed of Lake Lahontan deposits, playa deposits and young fan gravels and is mapped in Churchill County.

Qal₃: Younger Alluvium

Deposits of younger alluvium cover the valley floors and the low slopes of the ranges. It is mapped in Eureka County.

Qp₁: Playa Deposits

Playa Deposits, mostly silts and clays with local sands and gravel lenses are mapped in Eureka County. The deposits are often saline.

Qs₁: Sinter Deposits

Calcareous and siliceous sinter deposits from hot springs are mapped in Eureka County.

Qvu: Basaltic Volcanic Rocks

Quaternary aged volcanic rocks which appear to be volcanic cones and flows are mapped in Eureka County on the eastern flank of the Sulphur Spring Range.

Qa: Alluvium

A unit of valley alluvium and stream deposits mapped in Lander County.

Qm: Moraine

A unit of glacial till and moraine which is mapped in Lander County.

Qs₂: Sinter Deposits

Calcareous and siliceous sinter deposits from hot springs are mapped in Lander County.

Qt1: Slope Deposits

Talus and landslide deposits are sometime differentiated in Lander County.

Qp2: Playa Deposits

Playa deposits are mapped separately in Lander County.

Qf: Fan Deposits

Alluvial fan deposits are mapped separately in Lander County.

SECTION IV

RESULTS OF DATA ANALYSIS

A. GEOLOGIC BASE MAPS

The Millett geologic base map is created to the scale of the NTMS with geologic data and includes latitude, longitude and major geological features. The geologic base map is shown without the super-positioned flight lines at the scale of 1:250,000 and 1:500,000.

B. NATIONAL GAMMA RAY MAP SERIES (NGRMS)

The geologic base has been photographically screened to allow emphasizing of the flight line locations and information regarding data analyses. These maps are the base to which the statistical information for six variables has been added for every fifth data point and are identified as the National Gamma Ray Map Series which are presented at the scale of 1:250,000 and 1:500,000. The detail data for each of these map lines are presented as profile information for six variables and location of geologic information with statistical data included along each map line as discussed in Section IV (F).

C. RADIOMETRIC STACKED PROFILES

Sensitivities were normalized to the Lama I system.

The profiles of Map Lines 1 - 22 and Tie Lines 1 - 9 are presented within this report at the scale of 1:500,000. The same vertical scale is used for a given variable for all map lines, but the vertical scale changes to fit the specific variable plotted. The scale used for each variable are:

1. Altitude

100 feet/division, aircraft altitude above the surface; no averaging.

2. Tl (208Tl)

15 counts/second/division (C/S/div.). Seven seconds of data are averaged with weighting of 1:2:3:4:3:2:1 and the average value plotted at the center of the group of 7. 5.5 c/s = 1 ppm eTh. 5.3 c/s for the S-58T

3. Bi (214Bi)

5 C/S/div; 7-second weighted average as for Tl. 8.0 c/s = 1 ppm eU. 51.1 c/s for the S58-T

4. K (⁴⁰K)

35 C/S/div; 7-second weighted average as for T_L.
85.0 c/s = 1%K. 77.1 c/s for the S-58T

5. BiAir

5 C/S/div; 50-second average. 95-second average for the S-58T

6. Residual Magnetic Field (RMAG)

100 gammas/division; the residual magnetic field is the total magnetic field as measured by a proton precession magnetometer from which has been subtracted the International Geomagnetic Reference Field (Stassinapoulos; NSSDC-72-12).

7. Total Count, 400 keV to 2.80 MeV (GC)

1000 C/S/div; no averaging

8. ²¹⁴Bi/²⁰⁸T_L Ratio (Bi/T_L)

.08 /div; 7-second weighted averaging as for T_L.

9. ²¹⁴Bi/⁴⁰K Ratio (Bi/K)

.04 /div; 7-second weighted averaging as for T_L.

10. ²⁰⁸T_L/⁴⁰K Ratio (T_L/K)

.04 /div; 7-second weighted averaging as for T_L.

11. Geology

The surface geology along the flight line, with a width of about six miles, is displayed above the profiles and the flight path is superimposed.

D. MAGNETIC STACKED PROFILE DATA

For each Map Line and Tie line, a magnetic multiple-parameter stacked profile is produced at a scale of 1:500,000 in this report, and at a scale of 1:250,000 as separate sheets. The same vertical scale is used for a given variable for all Map Lines, but the vertical scale varies to fit the specific variable plotted. The scales used for each variable are:

1. Altitude

100 feet/division; aircraft altitude above the surface; no averaging.

2. Temperature

3 degree celsius/division; no averaging.

3. Barometric Pressure

0.40 inches mercury/division; no averaging.

4. Base Station - Magnetic Field

5 gammas/div; no averaging

5. Residual Magnetic Field

25 gammas/division; no averaging.

E. MAGNETIC TAPES AND LISTINGS

The description of the magnetic tapes and their listings is presented in Appendix II.

F. STATISTICAL AND GEOLOGICALLY-CREATED DEVIATIONS IN RESULTANT DATA

A set of tables are included; see Tables 1-6. These list the average value for each geologic unit encountered on each flight line as a function of flight line for each of the radiation variables.

Standard deviations of the data have been calculated assuming the data to have a normal distribution within the geologic type. When geochemical anomalies modify the normal distribution, then the frequency distribution of the data will be distorted about the mean. Geologic unit data have been analyzed to determine the variance.

$$s^2 = \frac{1}{N-1} \left\{ \sum_{i=1}^N x_i^2 - N\bar{x}^2 \right\}$$

where the standard deviation is s , N is the number of samples, x_i is the value at the sample number i , and $\bar{x}$ is the mean value for the geologic type. The listing for averaged record data output gives the mean value and magnitude of deviations, relative to the mean, with the $\pm 1\sigma$, $\pm 2\sigma$, and $\pm 3\sigma$ levels being placed on the NGRMS Sheets for the six variables as previously explained. The distribution of data within the geologic units encountered are included.

A statistical adequacy test is run on all data. If the test fails, the value of the displayed ratio variable is set to zero and not included in summary tables which gives the average value. The test is made on T_L(eTh), Bi (eU) and K where:

TABLES 1-6

	DC	DD	DEU	DL	DN	DS	DSRM	DSWU	DTM	GCC	GGH	GO	GU	IPP	IR	JA	JGR	JG	JTRMV		JV	KG1	KG2	KG3	KN	KNC	KU	OA	OCW	OE1	OE2	OEHC	OH	UHC	OL	OP1	OP2	OU	OV1
SL 1																				SL 1				100					35					134			41		
SL 2	80																			SL 2				95					59							97			
SL 3																				SL 3				95		94			144		116					99			
SL 4	33									63	85	62								SL 4				75		55										42			
SL 5								33		48									75	SL 5		84			37					27		78			48	69			
SL 6							85					59								SL 6											28			48	44	109			
SL 7							60					71								SL 7										21		57		46	47				
SL 8																				SL 8										32		56			29				
SL 9			16				62								103					SL 9							61			24					31				
SL 10		22	40							48		63								SL 10										39					33				
SL 11			20																	SL 11										26							30		
SL 12		25	26																	SL 12																	95		
SL 13		36				45														SL 13																	66		
SL 14		31				49									42					SL 14							46									54			
SL 15						38				39		63			38					SL 15														50			60		
SL 16										48		57								SL 16														40			36		
SL 17										50										SL 17														50					
SL 18		22																		SL 18																	57		
SL 19		15													83					SL 19		70															55		
SL 20		45											30	51						SL 20										25			26				52		
SL 21		25											14	60						SL 21										18					19		43		
SL 22						46								57		25				SL 22																	46		
SL 23																				SL 23																			
TL 1																				TL 1																			
TL 2																				TL 2																			
TL 3																				TL 3																	51		
TL 4										60		66								TL 4				104													63		
TL 5						51				39		50								TL 5		61												32			44		
TL 6							68		23											TL 6									45										
TL 7															61					TL 7															29	23			
TL 8		30																		TL 8																			
TL 9		35	26												39					TL 9						34		44		32					25				

Table 1. Geologic Unit Average Value as a Function of Map Line for 100% (Counts/Second)

48a

48b

[illegible]

	TR1	TR2	TR3	TR4	TR5	TR6	TR7	TR8	TR9	TR10	TR11	TR12	TR13	TR14	TR15	TR16	TR17	TR18	TR19	TR20	TR21	TR22	TR23	TR24	TR25	TR26	TR27	TR28	TR29	TR30	TR31	TR32	TR33	TR34	TR35	TR36	TR37	TR38	TR39	TR40	TR41	TR42	TR43	TR44	TR45	TR46	TR47	TR48	TR49	TR50	TR51	TR52	TR53	TR54	TR55	TR56	TR57	TR58	TR59	TR60	TR61	TR62	TR63	TR64	TR65	TR66	TR67	TR68	TR69	TR70	TR71	TR72	TR73	TR74	TR75	TR76	TR77	TR78	TR79	TR80	TR81	TR82	TR83	TR84	TR85	TR86	TR87	TR88	TR89	TR90	TR91	TR92	TR93	TR94	TR95	TR96	TR97	TR98	TR99	TR100	TR101	TR102	TR103	TR104	TR105	TR106	TR107	TR108	TR109	TR110	TR111	TR112	TR113	TR114	TR115	TR116	TR117	TR118	TR119	TR120	TR121	TR122	TR123	TR124	TR125	TR126	TR127	TR128	TR129	TR130	TR131	TR132	TR133	TR134	TR135	TR136	TR137	TR138	TR139	TR140	TR141	TR142	TR143	TR144	TR145	TR146	TR147	TR148	TR149	TR150	TR151	TR152	TR153	TR154	TR155	TR156	TR157	TR158	TR159	TR160	TR161	TR162	TR163	TR164	TR165	TR166	TR167	TR168	TR169	TR170	TR171	TR172	TR173	TR174	TR175	TR176	TR177	TR178	TR179	TR180	TR181	TR182	TR183	TR184	TR185	TR186	TR187	TR188	TR189	TR190	TR191	TR192	TR193	TR194	TR195	TR196	TR197	TR198	TR199	TR200	TR201	TR202	TR203	TR204	TR205	TR206	TR207	TR208	TR209	TR210	TR211	TR212	TR213	TR214	TR215	TR216	TR217	TR218	TR219	TR220	TR221	TR222	TR223	TR224	TR225	TR226	TR227	TR228	TR229	TR230	TR231	TR232	TR233	TR234	TR235	TR236	TR237	TR238	TR239	TR240	TR241	TR242	TR243	TR244	TR245	TR246	TR247	TR248	TR249	TR250	TR251	TR252	TR253	TR254	TR255	TR256	TR257	TR258	TR259	TR260	TR261	TR262	TR263	TR264	TR265	TR266	TR267	TR268	TR269	TR270	TR271	TR272	TR273	TR274	TR275	TR276	TR277	TR278	TR279	TR280	TR281	TR282	TR283	TR284	TR285	TR286	TR287	TR288	TR289	TR290	TR291	TR292	TR293	TR294	TR295	TR296	TR297	TR298	TR299	TR300	TR301	TR302	TR303	TR304	TR305	TR306	TR307	TR308	TR309	TR310	TR311	TR312	TR313	TR314	TR315	TR316	TR317	TR318	TR319	TR320	TR321	TR322	TR323	TR324	TR325	TR326	TR327	TR328	TR329	TR330	TR331	TR332	TR333	TR334	TR335	TR336	TR337	TR338	TR339	TR340	TR341	TR342	TR343	TR344	TR345	TR346	TR347	TR348	TR349	TR350	TR351	TR352	TR353	TR354	TR355	TR356	TR357	TR358	TR359	TR360	TR361	TR362	TR363	TR364	TR365	TR366	TR367	TR368	TR369	TR370	TR371	TR372	TR373	TR374	TR375	TR376	TR377	TR378	TR379	TR380	TR381	TR382	TR383	TR384	TR385	TR386	TR387	TR388	TR389	TR390	TR391	TR392	TR393	TR394	TR395	TR396	TR397	TR398	TR399	TR400	TR401	TR402	TR403	TR404	TR405	TR406	TR407	TR408	TR409	TR410	TR411	TR412	TR413	TR414	TR415	TR416	TR417	TR418	TR419	TR420	TR421	TR422	TR423	TR424	TR425	TR426	TR427	TR428	TR429	TR430	TR431	TR432	TR433	TR434	TR435	TR436	TR437	TR438	TR439	TR440	TR441	TR442	TR443	TR444	TR445	TR446	TR447	TR448	TR449	TR450	TR451	TR452	TR453	TR454	TR455	TR456	TR457	TR458	TR459	TR460	TR461	TR462	TR463	TR464	TR465	TR466	TR467	TR468	TR469	TR470	TR471	TR472	TR473	TR474	TR475	TR476	TR477	TR478	TR479	TR480	TR481	TR482	TR483	TR484	TR485	TR486	TR487	TR488	TR489	TR490	TR491	TR492	TR493	TR494	TR495	TR496	TR497	TR498	TR499	TR500	TR501	TR502	TR503	TR504	TR505	TR506	TR507	TR508	TR509	TR510	TR511	TR512	TR513	TR514	TR515	TR516	TR517	TR518	TR519	TR520	TR521	TR522	TR523	TR524	TR525	TR526	TR527	TR528	TR529	TR530	TR531	TR532	TR533	TR534	TR535	TR536	TR537	TR538	TR539	TR540	TR541	TR542	TR543	TR544	TR545	TR546	TR547	TR548	TR549	TR550	TR551	TR552	TR553	TR554	TR555	TR556	TR557	TR558	TR559	TR560	TR561	TR562	TR563	TR564	TR565	TR566	TR567	TR568	TR569	TR570	TR571	TR572	TR573	TR574	TR575	TR576	TR577	TR578	TR579	TR580	TR581	TR582	TR583	TR584	TR585	TR586	TR587	TR588	TR589	TR590	TR591	TR592	TR593	TR594	TR595	TR596	TR597	TR598	TR599	TR600	TR601	TR602	TR603	TR604	TR605	TR606	TR607	TR608	TR609	TR610	TR611	TR612	TR613	TR614	TR615	TR616	TR617	TR618	TR619	TR620	TR621	TR622	TR623	TR624	TR625	TR626	TR627	TR628	TR629	TR630	TR631	TR632	TR633	TR634	TR635	TR636	TR637	TR638	TR639	TR640	TR641	TR642	TR643	TR644	TR645	TR646	TR647	TR648	TR649	TR650	TR651	TR652	TR653	TR654	TR655	TR656	TR657	TR658	TR659	TR660	TR661	TR662	TR663	TR664	TR665	TR666	TR667	TR668	TR669	TR670	TR671	TR672	TR673	TR674	TR675	TR676	TR677	TR678	TR679	TR680	TR681	TR682	TR683	TR684	TR685	TR686	TR687	TR688	TR689	TR690	TR691	TR692	TR693	TR694	TR695	TR696	TR697	TR698	TR699	TR700	TR701	TR702	TR703	TR704	TR705	TR706	TR707	TR708	TR709	TR710	TR711	TR712	TR713	TR714	TR715	TR716	TR717	TR718	TR719	TR720	TR721	TR722	TR723	TR724	TR725	TR726	TR727	TR728	TR729	TR730	TR731	TR732	TR733	TR734	TR735	TR736	TR737	TR738	TR739	TR740	TR741	TR742	TR743	TR744	TR745	TR746	TR747	TR748	TR749	TR750	TR751	TR752	TR753	TR754	TR755	TR756	TR757	TR758	TR759	TR760	TR761	TR762	TR763	TR764	TR765	TR766	TR767	TR768	TR769	TR770	TR771	TR772	TR773	TR774	TR775	TR776	TR777	TR778	TR779	TR780	TR781	TR782	TR783	TR784	TR785	TR786	TR787	TR788	TR789	TR790	TR791	TR792	TR793	TR794	TR795	TR796	TR797	TR798	TR799	TR800	TR801	TR802	TR803	TR804	TR805	TR806	TR807	TR808	TR809	TR810	TR811	TR812	TR813	TR814	TR815	TR816	TR817	TR818	TR819	TR820	TR821	TR822	TR823	TR824	TR825	TR826	TR827	TR828	TR829	TR830	TR831	TR832	TR833	TR834	TR835	TR836	TR837	TR838	TR839	TR840	TR841	TR842	TR843	TR844	TR845	TR846	TR847	TR848	TR849	TR850	TR851	TR852	TR853	TR854	TR855	TR856	TR857	TR858	TR859	TR860	TR861	TR862	TR863	TR864	TR865	TR866	TR867	TR868	TR869	TR870	TR871	TR872	TR873	TR874	TR875	TR876	TR877	TR878	TR879	TR880	TR881	TR882	TR883	TR884	TR885	TR886	TR887	TR888	TR889	TR890	TR891	TR892	TR893	TR894	TR895	TR896	TR897	TR898	TR899	TR900	TR901	TR902	TR903	TR904	TR905	TR906	TR907	TR908	TR909	TR910	TR911	TR912	TR913	TR914	TR915	TR916	TR917	TR918	TR919	TR920	TR921	TR922	TR923	TR924	TR925	TR926	TR927	TR928	TR929	TR930	TR931	TR932	TR933	TR934	TR935	TR936	TR937	TR938	TR939	TR940	TR941	TR942	TR943	TR944	TR945	TR946	TR947	TR948	TR949	TR950	TR951	TR952	TR953	TR954	TR955	TR956	TR957	TR958	TR959	TR960	TR961	TR962	TR963	TR964	TR965	TR966	TR967	TR968	TR969	TR970	TR971	TR972	TR973	TR974	TR975	TR976	TR977	TR978	TR979	TR980	TR981	TR982	TR983	TR984	TR985	TR986	TR987	TR988	TR989	TR990	TR991	TR992	TR993	TR994	TR995	TR996	TR997	TR998	TR999	TR1000
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

	TVE	TVL	TVM	TVU	TWA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWT8	TWTU	TYR	TYS
SL 1			129		110									97			
SL 2			102		108									103			
SL 3		39	62		108									59		89	
SL 4				111	140		99									60	
SL 5				111			105		93								
SL 6				94			109		109								
SL 7				108			101		97								
SL 8				115			116		91	101							
SL 9				113			108		91		86						
SL10				110			103		89								
SL11				122			98		122								
SL12																	
SL13																	
SL14				86							66					83	
SL15				72							81				71		
SL16				55										90		50	
SL17				194													
SL18				49													
SL19				88				104									
SL20				49				80									82
SL21				75													62
SL22				83													44
SL23																	
TL 1	56												62	58		55	
TL 2																	51
TL 3			105				109	64		71							
TL 4																	
TL 5																	
TL 6																	
TL 7				102	78												
TL 8				52	120												
TL 9																	

	DC	DD	DEU	DL	DM	DS	DSRM	DSWU	DTM	GCC	GCH	GQ	GU	LPP	IR	JA	JGR	JG	JTRMV
SL 1																			
SL 2	35																		
SL 3																			
SL 4	26									30	12	27							30
SL 5								16		19									
SL 6							36					27							
SL 7							39					25							
SL 8																			
SL 9							31								25				
SL10		10		9						15		20							
SL11				6															
SL12		12		11															
SL13		19				27													
SL14		16				23										26			
SL15						18										11			
SL16										14									
SL17										13		17							
SL18										15		15							
SL19		14																	
SL20		13																	
SL21		22													13	25			
SL22		17												7	30				
SL23														23	23				
TL 1																			
TL 2																			
TL 3																			
TL 4																			
TL 5						16				23		28							
TL 6							21		20	17		16							
TL 7																			
TL 8		11														12			
TL 9		11	8													19			

Table 2. Geologic Unit Average Value as a Function of Map Line for ²¹⁴Bi (Counts/Second)

	JV	KG1	KG2	KG3	KN	KNC	MU	OA	OCW	OE1	OE2	OEBC	OH	OHC	OL	OP1	OP2	OU	OV1
ML 1				31					21					39			16		
ML 2				28					38								36		
ML 3				33					39		24			23			27		
ML 4				23													18		
ML 5			34							10		22			14	25			35
ML 6					27							19			16	23			
ML 7										10		21			17	19			16
ML 8										13		24				11			18
ML 9								33		10						11			27
ML10										9						5			26
ML11										3								19	31
ML12																			19
ML13							34												23
ML14															40				26
ML15															19				14
ML16															11				
ML17																			19
ML18																			29
ML19			37																28
ML20										13			16				8		25
ML21	10									9									26
ML22	23																		
ML23																			
TL 1																			
TL 2	9																	19	30
TL 3																			18
TL 4																			
TL 5				52											17		14		
TL 6			18																
TL 7									19							16			
TL 8																7			
TL 9					14		18			8									

49b

	OV2	OVI	PG	PIPA	PIPH	PIPU	PP1	PP2	QA	QAL1	QAL2	QF	QOA1	QOA2	QOA3	QOG	QP1	QP2	QP3
ML 1											34								
ML 2											39								
ML 3											33	36							
ML 4											25								
ML 5			23						39	37	38		20	28			26		
ML 6			21							33	32			25					
ML 7			36							34	33			32	30				
ML 8			51							43	24			41	38	41		44	
ML 9										45	23			40	54	25	37	31	41
ML10			40							41	33			42	31	46		38	
ML11			31							35	28			41	30	30	33		
ML12	26		20							34	28			40	36	27	42		
ML13										25	20			24	21	18	25		
ML14	27		18	31						30	24			34	35	28	50	44	
ML15	30					26				28	31			32	28	28	17		
ML16	24	19				11				21	19			23	19	20	24	20	
ML17	17		19	18		21				22	19			20	20	21	22		
ML18	20	18	16							20	21			24	18	22	22		
ML19	21	22	16							21	20			22	20	21	18		
ML20	28		25							37	32			41	40	33	28	38	
ML21	24		20	23		31				35	34			34	32	28	40	31	
ML22	27		13		21					36	20			32	33	22	32	27	27
ML23	28		30		22					31	24			30	30	26	21	26	24
TL 1												23				25			
TL 2												24				23			
TL 3												51						40	
TL 4												38							
TL 5												35							
TL 6			23									28							
TL 7												20							
TL 8												23							
TL 9	12										21					22			
	17										28					30			
											22					17			

49c

	QTAD	QT81	QT82	QTSU	QYA	SE	SL	SOEU	SOWU	TA2	TAD1	TAD2	TBM	TC	TD1	TD2	TEC	TG	TJG
ML 1			36																
ML 2			25							30									
ML 3																21			
ML 4		31													26	24			
ML 5				35									51						
ML 6				23	25								49						
ML 7				27	37								52						
ML 8	23			10	40						28		48						
ML 9							12	9					50						
ML10								7			33		48						
ML11					40		7				37								
ML12					24						19		22						
ML13			19		44						33		48						
ML14					28						33		37				47		
ML15					20						20		21				19		
ML16					21						16		21				24		14
ML17					23				14		23		29	43					
ML18					19	18	15		23		21		23	26			19		
ML19					15		13		24		37		43	49			44		
ML20					28		20		30				44	32			36		
ML21					19		12		27		27	33	41						
ML22	39				22		13				34	29	31						
ML23										20						24			
TL 1					18														
TL 2					19						31	50	39				36		
TL 3													42						
TL 4						26							24						
TL 5											17								
TL 6									19										
TL 7																			
TL 8							6												
TL 9							5												

49d

	TMC	TMD	TN	TOA	TOB	TOL	TOS	TOV	TOL	TR1	TR2	TRA1	TRA2	TRC1	TRC2	TRC3	TRCS	TRD	TRF
ML 1	39			22															
ML 2	42	57		31							31								
ML 3	36	38		25			27				34								
ML 4				30			30	34			32								
ML 5							28				30								
ML 6							26			49	32							35	
ML 7							37				43							40	
ML 8							46		50	59								35	
ML 9							41		50									43	
ML10							39		47									39	
ML11			53				43											41	
ML12			26				37											18	
ML13			41							20								41	
ML14					41		19						17					37	
ML15					15								11		11				
ML16					16								24	27					
ML17										43	21	18	24		16				
ML18										21	24		19						
ML19										34	46	35							
ML20											40	26		35					
ML21											43	17							
ML22					18						21	17							
ML23																			
TL 1											21					20		22	
TL 2											19							14	
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

49e

	TRI	TRL	TRLS	TRO1	TRO2	TRPZS	TRSL	TRSU	TRU	TS1	TS2	TS3	TS5	TS6	TSH	TT	TTN	TTM	TTS
ML 1															33				
ML 2														27	51				
ML 3															31				
ML 4													28		24	36			
ML 5																40			
ML 6																44			
ML 7	37																		
ML 8		45																	
ML 9		43																	
ML 10		35																	
ML 11		41															46		
ML 12	33	25							28		24							36	
ML 13		27							42			37							
ML 14		29							13										
ML 15		22																	
ML 16		24																	
ML 17																			
ML 18																			
ML 19																			
ML 20			26																
ML 21			18		14														
ML 22			27																
ML 23																			
TL 1		25																	
TL 2		23																	
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

49f

	TVF	TVL	TVM	TVU	TVA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWT8	TWTU	TYB	TYS
ML 1			47		30									32			
ML 2			42		39									43			
ML 3		31	20		30									24		29	
ML 4				45	39												
ML 5				34													
ML 6				32													
ML 7				35													
ML 8				37													
ML 9				39													
ML 10				33													
ML 11				40													
ML 12																	
ML 13																	
ML 14				31													
ML 15				21													
ML 16				21													
ML 17				21													
ML 18				21													
ML 19				41													
ML 20				25													
ML 21				30													
ML 22				30													
ML 23																	
TL 1	21																
TL 2																	
TL 3			50														
TL 4																	
TL 5																	
TL 6																	
TL 7				23	27												
TL 8				23	34												
TL 9																	

49g

	DC	DD	DEU	DL	DN	DS	DSRM	DSWU	DTM	GCC	GCH	GO	GU	LPP	IR	JA	JGR	JG	JTRMV
ML 1																			
ML 2	217																		
ML 3																			
ML 4	147									292	368	241							
ML 5								117		166								265	
ML 6							268					188							
ML 7							193					280							
ML 8																			
ML 9			48				222								268				
ML10		65	122							158		210							
ML11			69																
ML12		72	72																
ML13		145				155													
ML14		155				165									307				
ML15						116				109					196				
ML16										118		174							
ML17										129		160							
ML18		67																	
ML19		66													299				
ML20		179								91	158								
ML21		100								71	183								
ML22						161					182			109					
ML23																			
TL 1																			
TL 2																			
TL 3																			
TL 4										193		217							
TL 5						131				110		137							
TL 6							162		71										
TL 7															207				
TL 8		114																	
TL 9		132	82												307				

Table 3. Geologic Unit Average Value as a Function of Map Line for ⁴⁰K (Counts/Second)

	JV	KG1	KG2	KG3	KN	KNC	MU	OA	OCW	OE1	OE2	O&BC	OH	OHC	OL	OP1	OP2	OU	OV1
ML 1				399					133					382			151		
ML 2				345					198								272		
ML 3				295		266			357		291			276			286		
ML 4				299		176											119		
ML 5			340		149					105		213			218	201			
ML 6												142			193	117			338
ML 7										71		230			174	138			192
ML 8										97		158				94			196
ML 9								225		65						106			180
ML10										128						115			157
ML11										55								107	263
ML12																			181
ML13							193												199
ML14															208				208
ML15															118				99
ML16																			
ML17															139				
ML18																			148
ML19		241																	147
ML20										64			98						207
ML21	87									57						106			142
ML22	223																		144
ML23																			
TL 1	75																		
TL 2																			
TL 3																		180	
TL 4																			184
TL 5		164		335											104		84		139
TL 6										128									
TL 7																03			
TL 8																			
TL 9						136	198			100						107			

	OV2	OVI	PG	PLPA	PLPH	PLPU	PP1	PP2	QA	QAL1	QAL2	QF	QOA1	QOA2	QOA3	QOG	QP1	QP2	QP3
ML 1											295								
ML 2								350			294				264				
ML 3											297	360							
ML 4		178					289		303	317	243	283	210	242			279		
ML 5		184							263	238		248		176					
ML 6		253							258	236		262		236	304				
ML 7		299							248	187		235		272	286			255	
ML 8									264	204		250	314	218	270	267		242	
ML 9		205							275	242		267		235	318			278	
ML10		199							259	237		293	247	276	266				
ML11	153		99						261	249		288	266	243	316				
ML12		177							177	190		181	183	159	201				
ML13	157	177		183					261	217		240	214	224	327	310			
ML14	252					175			213	262		228	201	239		169			
ML15	108	134				145			165	157		159	123	155	157	69			
ML16	126		174	171		169			163	158		145	150	135	184				
ML17	117	126	164						168	165		158	144	133	152				
ML18	117	102	104						162	172		164	137	146	136				
ML19	164		122						255	233		269	252	198	219		275		
ML20	162		106	150		188			255	189		245	224	174	240		236		
ML21	166		87		140				249	169		225	221	176	213		257	174	
ML22	186		155		184				247	164		228	217	202	166		264	210	
ML23																			
TL 1											165				194				
TL 2							182		177		185	177	142		189				
TL 3					191				266		307	257					260		
TL 4									180		262	235	226						
TL 5									132		189	143	166						
TL 6		140							177		164	171	115						
TL 7										166	195			188					
TL 8	124								260	288				275					
TL 9	204								225	299				171					

50c

	QTAD	QTB1	QTB2	QTSU	QYA	SE	SL	SOEU	SOWU	TA2	TAD1	TAD2	TBM	TC	TD1	TD2	TEC	TG	TJG
ML 1			272																
ML 2			234							282									
ML 3																277			
ML 4		272													299	252			
ML 5				266									304						
ML 6				151	249								318						
ML 7				181	262								295						
ML 8	170			105	278						195		294						
ML 9							99	103					292						
ML10							77	75			239		310						
ML11					289						246								
ML12					194						178		164						
ML13			196		297						237		306						
ML14					269						253		284				305		
ML15					155						168		183				172		
ML16					177						159		167				204		137
ML17					187						183		208	200					
ML18					131	141	68		140		172		186	202			160		
ML19					116		76		106		257		268	348			258		
ML20					191		75		194				286	260			254		
ML21					173		86		169		192	227	282						
ML22	279				180		135				262	177	242						
ML23																			
TL 1					126					193						206			
TL 2					177														
TL 3											256	264	242				262		
TL 4													252						
TL 5						180													
TL 6											191		193						
TL 7									154										
TL 8							68												
TL 9							93												

50d

	TMC	TMD	TN	TOA	TOB	TOL	TOS	TOV	TOL	TRI	TR2	TRA1	TRA2	TRC1	TRC2	TRC3	TRCS	TRD	TRF
ML 1	315			239												396			
ML 2	309	316		129							284								
ML 3	314	291		267			306				296								
ML 4				311			300	314			289								
ML 5							237				275								
ML 6							283			362	284							322	
ML 7							262				321							306	
ML 8							287											260	
ML 9							296			383	334							315	
ML10							295			348								284	
ML11			326				341											308	
ML12			232				219											215	
ML13			279							128								324	
ML14				327			179											290	
ML15				178							192				79				
ML16				154							62			213					
ML17										200	194								
ML18										189	197	171	169		139				
ML19										243	198		132						
ML20											298	185							
ML21											264	142		214					
ML22				193							250	108							
ML23											164	109							
TL 1							195				187					117		203	
TL 2											195							223	
TL 3				131															
TL 4																			
TL 5																			
TL 6	213																		
TL 7																			
TL 8																			
TL 9																			

	TRI	TRL	TRLS	TRO1	TRO2	TRP2S	TRSL	TRSU	TRU	TS1	TS2	TS3	TS5	TS6	TSM	TT	TTH	TTM	TTS
ML 1															308				
ML 2															321				
ML 3														258	307				
ML 4													235		151	328			
ML 5																305			
ML 6																321			
ML 7	342																		
ML 8		292																	
ML 9		310																	
ML10		286																	
ML11		315																	
ML12	191	201																309	216
ML13		250																	
ML14		297																	
ML15		204																	
ML16		206																	
ML17																			
ML18																			
ML19																			
ML20																			
ML21																			
ML22																			
ML23																			
TL 1		191																	
TL 2		206																	
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

	TVF	TVL	TVM	TVU	TWA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWT8	TWTU	TYB	TYS
ML 1			358		307									307			
ML 2			345		284									333			
ML 3		281	239		285									247		269	
ML 4				333	328		344									242	
ML 5				272			318		288								
ML 6				253			331		345								
ML 7				306			323		299								
ML 8				315			304		316	328							
ML 9				298			322		312		306						
ML10				303			312		263								
ML11				296			330		336								
ML12																	
ML13										192							
ML14				237						278						270	
ML15				170										198			
ML16				144										212			
ML17				172											143		
ML18				103													
ML19				209													
ML20				168				296									224
ML21				244				252									176
ML22				271													151
ML23																	
TL 1	187														177	182	
TL 2													171				140
TL 3				316			316	216	213								
TL 4																	
TL 5																	
TL 6																	
TL 7				180	192												
TL 8				194	311												
TL 9																	

	DC	DD	DEU	DL	DN	DS	DSRM	DSWU	DTM	GCC	GGH	GO	GU	IPP	IR	JA	JGR	JG	JTRMV
ML 1																			
ML 2	55																		
ML 3																			
ML 4	83									49	15	44							40
ML 5								51		42									
ML 6							46					46							
ML 7							66					36							
ML 8																			
ML 9							52								24				
ML10		47	62							34		32							
ML11			32																
ML12		49	33																
ML13		54	42			61													
ML14		51				50										64			
ML15						49				39						30			
ML16										28		28							
ML17										32		29							
ML18		64																	
ML19		90																	
ML20		58																	
ML21		69																	
ML22																			
ML23																			
TL 1																			
TL 2																			
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8		43																	
TL 9		31	33																

Table 4. Geologic Unit Average Value as a Function of Map Line for $^{214}\text{Bi}/^{206}\text{Pb}$ (Times 100)

	JV	KG1	KG2	KG3	KN	KNC	MU	OA	OCM	OE1	OE2	OEBC	OH	OHC	OL	OP1	OP2	OU	OV1
ML 1				30					64					29			45		
ML 2				30					68								38		
ML 3				34		25			28		21			26			29		
ML 4				31		52											43		
ML 5			40		80					38		31			29	41			
ML 6												76			36	59			32
ML 7										50		37			40	45			35
ML 8										42		49				40			35
ML 9								55		46						37			58
ML10										25						15			56
ML11										14								64	34
ML12																			30
ML13						74													44
ML14															80				44
ML15															53				41
ML16															23				
ML17																			34
ML18																			57
ML19			55																55
ML20										53			60						58
ML21										48						47			57
ML22	53																		
ML23	52																		
TL 1	42																		
TL 2																		38	
TL 3																			49
TL 4				50											56				43
TL 5			30														59		
TL 6									50							60			
TL 7																31			
TL 8																			
TL 9					40		43			25									

51b

	OV2	OVI	PG	PIPA	PIPH	PIPU	PP1	PP2	QA	QAL1	QAL2	QF	QOA1	QOA2	QOA3	QOG	QPI	QPI2	QPI3
ML 1											39								
ML 2											43					40			
ML 3											34								
ML 4											35								
ML 5			45						38	36		31							
ML 6			36						42	41		40	33	37			33		
ML 7			38						44	43		41		42	39				
ML 8			50						55	39		52		46	49				53
ML 9									55	36		48	49	35	48	40			52
ML10			63						50	43		50		39	50				46
ML11			54						47	42		44	38	33	41				
ML12	75		67						45	38		43	50	31	45				
ML13		18							43	31		36	31	33	39				
ML14	62	34		67					38	43		41	49	41	49	46			
ML15	57						49		39	47		44	43	44		36			
ML16	75	41				24			35	39		39	42	38	45	77			
ML17	45		28	25		33			36	36		38	35	42	35				
ML18	57	30	33						35	37		37	38	43	41				
ML19	63	63	49						40	36		38	38	43	38				
ML20	61		63						52	49		46	44	40	44			60	
ML21	44		55	54		62			49	70		45	46	56	50			53	
ML22	59		59		46				48	49		42	47	42	48			52	60
ML23	57		70		42				45	53		43	45	45	43			49	43
TL 1											40					39			
TL 2											35		34	46		34			
TL 3											50							48	
TL 4											52								
TL 5											41								
TL 6			44								38								
TL 7																			
TL 8	42										36	34			28				
TL 9	40										40	33			35				
											41	31			39				

51c

	QTAD	QTB1	QTB2	QTSU	QYA	SE	SL	SOEU	SOWU	TA2	TAD1	TAD2	TBM	TC	TD1	TD2	TEC	TG	TJG
ML 1			41																
ML 2			37							42									
ML 3																31			
ML 4		41													35	40			
ML 5				36									44						
ML 6				45	38								44						
ML 7				43	49								48						
ML 8	37			34	47						35		41						
ML 9							39	30					45						
ML10								38			39		42						
ML11					47		28				38								
ML12					40						24		36						
ML13				33	52						41		44						
ML14					37						35		39				43		
ML15					39						28		31				32		
ML16					37						25		32				31		33
ML17					37				13		28		34	30					
ML18					42	34	60		52		34		32	34			32		
ML19					64		59		61		42		45	48			52		
ML20					55		85		64				44	44			47		
ML21					42		46		57		47	43	42						
ML22	43				46		37				42	52	39						
ML23										36									
TL 1					44											37			
TL 2					33						39	45	47				44		
TL 3													46						
TL 4						52													
TL 5													32						
TL 6									33		20								
TL 7																			
TL 8							47												
TL 9							16												

	TMC	TMD	TN	TOA	TOB	TOL	TOS	TOV	TOL	TR1	TR2	TRA1	TRA2	TRC1	TRC2	TRC3	TRCS	TRD	TRF
ML 1	40			25												86			
ML 2	39	46		80							43								
ML 3	32	37		26							38								
ML 4				29							42								
ML 5							29				40								
ML 6							40				40								
ML 7							32			40	43								38
ML 8							52				47								49
ML 9							54			44									44
ML10							49				49								46
ML11			49				43				46								45
ML12			31				32												43
ML13			45							50									29
ML14					31														43
ML15					27		37						43						35
ML16					32								49						
ML17											32	30	29	37	32				
ML18											28	32	39						
ML19										51	47	62							
ML20											48	69		55					
ML21											44	53							
ML22					37						62	54							
ML23																			
TL 1											38					40		33	
TL 2					36		37				27							19	
TL 3																			
TL 4																			
TL 5																			
TL 6	21																		
TL 7																			
TL 8																			
TL 9																			

	TRI	TRL	TRLS	TRO1	TRO2	TRPZS-TRSL	TRSU	TRU	TS1	TS2	TS3	TS5	TS6	TSH	TT	TTN	TTM	TTS
ML 1														30				
ML 2													29	40				
ML 3												42		26	33			
ML 4														56	37			
ML 5															40			
ML 6	40																	
ML 7		52																
ML 8		52																
ML 9		43																
ML10		46														48		
ML11	40	35						38		30							41	
ML12		41						44			48							
ML13		36						47										
ML14		31				31	25							43			31	
ML15		28					27							45			38	
ML16							26							36			56	
ML17														41	26			
ML18							50		19	39				38	24		27	
ML19			39				54			31				47	50		53	
ML20			45	43						44				40			56	
ML21			38											46				
ML22				29														
ML23																		
TL 1		37																
TL 2		33																
TL 3												35			47			
TL 4																		
TL 5																		
TL 6												43						
TL 7														36				
TL 8																		
TL 9																		

51f

	TVF	TVL	TVM	TVU	TWA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWTB	TWTU	TYB	TYS
ML 1			37		27									33			
ML 2			41		36									42			
ML 3		80	33		28									45		33	
ML 4				40	29		31										
ML 5				32			42		35							39	
ML 6				36			44		36								
ML 7				34			50		46								
ML 8				32			47		49	45							
ML 9				35			48		49		46						
ML10				30			44		40								
ML11				32			43		45								
ML12																	
ML13																	
ML14				36								49				38	
ML15				29								47					
ML16				38											30		
ML17				17											25		
ML18				53												36	
ML19				56													
ML20				53				41									50
ML21				41				56									43
ML22				36													43
ML23																	
TL 1	38													41		42	
TL 2																	39
TL 3			48				48	52	32				36				
TL 4																	
TL 5																	
TL 6																	
TL 7				25	34												
TL 8				45	28												
TL 9																	

51g

	DC	DD	DEU	DL	DN	DS	DSRM	DSWU	DTM	ECC	EGH	EO	EU	IPP	IR	JA	JGR	JG	JTRMV
ML 1																			
ML 2	190																		
ML 3																			
ML 4	190									104	40	115							
ML 5								150		121								113	
ML 6							147					145							
ML 7							208					96							
ML 8																			
ML 9			214				149								93				
ML10		174	99							107		96							
ML11			94																
ML12		170	155																
ML13		135				181													
ML14		109				147									86				
ML15						161				140					63				
ML16										117		102							
ML17										125		100							
ML18		220																	
ML19		207													112				
ML20		146											145	160					
ML21		173								107			165	129					
ML22						179										112			
ML23																			
TL 1																			
TL 2																			
TL 3																			
TL 4										123		135							
TL 5						129				162		120							
TL 6							140		339										
TL 7															57				
TL 8		121													63				
TL 9		87	108																

Table 5. Geologic Unit Average Value as a Function of
Map Line 21481/4K (Times 1000)

	JV	KG1	KG2	KG3	KN	KNC	NU	OA	OCW	OE1	OE2	OEBC	OH	OHC	OL	OP1	OP2	OU	OV1
ML 1				77					165					104			118		
ML 2				85					198					85			135		
ML 3				113			90		112		85						98		
ML 4				77			219										156		
ML 5			100		203					102		108			65	132			
ML 6												140			92	210			104
ML 7										155		94			107	150			108
ML 8										144		174				130			104
ML 9								150		171						116			157
ML10										73						45			171
ML11										94							180		122
ML12																			109
ML13								184											124
ML14															190				126
ML15															181				150
ML16																			
ML17															85				
ML18																			130
ML19		157																	228
ML20										205			163						136
ML21	129									158						85			177
ML22	103																		182
ML23																			
TL 1	160																		
TL 2																			
TL 3																		108	
TL 4																			166
TL 5		118		157											176				143
TL 6										167									
TL 7																236	167		
TL 8																			
TL 9										82						75			

	OV2	OV1	PG	PIPA	PIPH	PIPU	PP1	PP2	QA	QAL1	QAL2	QF	QOA1	QOA2	QOA3	QOG	QP1	QP2	QP3	
ML 1											118									
ML 2											135				96					
ML 3								113			111									
ML 4			136				100		123	122	107	122	98	116			94			
ML 5			115						126	140		131		145						
ML 6			139						132	143		130		138	100					
ML 7			173						181	134		174		152	146			175		
ML 8									170	114		161	174	122	142	120		173		
ML 9			198						150	138		159		133	148			136		
ML10			158						135	122		142	124	111	125					
ML11	172		209						130	118		141	138	110	133					
ML12			85						142	108		136	118	123	126					
ML13	174	110		174					114	111		142	171	128	152	144				
ML14	121					153			136	122		143	143	121		103				
ML15	227	152				81			129	128		148	163	134	170	296				
ML16	135		114	106		128			135	125		146	136	159	123					
ML17	180	144	102						124	130		153	130	173	147					
ML18	195	236	158						134	120		139	147	164	137					
ML19	174		216						148	139		155	161	169	129		139			
ML20	157		196	157		166			136	186		143	147	163	174		132			
ML21	163		183		150				146	125		145	150	136	151		111	156		
ML22	154		195		122				128	153		136	143	136	128		100	120		
ML23																				
TL 1											139				131					
TL 2											131	126	165		122					
TL 3							115		151		167	149					154			
TL 4						149			142		146	151	140							
TL 5									150		148	144	112							
TL 6			168						140		145	137	153							
TL 7																				
TL 8	100									129	147			119						
TL 9	89									110	118			112						
										101	110			107						

	QTAD	QT81	QT82	QTSU	QYA	SE	SL	SOEU	SOWU	TA2	TAD1	TAD2	T8M	TC	TD1	TD2	TEC	TG	TJG
ML 1			135																
ML 2			110																
ML 3										107									
ML 4		117													88	80			
ML 5				133												99			
ML 6				168	105														
ML 7				146	143														
ML 8	142			102	144														
ML 9							131	92											
ML10							101	98											
ML11					140														
ML12					128														
ML13				100	150														
ML14					105														
ML15					133														
ML16					121														
ML17					123														
ML18					147	128			104										
ML19					135				216										
ML20					148				175										
ML21					111				160										
ML22					125				163										
ML23	141																		
TL 1					150														
TL 2					110					104									
TL 3											122	192	163						
TL 4													167						
TL 5							148												
TL 6											96		131						
TL 7																			
TL 8								99											
TL 9								63											

	TNC	TND	TN	TOA	TOB	TOL	TOS	TOV	TOL	TRI	TR2	TRA1	TRA2	TRC1	TRC2	TRC3	TRCS	TRD	TRF
ML 1	130			93												93			
ML 2	136	183		250							110								
ML 3	117	131		95			90				116								
ML 4				99			100	107			114								
ML 5							121				110								
ML 6							93			137	113							111	
ML 7							142				135							132	
ML 8							162											135	
ML 9							141											139	
ML10							137											139	
ML11			163				128											136	
ML12			113				170											92	
ML13			148							159								131	
ML14																		129	
ML15					129		111												
ML16					86														
ML17					109														
ML18											125								
ML19											113	109	148						
ML20											115	122	149						
ML21											141	155	205						
ML22												157	198						
ML23												174	159						
TL 1												131	156						
TL 2											116					181		113	
TL 3											98							65	
TL 4																			
TL 5																			
TL 6	82																		
TL 7																			
TL 8																			
TL 9																			

52e

	TRI	TRL	TRLS	TRO1	TRO2	TRPZS	TRSL	TRSU	TRU	TS1	TS2	TS3	TS5	TS6	TSH	TT	ITH	TTM	TTS
ML 1															110				
ML 2															159				
ML 3															102				
ML 4															165				
ML 5																			
ML 6																			
ML 7																			
ML 8	108																		
ML 9		153																	
ML10		139																	
ML11		125																	
ML12		132																	
ML13	176	123																	
ML14		105																	
ML15		102																	
ML16		109																	
ML17		120																	
ML18																			
ML19																			
ML20																			
ML21																			
ML22																			
ML23																			
TL 1																			
TL 2																			
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

52f

	TVF	TVL	TVM	TVU	TWA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWT8	TWTU	TYB	TYS
ML 1			133		100									107			
ML 2			122		138									131			
ML 3		111	81		109									101		107	
ML 4				137	122		93									98	
ML 5				127			140		114								
ML 6				134			147		115								
ML 7				120			157		149								
ML 8				119			182		144	140							
ML 9				133			163		144		130						
ML10				110			147		139								
ML11				135			130		163								
ML12																	
ML13											170						
ML14				135			142									117	
ML15				127									107				
ML16				145									107				
ML17				124											127		
ML18				235													
ML19				194				146									
ML20				153				175									186
ML21				128													155
ML22				112													127
ML23																	
TL 1	113												132	135		128	143
TL 2									105								
TL 3			161				165	155									
TL 4																	
TL 5																	
TL 6																	
TL 7				135	140												
TL 8				121	110												
TL 9																	

	DC	DD	DEU	DL	DN	DS	DSRM	DSWU	DTM	ECC	EGH	GO	GU	LPP	IR	JA	JGR	JG	JTRMV
ML 1																			
ML 2	357																		
ML 3																			
ML 4	228																		
ML 5								290		219	240	264							287
ML 6							314			294		315							
ML 7							312					264							
ML 8																			
ML 9							282								378				
ML10		371	363							310		300							
ML11			292																
ML12		349	368																
ML13		251				297													
ML14		221				296									141				
ML15						327				360					197				
ML16										410		363							
ML17										388		358							
ML18		344																	
ML19		234													281				
ML20		251											338	325					
ML21		255											207	326	312		232		
ML22						285													
ML23																			
TL 1																			
TL 2																			
TL 3																			
TL 4										310		309							
TL 5										353		366							
TL 6						391													
TL 7						401			344										
TL 8															293				
TL 9		279																	
TL 9		272	323												128				

Table 6. Geologic Unit Average Value as a Function of Map Line 209T/4K (Times 1000)

	JV	KG1	KG2	KG3	KN	KNC	MU	OA	OCW	OE1	OE2	OEBC	OH	OHC	OL	OP1	OP2	OU	OV1
ML 1				255					263					352			263		
ML 2				279					296								356		
ML 3				326		352			404		403			325			345		
ML 4				251		357											358		
ML 5			249		255					262		361			223	332			
ML 6												198			261	395			323
ML 7										307		250			271	344			300
ML 8										343		358				335			291
ML 9								271		382						306			267
ML10										307						297			309
ML11										534								280	359
ML12																			366
ML13							243												285
ML14															240				290
ML15															339				367
ML16															364				
ML17																			383
ML18																			416
ML19			292																253
ML20										387			273						306
ML21										332						178			320
ML22	256																		
ML23	220																		
TL 1	364																		
TL 2																		283	
TL 3															317				344
TL 4				314													281		327
TL 5																385			
TL 6		378							344										
TL 7																			
TL 8																247			
TL 9					259		223			326									

53b

	OV2	OV1	PG	PIPA	PIPH	PIPU	PP1	PP2	OA	OAL1	OAL2	OF	QOA1	QOA2	QOA3	QOG	QP1	QP2	QP3
ML 1											310								
ML 2											315				234				
ML 3											337	327							
ML 4											307	317	296	314			285		
ML 5			304				289	337	323	338		330							
ML 6			315						302	345		314							
ML 7			366						308	330		314							
ML 8			341						336	338		335							329
ML 9									313	319		334	352	346	296	300			330
ML10									298	316		320		348	291				297
ML11									286	291		321	325	340	300				
ML12	227		309						289	319		332	275	353	296				
ML13									334	352		383	385	375	319				
ML14	281		333	256					292	265		347	348	315	312	312			
ML15	212					314			353	266		325	327	283		298			
ML16	306		381			332			373	332		379	384	353	373	382			
ML17	301			408	417	380			377	345		380	387	383	351				
ML18	314	570	306						348	344		410	340	431	352				
ML19	306	394	329						336	336		366	393	403	360				
ML20	286		338						288	282		331	360	425	294			230	
ML21	345		358	293		269			278	272		319	319	292	350			250	
ML22	283		295		320				303	265		343	320	328	314			214	261
ML23	274		278		287				285	294		317	319	300	298			206	274
TL 1											354				334				
TL 2											370	367	360		357				
TL 3											334	320						321	
TL 4											296	317	326						
TL 5											323	384	363						
TL 6											415	375	361						
TL 7											426								
TL 8		380									362				433				
TL 9	246										276				319				
	220										244	353			278				

53c

	QTAD	QT81	QT82	QTSU	QYA	SE	SL	SOEU	SOWU	TA2	TAD1	TAD2	TBM	TC	TD1	TD2	TEC	TG	TJG
ML 1			331																
ML 2			297							251									
ML 3																			
ML 4		282													247	262			
ML 5				371									382			246			
ML 6				367	274								351						
ML 7				339	295								372						
ML 8				304	302						412		396						
ML 9	384						340	305					384						
ML10								259			354		367						
ML11					293		364				408								
ML12					317						435		393						
ML13				301	286						346		361						
ML14					284						373		347				364		
ML15					338						445		382				352		
ML16					324						400		410				382		323
ML17					332				870		468		414	718					
ML18					349	369	388		456		370		390	377			377		
ML19					270		295		295		340		354	297			333		
ML20					275		327		253				357	294			303		
ML21					274		306		287		311	340	349						
ML22					273		273				314	326	327						
ML23																			
TL 1					341					287						313			
TL 2					329														
TL 3											310	441	341				314		
TL 4						286							365						
TL 5																			
TL 6											468		409						
TL 7																			
TL 8							226		409										
TL 9							387												

	TMC	TMD	TN	TOA	TOB	TOL	TOS	TOV	TOL	TR1	TR2	TRA1	TRA2	TRC1	TRC2	TRC3	TRCS	TRD	TRF
ML 1	332			365												109			
ML 2	348	393		318							254								
ML 3	366	352		367							304								
ML 4				336							268								
ML 5							305				276								
ML 6							253	246			262								
ML 7							298			339	285							287	
ML 8							271											266	
ML 9							299			400								304	
ML10							287											302	
ML11							316											306	
ML12							274											312	
ML13			332				527											316	
ML14			361															299	
ML15			328							320								365	
ML16					411		295						220						
ML17					323								394						
ML18					328								396						
ML19										657	389		375	401	379				
ML20										404	377		380						
ML21										276	382								
ML22											333	340							
ML23											332	289		301					
TL 1											386	306							
TL 2											216	285							
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

	TRI	TRL	TRLS	TRO1	TRO2	TRPZS	TRSL	TRSU	TRU	TS1	TS2	TS3	TS5	TS6	TSH	TT	TTM	TTM	TTT
ML 1															360				
ML 2														361	395				
ML 3														318	392	341			
ML 4													282		318	341			
ML 5																351			
ML 6																342			
ML 7	267																		
ML 8		292																	
ML 9		266																	
ML10		293																	
ML11		289															312		
ML12	430	351							416		358							410	
ML13		251							309			310							
ML14		285							283										
ML15		351																	
ML16		433																	
ML17																			
ML18																			
ML19																			
ML20																			
ML21																			
ML22																			
ML23																			
TL 1		348																	
TL 2		351																	
TL 3																			
TL 4																			
TL 5																			
TL 6																			
TL 7																			
TL 8																			
TL 9																			

	TVF	TVL	TVM	TVU	TWA	TWT1	TWT2	TWT3	TWT4	TWT5A	TWT5B	TWT6	TWT7	TWTB	TWTU	TYB	TYS
ML 1					359									321			
ML 2					378									310			
ML 3		141	258		381									231		330	
ML 4				334	427		290										
ML 5				402			330		323							249	
ML 6				375			333		317								
ML 7				353			317		326								
ML 8				370			384		292	310							
ML 9				380			338		292		282						
ML10				366			333		344								
ML11				412			299		363								
ML12																	
ML13																	
ML14				366													
ML15				426													
ML16				384													
ML17				1035													
ML18				450													
ML19				385													
ML20				290													
ML21				313													
ML22				313													
ML23																	
TL 1		298															
TL 2																	
TL 3			335														
TL 4							346	299	333								
TL 5																	
TL 6																	
TL 7				568	409												
TL 8				268	390												
TL 9																	

- (1) $\sigma_{T_2} = \sqrt{T_{2\Sigma} - T_{21}}$; Test does not fail if $T_{21} \geq 1.5 \sigma_{T_2}$
- (2) $\sigma_{Bi} = \sqrt{Bi_{\Sigma} - Bi_{SUR}}$; Test does not fail if $Bi_{11} \geq 1.5 \sigma_{Bi}$
- (3) $\sigma_K = \sqrt{K_{\Sigma} - K_1}$; Test does not fail if $K_1 \geq 1.5 \sigma_K$

Where Σ represents the total raw count in the energy interval, and subscript (1) represents results of 4 π data analysis. A column set is placed onto the microfiche for the single point listings of reduced data which lists A-K-U-T as altitude (A), potassium (K), uranium (U) and thorium (T). If the statistical adequacy test does not fail, a zero (0) is inserted. If it fails, a one (1) is inserted for the K-U-T. However, for altitude (A), 0 represents data from 0-700 feet. 1 represents data from 701-1000 feet, and 2 represents data from 1001 and greater feet.

G. FREQUENCY DISTRIBUTIONS OF DATA FOR EACH GEOLOGIC TYPE

The geologic units have been the basis for separation of the six radiation variables. Frequency distribution plots, which display the number of occurrences at a specific magnitude as a function of the magnitude for each of the six radiation variables, are included for each geologic unit. Data from all map line and tie lines have been included to determine these frequency distributions in Appendix I. Table A1-1 gives a summary of the average and standard deviation values for all geologic units, (also included on all histograms in Appendix I).

H. MICROFICHE REPRODUCTION OF THE SINGLE RECORD REDUCED AND AVERAGED RECORD DATA

The output listings of the single record non-averaged reduced data and averaged record data have been reproduced on MICROFICHE and are included with the report where up to 208 computer listings may be placed on a projectable 4" x 5-3/4" transparency.

I. TEST LINES

Flight lines within the map sheet area were chosen having a length of about five miles, and were surveyed prior to and following each day's operation, conditions allowing such flights. The results of these test line surveys over the same morning and evening surface location are summarized in Appendix III.

J. ALTITUDE AND GROUND SPEED HISTOGRAMS

A histogram of the ground speed of the helicopter and its altitude are included for each map and tie line in Appendix III.

K. ANOMALOUS DATA DETERMINED FROM EXAMINATION OF PROFILE LINE DATA

An evaluation of the results of all data from flight line profiles and statistical deviation maps (NGRMS maps) is made for each line. Particular attention should be given to the eU/eTh ratio in the profile data and in the NGRMS map to detect regions of anomalous eU.

1. Analysis of Histograms

The radioactivity data is shown in histogram form with counts per second (c/s) plotted against number of events (Appendix I). The histograms for ²⁰⁸Tl and ⁴⁰K were examined for conformity to a Gaussian curve. It is generally assumed that a geologic map unit, which encompasses a fairly homogeneous lithology, would have a unimodal distribution. Where map units vary significantly from a unimodal distribution, a further subdivision into more homogeneous lithologic types may be recommended. Table 7 shows the map units which vary from a unimodal model, and for which separation of two or more distributions is feasible. Only units with excess of 200 events are considered.

2. Interpretation of Radioactivity Data

Introduction

The ²⁰⁸Tl, ²¹⁴Bi, and ²¹⁴Bi/²⁰⁸Tl (ratio) data were examined for anomalous values. An anomaly is defined by a minimum of two adjacent, two-standard deviation values, or a single, three-standard deviation value. The anomalies were listed by flight line in Table 8; by geologic map unit in Table 9; Table 9 is statistically summarized in Table 10. Only positive anomalies were examined for ²⁰⁸Tl and ²¹⁴Bi, but both positive and negative values were studied for the ratio anomaly.

TABLE 7. List of Radioactivity Histograms with Distributions which Deviate Significantly from a Unimodal Model

Geologic Unit	Number of Events	Recommended Split c/s (²⁰⁸ Tl)
Gq	742	none
OGbc	241	27,58,83 ;
Op1	690	58;
Ocw	610	58;
Ol	378	19,63;
Ov1	1424	81 ;
Ov2	1426	none
Ovi	744	none
S0wu	606	67,101;
S1	440	none
DSrm	275	70,89,115;
Deu	466	44;
lPp	204	73;
Pg	239	55;
Trs1	492	none
Jv	203	38;
Jgl	875	102;
Kg3	388	none
ir	306	65;
To12	548	77;
Twa	1336	50;
Tvm	724	40,108;
Tmc	646	62;
Tad1	2194	none
Tth	733	none
Twt1	617	none
Twt2	857	none
Tr1	255	none
Tec	465	71;
Twt4	1330	none
Tsh	542	60,139;
Trd	2261	none
Tr1	1991	none
Tos	700	none
Tbm	3107	40;
Tn	237	95;
Tt	477	none
Twtb	464	113;
Ts5	594	68;
Tvu	3893	none
Tg	258	104;
QTsu	484	73
Qa12	8226	none
Qoa1	2436	none
Qoa2	10279	none
Qya	4653	15;
Qp2	702	67;

TABLE 8. Summary of Anomalies

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML-1			Qa12, 4020-4035;Tmc,4540; Qa1 2,4760-4800;
ML-2	Dc,3290-3300;	Qa12,1820-1825;Tmd,2100; Tmc,2140-2150;Qa12, 2560-2570,2820-2830; Tsh,2870-2880;Dc,3290- 3300;	Qa12,1630,1650,1635, 1725;Twa,2700;To1,3210;
ML-3	Tsh 3110,3130,3170;Ocw, 3210-3270;Qa12, 3660-3670 3800-3820,3940-3950,5110- 5130;Tr2,5250;	Qa12,1800-1810,1940- 1970;	Twtb,4280;Qa12,4360-4370, 4430-4440; [Twa,2395];
ML-4	Qf,1060-1075;6cc,1290- 1300;Qa12,2260-2270; Twa,2500-2510,2605-2615; Knc,2140-2145;	6gh,1260-1270;Kg3, 1350-1360;	Ocw,1930;D1,2650-2665; Dc 3210-3215;
ML-5	Op1,460-475;6w,525;Qa1 1, 665-680;Qf,1335-1350; Twt1,1480;	Op1,460-470;520-525;	Qoa2,180-195;Kn,290; Qoa2,625;Op1,850-855; Qf,1155;[Qf,2325];
ML-6	Qf,4685-4690,4730-4750; Qa,4900-4920;Qf5035-5040; TR2,5230-5260;O 1,6150- 6160;Tvu,6740;	Tr2,5270;Ov1,6160; Qoa2,6880-6890;	Qa,5770;Qf6035;DSrm, 6065-6080;Qf,6085;Qoa 2, 6450-6460;Tvu,6700;Dn, 7050,7080,7280-7290;
ML-7	Tvu,1070;Op1,1030-1040; O6bc,2120;6q,2150,Qf, 2560;	Qoa2,670-725,760-765, 820-835;Op1,1140;Tbm, 1590,1615;6q2145- 2155;Qf,2560-2575;Qa, 2860-2870;Qp2,2965- 2980;Qa,2980-3000; Qf,3000-3050;Qya 3715- 3720;	Qoa2,220-225,300-310; Qtsu,470;Tvu,1190;Qf, 1750;Qa,1770-1775,1785- 1790;1815-1835;Twt2,2630; Qf,2800-2810;Qa,2810- 2820;Qf,3050-3015,3030- 3035
ML-8	Qoa2,650-665;Qf,1490- 1500,2350-2360,2370- 2380,2400-2410;Twt, 2480;	Qoa1,1485-1500;Qf,2375- 2395,2410-2415;Qa, 2525-2535,2660-2735; Qf,2735-2780;Twt4, 2810-2830;Tos,3410- 3425;Tr1,3425-3450;	Qf,1390-1400;Qa 2520- 2535,2615-2625,2710-2730, 2735-2765;Tos,3415-3420; Tr1,3430,3440;
ML-9	Tbm,2055-2060;Qoa2, 2775-2810,2825-2830, 2840-2905;SOeu, 3145;	Tr1,140-160;Qoa3,290- 300,360-370;Qf,810-835; Twt2,1010;Tbm,2060-2065 Qa,2070-2080;Qf,2080- 2095,2345-2350;Tvu, 2600-2615,Qoa2,2775- 2780,2780-2790,2820- 2830,2840-2845,2945;	Tr1,150-160;Qa,1465;Tbm, 2125;Ov1,2150;Tvu,3385;

57a

(TABLE 8. Cont'd.)

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML-10	Oe1,360-370,400-410; Qoa2,420-425;	Oe1,390-420;Tvu,1270- 1280;Ov1,2220;Trd, 3660-3670;	
ML-11	Qoa3,620-625;Tos,790- 815;Qf,835-840;Qa1 1, 2750-2755;Jgr,1855-1865; Tad1,2065-2085;Qf,2115- 2120,2150-2160;Qoa2, 2360-2365;	Ttm,780-785;Tr1,475- 520;	Jgr,1790;Qf,1585;
ML-12		Qf,190-200;	Qoa2,3070;Qf,190-200;
ML-13	Qoa3,360-370-415,790- 800;Qya,415-430,610-620, 630-660,690-700,730-735 Twt1,2140-2150;	Qoa3,375-420;Qya,440-450, 600-740;P1Pa,1150-1155; Tad1,2150-2170;Qoa2, 2405-2420;	Qa,1175;Tad1,1385-1395; Qa11,2530-2540,2720; Qoa2,3220;
ML-14	Tbm,1880-1885;Tob,3210- 3230,3240-3270;Tr1,3230- 3240,3270-3275;	Ov2,220;Ds,1765;O1, 2320-2335;Tob,3250, 3260-3270;Tyb,3410;	Qa11,130-145;ir,165-175; Qoa2,355-380,790-800; Twt,2330;
ML-15E			O 2,8150-8180;6cc, 10230;
ML-15W			Tr2,1150;
ML-16E			Qoa2,7100-7115;
ML-16W			[Tr1,2490];
ML-17E	Qoa2,3895-3935;SOwu, 3995-4020;Tvu,3935- 3995,4070-4100,Ov1, 4115-4120,4135-4140;Qf, 4650-4705;Tr1,4740-4750; Tth,4930-4935;	Tc,4655-4670;	[Qa,4970-4980;Tbm,4580]; Qoa2,2410-2430,2450- 2490;
ML-17W	Tra2,4815-4825		
ML-18E	Tg,1415-1425;Qoa2, 1425-1435;		Tad1,160-170;Qf,1185; Ov1,1250-1265-1290;Tvu, 1885;Dn,1910-1920;Ov2, 2000-2020;Pg,2250-2260; S1,2290;
ML-18W			[Qoa3,6360];

57b

(TABLE 8. Cont'd.)

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML-19	Tr2,560-570,730,745- 765,845-850;Qoa1,1660- 1665,1715-1735;Ov1,1835- 1845;Tvu,2675-2695;3285- 3300;Ov2,3300-3310;	Tr2,560-590,630-640; Trsu,680-690;Tr2,690- 720,730-770,850,875, 910;Qoa1,1710-1730; Ov1,1835-1840;Tth, 2025-2050;Tvu,2670-2700 Qoa2,2740-2750;Qa11, 3560-3580,3600-3630;	Qya 140;Tbm,945;Ov1,1980; Tth,2030,2050;Tvu 2670; Dd 3115-3125;Tvu,3170;
ML-20	Tr2,2060-2065;Tbm,2620- 2625,3040-3045;Tg,4075 4080;Qoa2,4155-4170;Dn, 4340-4360;	Qya,1820,1840-1850,1890- 1920;Tr2,2100-2115;Qa, 2960-2970;SOwu,3940;Tg 2985-2995;Tbm,3040-3050; Qoa2,1165;Dd,4350;Tvu, 4465-4475;Qa11,4880- 4900;	Tr2,2100;Qoa3,2170;P1Pa, 2960-2970;SOwu,3940;Tg 3970;Qoa2,4100-4135; O 2,4545;S1,4730-4740; Qa11,4750-4760,4775, 4820-4830;
ML-21	Qa,2615-2620;	1Pp,2050;	S1,145-150;Tad1,1485- 1490;Qoa1,1860;
ML-22	Qoa1,4230-4235,4245- 4250;Jv,5440-5445;		Qa1,2250;Dn,2290;Tr2, 5600;
TL-1			
TL-2			
TL-3	Tad2,330-340;Twt2,1880- 1900,1930-1940;	Qa,330-340;Tec,390; Qa12,2105-2145,2160, 2180-2220;2215-2220;	Tvm,1975;
TL-4	Kg3,9190-9200,9270- 9280;	6gh,9130-9140,9190- 9200,9260-9265;	Qa,9930,9945;Qf,9810;
TL-5			[Ov1,1715-1720];
TL-6	Tbm,7270-7280;		DSrm,6930-6940;[Tbm, 7200;Ov1,7550-7560];
TL-7	Tvu,5130-5170,5190- 5210,5500-5570;	Tvu,5525;	Op1,3930;
TL-8	Qoa2,1565-1575;Qa11, 945-950,800-850;Dd, 460-470;		
TL-9			Qa1,925,940;

57c

TABLE 9. Radioactivity Anomalies per Geologic Map Unit

Geologic Map Unit	^{208}Tl	^{214}Bi	$^{214}\text{Bi}/^{208}\text{Tl}$
Gq	1	1	0
Gcc	1	0	1
Gu	1	0	0
Ggh	0	4	0
O6bc	1	0	0
Op1	2	3	2
Ocw	1	0	1
Oel	2	1	0
O1	0	1	0
Ov1	4	3	4 (2)
Ov2	1	1	3
S0eu	1	0	0
S0wu	1	0	1
S1	0	0	3
DSrm	0	0	2
D1	0	0	1
Ds	0	1	0
Dn	1	0	5
Dc	1	1	1
Dd	1	1	1
P1Pa	0	1	1
1Pp	0	1	1
Pg	0	0	1
Trc2	1	0	0
Trsu	0	1	0
Jv	1	0	0
Jgr	1	0	1
Knc	1	0	0
Kn	0	0	1
Kg3	2	1	0
ir	1	0	1
ToG	2	2	0
Twa	2	2	1 (1)
Tvm	0	0	1
Tad1	1	1	3
Tad2	1	1	0
Tth	1	1	1
Twt1	2	0	0
Twt2	2	0	1
Tr1	1	0	1
Tr2	7	9	3
Tc	0	1	0
Twt	1	0	1
Tec	0	1	0
Ttm	0	1	0
Tmc	0	0	1

(Table 9. Cont'd.)

Geologic Map Unit	^{208}Tl	^{214}Bi	$^{214}\text{Bi}/^{208}\text{Tl}$
Twt4	0	1	0
Tsh	1	1	0
Tmd	0	1	0
Trd	0	1	0
Tr1	2	3	2 (1)
Tos	1	1	1
Tbm	5	3	2 (2)
Twtb	0	0	1
Tyb	0	1	0
Tvu	8	5	5
Tg	2	0	1
QTsu	0	0	1
Qa11	4	3	8
Qa12	6	9	8
Qoa1	4	3	1
Qoa2	9	10	13
Qoa3	4	3	1 (1)
Qya	5	6	1
Qa	2	7	13 (1)
Qp2	0	1	0
Qf	16	8	12 (1)

(....) denotes negative anomalies

TABLE 10. Statistical Summary of Radioactivity Anomalies

	^{208}Tl	^{214}Bi	$^{214}\text{Bi}/^{208}\text{Tl}$
<u>Quaternary Geologic Map Units</u>			
No. of Anomalies	50	50	58 (3)
No. of units with Anomalies	8	9	9 (3)
<u>Tertiary Units</u>			
No. of Anomalies	46	39	28 (4)
No. of units with Anomalies	22	21	18 (3)
<u>Mesozoic Units</u>			
No. of Anomalies	7	2	3 (0)
No. of units with Anomalies	6	2	3 (0)
<u>Paleozoic Units</u>			
No. of Anomalies	19	19	28 (2)
No. of units with Anomalies	14	12	15 (1)
<u>Total Sample</u>			
No. of Anomalies	122	110	117 (9)
No. of units with Anomalies	50	44	45 (7)

(....) denotes negative anomalies

Relationship of Geologic Map Unit to the Radioactivity Anomalies

Quaternary Geologic Units: QTsu,Qal₁,Qal₂,Qoa₁,Qoa₂,Qoa₃,Qya,Qa,Qp₂,Qf

²⁰⁸Tl Anomalies

Forty-one percent of the ²⁰⁸Tl anomalies occur in eight Quaternary or Quaternary-Tertiary aged units, which comprise approximately fifty-four percent of the map area. Most of the ²⁰⁸Tl anomalies occur in the Qoa, Qal, or Qf units. The most likely concentration of thorium-rich minerals will occur in placer deposits - usually gravels or sands derived from plutonic igneous rock. However, none of the ²⁰⁸Tl anomalies coincide with ratio anomalies. Most ²⁰⁸Tl anomalies are probably the result of intra-unit changes in lithology.

²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl Anomalies

Forty-five percent of the ²¹⁴Bi anomalies and fifty percent of the ratio anomalies occur in nine Quaternary units, which occupy approximately fifty-four percent of the map area. Uranium concentrations in the unconsolidated deposits are most likely to occur as (i) placer deposits, as (ii) epigenetic precipitation of uranyl ions from groundwaters, or (iii) in evaporite deposits resulting from local evaporation sinks. Only two of the ²¹⁴Bi anomalies coincide with a ratio anomalies; these occur at ML8, stations 2525-2535 and 2660-2735, and are in the Qa unit.

Tertiary Geologic Units: Tob,Twa,Tvm,Tmc,Tad₁,Tad₂,Tth,Twt₁,Twt₂,Tr₁,Tr₂,Tc,Twt,Tec,Ttm,Twt₄,Tsh,Tmd,Trd,Trl,Tos,Tbm,Twtb,Tyb,Tvu,Tg

²⁰⁸Tl Anomalies

Thirty-seven percent of the ²⁰⁸Tl anomalies occur in twenty-two Tertiary units, which occupy some twenty-nine percent of the map area. The anomalies are fairly evenly distributed throughout the Tertiary units. Many anomalies occur in the Tr₂ and Tvu units. None of the ²⁰⁸Tl anomalies coincide with ratio anomalies. Most, if not all, of the anomalies are the result of intra-unit changes in lithology.

²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl Anomalies

Thirty-five percent of the ²¹⁴Bi anomalies and twenty-four percent of the ratio anomalies occur in twenty-one and eighteen of the Tertiary units. These units occupy approximately twenty-nine percent of the map area. Listed below are the ²¹⁴Bi anomalies which coincide with ratio anomalies in the Tertiary units.

Geologic Unit

Tos
Tr₁
Tr₁
Tvu
Tth
Tr₂

Flight Line

ML8, stations 3410-3425;
ML8, stations 3425-3450;
ML9, stations, 140-160;
ML19, stations, 2670-2700;
ML19, stations, 2025-2050;
ML20, stations, 2100-2115;

Some of the ²¹⁴Bi anomalies result from uranium mineral concentrations in fault or vein zones; other concentrations are probably epigenetically-formed uranyl ion deposits derived from extrusive, or tuffaceous, rocks. Rhyolitic rocks are major sources for the uranyl ion, which may be moved in alkaline groundwaters and deposited in reducing environments; particularly, in the presence of carbonaceous material.

Mesozoic Geologic Units: Trc₂,Trsu,Jv,Jgr,Knc,Kn,Kg₃,ir

²⁰⁸Tl Anomalies

Six percent of the ²⁰⁸Tl anomalies occur in the Mesozoic units, which occupy some three percent of the map area. The anomalies are fairly evenly distributed throughout six Mesozoic units. The most likely sources of thorium mineral concentrations in the Mesozoic units are pegmatites and hydrothermal veins associated with plutonic intrusive rocks; i.e., Jgr and Kg₃. None of the ²⁰⁸Tl anomalies coincide with ratio anomalies.

²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl Anomalies

Only two ²¹⁴Bi anomalies and three ratio anomalies occur in the Mesozoic units. One of the ²¹⁴Bi anomalies is in the Trsu unit, which includes intercalated limestone and dolomite; the other is in a Kg₃ unit of granitic composition. The former may be a groundwater deposit; the latter may be associated with pegmatite or vein phenomena. None of the ²¹⁴Bi anomalies coincide with ratio anomalies.

Paleozoic Geologic Units: Gq,Gcc,Gu,Ggh,OGbc,Op₁,Ocw,Oe₁,O₁,Ov₁,Ov₂,SOeu,SOWu,Sl,DSrm,Dl,Ds,Dn,Dc,DD,PiPa,lPp,Pg

²⁰⁸Tl Anomalies

Fifteen percent of the ²⁰⁸Tl anomalies occur in fourteen of the Paleozoic units, which occupy approximately twelve percent of the map area. The anomalies are fairly evenly distributed throughout the units, with Ov₁ having the highest aggregate (4). Many of these anomalies are associated with intra-unit changes in lithology. Some may be related to vein deposits in faulted zones. None of the ²⁰⁸Tl anomalies coincide with ratio anomalies.

²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl Anomalies

Seventeen percent of the ²¹⁴Bi and twenty-four percent of the ratio anomalies occur in the Paleozoic units, which occupy some twelve to

thirteen percent of the map area. None of the ²¹⁴Bi anomalies coincide with ratio anomalies. The highest ²¹⁴Bi anomaly aggregates occur in the Ggh (4), Op₁ (3), Ov₁ (3) units; whereas, the highest ratio anomaly aggregates occur in the Ov₁ (4), Ov₂ (3), Sl (3) and Dn (5) units. Some of the anomalies may be due to groundwater precipitation in pore spaces, or where groundwater circulation has been impeded by structural or lithologic features; some may be related to vein or brecciated deposits in fracture and fault zones. Most anomalies are related to lithologic changes within a particular unit.

Relationship of Radioactivity Anomalies to the Known Occurrence of Radioactive Minerals

²⁰⁸Tl Anomalies

There appear to be no coincidences of ²⁰⁸Tl anomalies with known occurrences of thorium-rich mineral concentrations.

²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl Anomalies

A small ²¹⁴Bi anomaly on ML10, station 2220, is in the general vicinity of several groups of claims in the Austin area. These several groups include the Early Day Claims, the Rundberg Claims, the Apex Mineral County Claims, the El Dorado Claim, the Buck Claims, and the Johnson Canyon Claims. The ²¹⁴Bi anomaly occurs in the Valmy Formation (Ov₁). Uranium deposits in the vicinity of the Austin Pluton, generally, are at or near the contact of the Jurassic granitic intrusive with Cambrian and Ordovician rocks (Garside, 1973).

The Relationship of Radioactivity Anomalies to Cultural Features

The Millett National Topographic Map Sheet (N.T.M.S., 1955) depicts an area of arid basins and rugged-dissected ranges. Ranching is the major occupation of the lowlands; whereas, mining is the major occupation in the ranges. There are very few towns, and none with populations exceeding one thousand. The primary and secondary all-weather, hard-surface road network is sparsely developed. There appear to be no major coincidences of radioactivity anomalies with cultural features.

Trends

²⁰⁸Tl Anomalies

The ²⁰⁸Tl anomalies are unevenly distributed throughout the map area. They appear to be most densely concentrated in the southeastern quadrant of the map sheet in the vicinity of the Monitor and Antelope ranges, and in the vicinity of the Antelope Valley. Other major clusters of ²⁰⁸Tl anomalies occur: (i) in the Edwards Creek Valley, between TL1 and TL3 and between ML12 and ML14; (ii) in the Shoshone and southern Toiyabe ranges, south of ML10, between TL2 and TL5; (iii) in the southern Simpson Park Mountains, in the vicinity of TL6, between ML8 and ML13; and (iv) on the eastern flank of the central part of the Simpson Park Mountains, in the vicinity of TL7, between ML16 and ML17.

²¹⁴Bi Anomalies

The ²¹⁴Bi anomalies are also unevenly distributed throughout the map sheet area. Some major clusters of ²¹⁴Bi anomalies can be discerned. These clusters include: (i) a group of ²¹⁴Bi anomalies in the vicinity of TL2, between ML19 and ML20, in the northern part of the Clan Alpine Mountains; (ii) a group of ²¹⁴Bi anomalies in Edwards Creek Valley, between TL1 and TL3 and between ML11 and ML14; (iii) a group in Smith Creek Valley, between TL2 and TL4 and ML7 and ML9; (iv) a group in the Toiyabe Range, in the vicinity of TL4 and south of ML5; and (v) a group of ²¹⁴Bi anomalies in Antelope Valley, in the vicinity of TL8, between ML6 and ML9.

²¹⁴Bi/²⁰⁸Tl Anomalies

The ratio anomalies are more evenly distributed throughout the map sheet area than are the ²¹⁴Bi or ²⁰⁸Tl anomalies. However, minor clustering of the ratio anomalies is apparent. Some of the more prominent of these minor clusters are: (i) in Smith Creek Valley, between TL2 and TL3 and between ML7 and ML8; (ii) in Big Smoky Valley, between TL4 and TL6 and south of ML2; (iii) in the Roberts Mountains, in the vicinity of TL8 and between ML17 and ML20; and (iv) in Diamond Valley, in the vicinity TL9 and north of ML18.

3. Summary and Recommendations

Between forty and fifty percent of the radioactivity anomalies occur in the Quaternary units. Many of these anomalies, particularly the ²⁰⁸Tl anomalies, would appear to be the result of intra-geologic unit changes in lithology. Some of the ²¹⁴Bi and ratio anomalies in the Quaternary units may be the result of epigenetically-controlled precipitation of uranyl ions from groundwater, or occur as a result of evaporation in interior drainage basins. Very few ²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl anomalies coincide geographically.

The greatest number of coincidences of ²¹⁴Bi and ²¹⁴Bi/²⁰⁸Tl anomalies occur in the Tertiary units. The rhyolitic unit, Tr₂, has the highest number of ²⁰⁸Tl and ²¹⁴Bi anomalies, but relatively few ratio anomalies. The Tr₂ unit is widespread in Churchill County.

There are surprisingly few anomalies in the Cretaceous plutonic igneous units. The Austin Pluton and its regional contacts with Paleozoic rocks is one of the major uranium-producing areas in Nevada. However, only one ²¹⁴Bi anomaly is in the general vicinity of the large number of uranium claims associated with this pluton.

The Gold Hill Formation (Ggh), the Pogonip Group (Op) and the Valmy Formation (Ov) have the highest aggregates of ²¹⁴Bi anomalies of all the Paleozoic rocks. Contact areas between some of the Paleozoic rocks and the Mesozoic intrusives are known to be likely loci for uranium mineralization.

APPENDIX I

FREQUENCY DISTRIBUTION OF RADIATION DATA

AS A FUNCTION OF GEOLOGIC UNIT

Tλ		BI		K		Bi/Tλ		BI/K		Tλ/K		NO. EVENTS	GEOL. UNIT
σ	̄	σ	̄	σ	̄	σ	̄	σ	̄	σ	̄		
39.1345	61.7	7.0664	32.1	84.4207	190.1	0.2714	0.6664	0.0621	0.1904	0.0777	0.3064	28.0	DC
13.6292	28.5	5.4768	12.8	57.5757	99.1	0.1852	0.4805	0.0677	0.1471	0.0883	0.3076	615.0	DD
11.9992	26.3	4.8472	9.7	32.5240	79.8	0.2429	0.4117	0.0767	0.1356	0.0815	0.3342	466.0	DEU
47.0024	94.1	5.1809	30.2	66.2010	237.5	0.1591	0.3896	0.0252	0.1323	0.1002	0.3731	26.0	DL
14.5776	29.0	7.8707	14.3	47.0416	96.4	0.2163	0.5084	0.0618	0.1520	0.0691	0.3087	977.0	DN
13.3576	47.0	5.5971	22.5	38.5339	151.2	0.1728	0.5061	0.0457	0.1547	0.0538	0.3142	446.0	DS
28.0006	71.6	11.6810	33.3	68.1284	220.8	0.1837	0.5021	0.0566	0.1595	0.0757	0.3253	275.0	DSRM
7.7791	33.3	3.6711	16.8	34.3732	117.2	0.0865	0.5133	0.0401	0.1508	0.0332	0.2908	12.0	DSWU
7.5330	23.9	5.9059	20.4	23.8084	71.0	0.4768	0.9908	0.1681	0.3395	0.0581	0.3444	39.0	DTM
12.9032	47.7	7.5388	19.0	67.1548	156.0	0.1573	0.4109	0.0502	0.1299	0.0704	0.3271	922.0	EGCC
19.4763	85.5	10.5608	12.3	108.1564	368.8	0.1301	0.1544	0.0359	0.0400	0.0546	0.2407	68.0	EGH
12.9847	60.8	6.7986	19.3	59.9114	186.7	0.1045	0.3237	0.0325	0.1071	0.0625	0.3393	742.0	GU
8.5727	20.3	4.0188	9.3	18.6002	78.6	0.2182	0.4929	0.0507	0.1207	0.0766	0.2540	45.0	GU
13.0170	55.7	6.1611	25.2	34.8391	175.2	0.0856	0.4597	0.0249	0.1448	0.0489	0.3188	204.0	IPP
21.4500	48.0	8.1956	19.7	58.5949	269.0	0.1713	0.4331	0.0279	0.0731	0.0780	0.1845	306.0	IK
1.9709	25.5	1.4200	12.4	6.9111	109.9	0.0493	0.4857	0.0166	0.1129	0.0231	0.2321	14.0	JA
18.3332	75.0	10.1301	27.1	55.3256	239.2	0.1041	0.3608	0.0313	0.1128	0.0547	0.3180	875.0	JGR
17.0012	37.9	9.3160	17.0	53.9901	108.3	0.1789	0.4577	0.0666	0.1672	0.1369	0.3890	138.0	JG
12.0227	75.7	5.3400	30.1	39.0057	265.4	0.0624	0.4015	0.0076	0.1133	0.0409	0.2870	27.0	JTRMV
28.8498	39.3	9.0706	17.5	86.1474	162.7	0.1808	0.4911	0.0689	0.1238	0.1264	0.2687	203.0	JV
18.5484	66.5	11.2274	29.2	49.1925	208.4	0.1746	0.4466	0.0457	0.1402	0.0831	0.3298	53.0	KG1
5.2610	84.7	3.7118	34.0	12.3112	340.3	0.0482	0.4010	0.0120	0.1000	0.0266	0.2490	10.0	KG2
20.8926	90.6	12.3486	31.9	59.3256	315.3	0.1026	0.3484	0.0371	0.1013	0.0540	0.2890	388.0	KG3
7.1997	36.4	11.3499	20.9	28.8575	143.3	0.4409	0.6079	0.1134	0.1554	0.0423	0.2576	178.0	KN
25.5814	65.9	3.2681	22.7	74.9527	200.8	0.3222	0.4527	0.2168	0.1846	0.1088	0.3559	41.0	KNC
4.6124	45.0	8.2604	23.5	18.7130	197.4	0.1754	0.5244	0.0493	0.1215	0.0289	0.2294	52.0	MU
4.4861	61.1	2.8158	33.8	9.1261	225.0	0.0308	0.5525	0.0181	0.1500	0.0356	0.2713	8.0	OA
41.6100	58.5	10.9819	25.4	88.5927	172.4	0.2648	0.5368	0.0772	0.1628	0.0779	0.3217	610.0	OCW
8.2323	30.3	4.1065	9.2	27.5224	91.1	0.1658	0.3242	0.0608	0.1109	0.0986	0.3466	414.0	OE1
10.5667	116.9	2.8500	24.7	12.3540	291.2	0.0223	0.2120	0.0127	0.0850	0.0487	0.4030	10.0	OE2
28.0917	55.1	4.7573	21.4	56.1628	180.8	0.2775	0.5119	0.0438	0.1279	0.0956	0.2915	241.0	OEBC
4.9329	26.7	3.0000	16.0	12.8387	98.7	0.0548	0.6000	0.0358	0.1633	0.0344	0.2733	3.0	OH
21.2571	122.8	9.0219	35.6	51.0365	354.1	0.0371	0.2876	0.0195	0.0997	0.0329	0.3456	34.0	OHC
14.1614	45.3	8.7841	17.7	59.2239	158.2	0.2023	0.4218	0.0618	0.1238	0.0765	0.3014	378.0	OL
28.5270	42.8	10.2254	17.4	74.0754	130.2	0.2010	0.4424	0.0789	0.1457	0.1060	0.3328	690.0	OP1
34.9893	52.0	9.3619	19.8	90.4869	161.8	0.2377	0.4666	0.0624	0.1370	0.0539	0.3040	194.0	OP2
13.6597	41.5	3.5778	19.2	44.0748	146.7	0.1655	0.5038	0.0469	0.1416	0.0267	0.2822	37.0	OU
17.8969	53.2	7.7825	22.9	63.9855	174.3	0.1506	0.4513	0.0616	0.1439	0.0978	0.3210	1424.0	OV1
13.1715	43.0	8.9134	24.0	45.2193	147.9	0.1995	0.5749	0.0618	0.1687	0.0600	0.2961	1426.0	OV2
30.2557	60.4	10.4713	24.3	58.5083	161.4	0.2086	0.4494	0.0697	0.1593	0.1570	0.3797	744.0	OVI
16.0473	42.5	6.1413	20.4	37.7549	125.4	0.2068	0.5313	0.0668	0.1745	0.0562	0.3368	239.0	PG
16.3974	49.7	6.0425	22.9	40.5008	157.6	0.1547	0.4957	0.0348	0.1489	0.0638	0.3153	151.0	P1PA
4.7132	52.1	2.9666	22.3	16.4322	180.3	0.0678	0.4313	0.0200	0.1247	0.0295	0.2902	45.0	P1PH
10.9434	51.8	9.3207	18.5	31.4218	162.0	0.1678	0.3526	0.0492	0.1113	0.0456	0.3230	367.0	P1PU
12.2266	69.3	4.8826	23.6	55.7654	218.8	0.0536	0.3428	0.0196	0.1101	0.0314	0.3225	68.0	PP1
12.0560	117.8	5.1563	39.5	24.8409	350.0	0.0524	0.3380	0.0182	0.1135	0.0321	0.3371	55.0	PP2
20.5074	72.5	11.4460	33.8	61.1539	233.7	0.1163	0.4719	0.0332	0.1446	0.0573	0.3134	6871.0	QA
19.1728	61.6	7.8432	24.6	61.4166	206.8	0.1256	0.4162	0.0324	0.1220	0.0595	0.3015	4420.0	QAL1
25.2735	90.5	10.1491	34.0	62.3390	277.6	0.1143	0.3880	0.0322	0.1238	0.0611	0.3271	8226.0	QAL2
20.9036	75.8	10.8440	31.7	64.5359	222.4	0.1007	0.4221	0.0325	0.1440	0.0584	0.3468	15818.0	QF
16.5402	59.7	8.2041	24.4	51.5455	172.6	0.0941	0.4134	0.0334	0.1441	0.0519	0.3525	2436.0	QUA1
30.4323	69.2	9.3105	25.5	76.9707	199.8	0.1308	0.3962	0.0420	0.1341	0.1006	0.3508	10279.0	QUA2
17.4446	71.5	10.5772	30.6	65.5821	227.4	0.0943	0.4276	0.0304	0.1358	0.0519	0.3217	3223.0	QUA3
23.8011	61.7	11.6731	24.1	76.2050	202.6	0.1443	0.4056	0.0491	0.1226	0.0482	0.3053	97.0	QOG
9.5469	79.9	2.3042	26.1	35.2177	279.6	0.0495	0.3314	0.0199	0.0943	0.0199	0.2857	7.0	QP1
15.0964	68.7	8.3051	35.3	30.7023	254.7	0.0852	0.5197	0.0369	0.1408	0.0613	0.2722	702.0	QP2
7.8685	50.9	4.4840	26.1	26.5674	191.3	0.1298	0.5264	0.0395	0.1400	0.0280	0.2672	74.0	QP3
10.6950	90.0	6.7736	38.5	36.0283	271.8	0.0633	0.4282	0.0200	0.1418	0.0294	0.3325	71.0	QTAD
4.4505	77.0	3.5645	31.9	13.5853	272.7	0.0577	0.4164	0.0191	0.1177	0.0220	0.2627	22.0	QTB1
18.3607	71.2	7.3784	26.8	41.4696	237.5	0.0723	0.3774	0.0261	0.1126	0.0493	0.3003	87.0	QTB2
33.9891	65.0	11.5098	25.4	75.9379	179.8	0.1154	0.4150	0.0455	0.1444	0.0587	0.3505	484.0	QTSU
18.0863	55.6	9.4305	23.6	63.1576	182.5	0.2886	0.4412	0.0314	0.1315	0.0532	0.3088	4653.0	QYA
6.2882	52.1	5.1818	20.9	22.8370	154.5	0.1112	0.4071	0.0247	0.1348	0.0502	0.3419	63.0	SE
8.3341	12.5	6.5091	12.5	24.3258	82.6	0.2661	0.5110	0.0847	0.1587	0.0788	0.3175	440.0	SL
6.3915	28.3	1.9965	8.8	19.4128	96.5	0.0997	0.3261	0.0255	0.0937	0.0452	0.2941	41.0	SOEU
39.0983	62.1	8.7752	22.5	40.5235	149.0	0.2374	0.4535	0.0629	0.1554	0.2411	0.4236	606.0	SO40
13.2029	67.6	5.9675	27.6	48.1851	260.5	0.0811	0.4137	0.0190	0.1065	0.0303	0.2607	81.0	TA2
18.7627	81.5	9.3368	25.5	47.0320	203.8	0.1084	0.3197	0.0322	0.1246	0.0690	0.4045	2194.0	TAD1
34.8474	81.2	12.8706	36.4	55.1365	218.4	0.0922	0.4723	0.0391	0.1665	0.0949	0.3606	136.0	TAD2
20.4523	91.8	12.4631	36.9	59.4191	246.7	0.0993	0.4003	0.0329	0.1482	0.0465	0.3762	3107.0	TBM
19.8183	85.0	11.4450	32.7	66.8472	240.1	0.1015	0.3858	0.0326	0.1368	0.0920	0.3662	191.0	TC
6.5411	73.2	3.4464	26.2	33.3282	299.1	0.0437	0.3591	0.0176	0.0883	0.0436	0.2478	23.0	TD1
12.1394	67.0	4.8187	23.5	41.9240	258.2	0.0984	0.3631	0.0259	0.0934	0.0454	0.2624	162.0	TD2
24.2513	83.5	11.3808	36.8	58.3720	254.9	0.0912	0.4452	0.0300	0.1434	0.0498	0.3260	465.0	TEC
59.0840	109.4	14.5670	32.4	42.4573	187.8	0.1564	0.3467	0.0529	0.1726	0.2592	0.5795	258.0	TG
5.5374	44.6	2.7926	14.8	4.9661	137.6	0.0611	0.3319	0.0219	0.1075	0.0419	0.3238	16.0	TJG
20.1237	102.5	12.4522	35.1	56.4719	290.4	0.1209	0.3451	0.0367	0.1203	0.0450	0.3554	646.0	TMC
17.5847	108.9	12.2871	43.8	35.9793	298.8	0.0859	0.4028	0.0373	0.1464	0.0468	0.3647	135.0	TMD
10.5690	87.5	10.3227	30.8	34.2953	247.7	0.0894	0.3494	0.0277	0.1227	0.0309	0.3548	237.0	TN
15.3755	87.9	6.7016	23.6	43.7789	243.2	0.1195	0.2781	0.0358	0.0991	0.0318	0.3621	159.0	TUA
30.1298	59.6	10.4526	19.7	62.1777	173.3	0.0981	0.3332	0.0426	0.1123

NO. OF EVENTS

GEOLOGIC UNIT KG1

A21

GEOLOGIC UNIT KG2

A22

NO. OF EVENTS

A27

A28

NO. OF EVENTS

A43

A44

MILLETT

A45

MILLETT

A46

R49

R50

NO. OF EVENTS

A59

A60

A63

A64

MILLETT

MILLETT

A69

MILLETT

A70

A83

A84

A85

A86

NO. OF EVENTS

A91

NO. OF EVENTS

A92

MILLETT

A 101

MILLETT

A 102

A 103

A 104

A111

A112

A115

A116

MILLETT

NO. OF EVENTS

RA126

MILLETT

MILLETT

APPENDIX II
DESCRIPTION OF MAGNETIC TAPES AND LISTINGS

A. DESCRIPTION OF DATA TAPES

A1. General

All data tapes are 9-track, 800 BPI (NRZI), odd parity, EBCDIC code. Each tape contains a gum label giving the survey project name, month and year of survey, tape type, subcontractor name, date tape created, tape reel count, tape recording characteristics, block size in Bytes and location of tape format information.

The general description for each of the tape types is as follows:

Block Number	Description
1	Format Description
2	Tape Identification
3	First Data Block
4	Second Data Block
.	.
.	.
.	Last Data Block
EOF	

A2. Raw Spectral Data Tapes

Block Size (Physical Record): 6600 characters
Logical Record, Data : 1100 characters

1. Format Description Block (Block 1)

The Format Description utilizes 4248 characters. The remaining 2352 characters of this block are blanks.

Line Number	Character Number
1	1234567890123456789012345678901234567890123456789012
2	01 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
3	RAW SPECTRAL DATA TAPE
4	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK ON TAPE)
5	
6	
7	ITEM FORMAT DESCRIPTION
8	1 A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2 A20 NAME OF SUBCONTRACTOR
10	3 14 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)

Line Number	Character Number
11	4 11 AERIAL SYSTEM IDENTIFICATION CODE
12	5 A20 AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
13	6 I3 BFEC CALIBRATION REPORT NUMBER
14	7 F6.3 4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
15	
16	8 F6.3 2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
17	
18	9 I3 NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
19	10 I3 NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
20	11 I3 NUMBER OF FLIGHT LINES ON THIS TAPE
21	12 I4 FIRST FLIGHT LINE NUMBER ON THIS TAPE
22	13 I6 FIRST RECORD NUMBER OF FIRST FLIGHT LINE
23	14 I3 JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE WAS COLLECTED
24	
25	15-17 I4,I6,I3 REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS TAPE
26	
27	* * *
28	* * *
29	* * *
30	306-308 I4,I6,I3 REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS TAPE
31	
32	
33	FORMAT FOR RAW SPECTRAL DATA RECORD (THIRD THRU LAST BLOCK ON TAPE)
34	
35	ITEM FORMAT DESCRIPTION
36	1 I1 AERIAL SYSTEM IDENTIFICATION CODE
37	2 I4 FLIGHT LINE NUMBER
38	3 I6 RECORD IDENTIFICATION NUMBER
39	4 I6 GMT TIME OF DAY (HHMMSS)
40	5 F8.4 LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
41	6 F8.4 LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
42	7 F6.1 TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
43	8 F7.1 TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
44	
45	9 A8 SURFACE GEOLOGIC MAP UNIT CODE
46	10 I4 QUALITY FLAG CODES
47	11 F4.1 OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
48	
49	12 F5.1 OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
50	13 F5.3 LIVE TIME COUNTING PERIOD TO THREE DECIMAL PLACES IN SECONDS
51	
52	14 I4 SUMMED RAW OUTPUT FROM COSMIC CHANNELS (3-6 MEV) IN COUNTS
53	
54	15 I4 RAW OUTPUT FROM CHANNEL 1 IN COUNTS
55	16 I4 RAW OUTPUT FROM CHANNEL 2 IN COUNTS
56	* * *
57	* * *
58	* * *
59	270 14 RAW OUTPUT FROM CHANNEL 256 IN COUNTS
-	- - 2352 BLANK CHARACTERS

2. Tape Identification Block (Block 2)

The information and format for this block are indicated in lines 8 through 30 of the Format Description Block A2.1, and 1396 characters are produced. The remaining 5204 characters in this block are blanks.

If fewer than 99 flight lines exist, the unused flight line information, 13 characters per flight line, is filled with 9's through the 99th flight line.

3. Raw Spectral Data Blocks

The information and format for the logical records in these blocks are indicated in lines 36 through 59 of the Format Description Block A2.1. One logical record contains 1100 characters. There are six such logical records per 6600 character physical record or block.

The 2 π data logical record is recorded after the corresponding 4 π data collection intervals at a frequency dependent on the 2 π system data collection interval. For example, if the 4 π data collection interval is 1 second and the 2 π data collection interval is 10 seconds, then 10 records of 4 π data are recorded followed by 1 record of the 2 π data which was collected during the preceding 10 seconds. The format for the 2 π data is identical to that of the 4 π data, except for lines 40 through 49 of the Format Description Block given above. These variables are expressed in the 2 π record as all nines in the format specified for I and F fields, and all zeros for A fields.

A3. Single Record Reduced Data Tapes

Block Size (Physical Record): 6900 characters
Logical Record, Data : 138 characters

1. Format Description Block (Block 1)

The Format Description utilizes 6768 characters. The remaining 132 characters of this block are blanks.

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	

Line Number	Character Number
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	8 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
19	
20	9 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH
21	
22	10 I6 BLANK FIELD (999999)
23	11 F6.3 4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
24	
25	12 F6.3 2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
26	
27	13 I3 NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
28	
29	14 I3 NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM
30	
31	15-24 (SAME) REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
32	* * *
33	* * *
34	* * *
35	
36	85-94 (SAME) REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
37	
38	95 I3 NUMBER OF FLIGHT LINES ON THIS TAPE
39	
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,I6,I3 REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
45	
46	* * *
47	* * *
48	* * *
49	390-392 I4,I6,I3 REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS TAPE
50	
51	
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

Line Number	Character Number
60	6 F8.4 LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
61	7 F6.1 TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
62	8 F7.1 RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
63	
64	9 A8 SURFACE GEOLOGIC MAP UNIT CODE
65	10 I4 QUALITY FLAG CODES
66	11 F6.1 APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
67	
68	12 F4.1 UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
69	
70	13 F6.1 APPARENT CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
71	
72	14 F4.1 UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
73	
74	15 F6.1 APPARENT CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
75	
76	16 F4.1 UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
77	
78	17 F6.1 URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
79	
80	18 F6.1 URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
81	
82	19 F6.1 THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
83	
84	20 F8.1 GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
85	
86	21 F6.1 UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
87	
88	22 F5.1 ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
89	
90	23 F4.1 UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
91	
92	24 F4.1 OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
93	
94	25 F5.1 OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG

2. Tape Identification Block (Block 2)

The information and format for this block are indicated in lines 8 through 49 of the Format Description Block A3.1, and 1922 characters are produced. The remaining 4978 characters of this block are blanks.

If less than nine aerial systems are used, the space allocated for additional systems is filled with 9's in the format specified for each item using I and F fields, and with zeros for A fields.

Similarly, if fewer than 99 flight lines exist, the unused flight line information, 13 characters per flight line, is filled with 9's through the 99th flight line.

3. Single Record Reduced Data Blocks

The information and format for the logical records in these blocks are indicated in lines 55 through 94 of the Format Description Block A3.1. One logical record contains 138 characters. There are 50 such logical records per 6900 character physical record or block.

The data appearing in locations specified by lines 68, 72, 76, 86 and 90 of the Format Description Block A3.1 are 9's in the format specified in each case.

A4. Statistical Analysis Data Tapes

Block Size (Physical Record): 8000 characters
Logical Record, Data : 160 characters

1. Format Description Block (Block 1)

The Format Description utilizes 7560 characters. The remaining 440 characters are blanks.

Line Number	Character Number	
1	03 0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2		
3		STATISTICAL ANALYSIS DATA TAPE
4		
5		FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6		
7	ITEM	FORMAT DESCRIPTION
8	1	A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20 NAME OF SUBCONTRACTOR
10	3	I4 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I1 NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR 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
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		

Line Number	Character Number	
30	13 13	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
31		
32	14 13	NUMBER OF CHANNELS (0-3 MEV) IN 2PI 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 13	NUMBER OF FLIGHT LINES ON THIS TAPE
40	96 14	FIRST FLIGHT LINE NUMBER ON THIS TAPE
41	97 16	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42	98 13	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS COLLECTED
43		
44	99-101 14,16,13	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
45		
46	*	*
47	*	*
48	*	*
49	390-392 14,16,13	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS TAPE
50		
51		
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	F8.4 LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
60	6	F8.4 LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
61	7	F6.1 TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
62	8	F7.1 RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
63		
64	9	A8 SURFACE GEOLOGIC MAP UNIT CODE
65	10	I5 QUALITY FLAG CODES
66	11	F6.1 AVERAGED CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
67		
68	12	F4.1 UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
69		
70	13	F5.1 POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
71		
72	14	F6.1 AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
73		
74	15	F4.1 UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
75		
76	16	F5.1 URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
77		
78	17	F6.1 AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
79		
80	18	F4.1 UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
81		

Line Number	Character Number	
82	19 F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
83		
84	20 F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
85		
86	21 F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
87		
88	22 F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
89		
90	23 F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
91		
92	24 F6.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
93		
94	25 F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
95		
96	26 F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
97		
98	27 F5.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
99		
100		
101	28 F6.1	AVERAGED THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
102		
103	29 F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
104		
105		

2. Tape Identification Block (Block 2)

The information and format for this block are indicated in lines 8 through 49 of the Format Description Block A4.1, and 1922 characters are produced. The remaining 6078 characters of this block are blanks.

If less than nine aerial systems are used, the space allocated for additional systems is filled with 9's in the format specified for each item using I and F fields, and with zeros for A fields.

Similarly, if fewer than 99 flight lines exist, the unused flight line information, 13 characters per flight line, is filled with 9's through the 99th flight line.

3. Statistical Analysis Data Blocks

The information and format for the logical records in these blocks are indicated in lines 55 through 103 of the Format Description Block A4.1. One logical record contains 160 characters. There are 50 such logical records per 8000 character physical record or block.

The data appearing in locations specified by lines 68, 74, 80, 86 and 90 of the Format Description Block A4.1 are 9's in the format specified in each case.

A5. Magnetic Data Tapes

Block Size (Physical Record): 8000 characters
Logical Record (Data) : 80 characters

1. Format Description Block (Block 1)

The Format Description utilizes 3384 characters. The remaining 4616 characters are blanks.

Line Number	Character Number	
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	14 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	13 NUMBER OF FLIGHT LINES ON THIS TAPE
12	5	14 FIRST FLIGHT LINE ON THIS TAPE
13	6	16 FIRST RECORD NUMBER OF FIRST FLIGHT LINE
14	7	13 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	11 AERIAL SYSTEM IDENTIFICATION CODE
32	2	14 FLIGHT LINE NUMBER
33	3	16 RECORD IDENTIFICATION NUMBER
34	4	16 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

AII-9

Line Number	Character Number	
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)

2. Tape Identification Block (Block 2)

The information and format for this block are indicated in lines 8 through 25 of the Format Description Block A5.1, and 2938 characters are produced. The remaining 5062 characters of this block are blanks.

If fewer than 99 flight lines exist, the unused flight line information, 29 characters per flight line, is filled with 9's through the 99th flight line in the format indicated.

3. Magnetic Data Blocks

The information and format for the logical records in these blocks are indicated in lines 31 through 46 of the Format Description Block A5.1. One logical record contains 80 characters. There are 100 such logical records per 8000 character physical record or block.

If the magnetic depth-to-basement is not required, this item is expressed as 99999.9.

A6. Statistical Analysis Summary Tapes

Block Size (Physical Record): 7000 characters
Logical Record (Data) : 140 characters

1. Format Description Block (Block 1)

The Format Description utilizes 4320 characters. The remaining 2680 characters are blanks.

Line Number	Character Number	
1	05 0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)
2		
3		STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)
4		
5		FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6		
7	ITEM	FORMAT DESCRIPTION
8	1	A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20 NAME OF SUBCONTRACTOR
10	3	14 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	16 NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS

AII-10

Line Number	Character Number	
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		UNIT
22	4	F6.1 POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL
23		PLACE 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
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

AII-11

2. Tape Identification Block (Block 2)

The information and format for this block are indicated in lines 8 through 11 of the Format Description Block A6.1, and 70 characters are produced. The remaining 6930 characters of this block are blanks.

3. Statistical Analysis Summary Data Blocks

The information and format for the logical records in these blocks are indicated in lines 18 through 60 of the Format Description Block A6.1. One logical record contains 140 characters. There are 50 such logical records per 7000 character physical record or block.

B. DESCRIPTION OF LISTINGS

B1. Single record reduced data listings: include the following information on Microfiche:

ITEM	DESCRIPTION
REC	Sequential record number
Lat	Location Y in latitude
Long	Location X in longitude
RMag	Residual magnetic field, gammas
Alt	Surface altitude
GEO UNIT	Geologic Type
AKUT	A=Altitude; K=Potassium; U=Uranium T=Thorium - Results of statistical adequacy test
COS	Cosmic c/s
BiAir	Airborne ²¹⁴ Bi, 4π data
GC	Gross count, .4 MeV - 2.8 MeV
T ₂	²⁰⁸ Tl c/s
Bi	²¹⁴ Bi c/s
K	⁴⁰ K c/s
Bi:T ₂	Ratio
Bi:k	Ratio
T ₂ :K	Ratio
TEMP	Outside Air Temperature (°C)
BP	Atmospheric Pressure (In. Hg)

B2. Averaged record data listings: include the following information on Microfiche:

ITEM	DESCRIPTION
REC	Sequential Record number
GEO UNIT	Geologic type
AKUT	A=Altitude; K=Potassium; U=Uranium; T=Thorium - Results of statistical adequacy test
Long	Longitude of X location of geologic type
Lat	Latitude of Y location of geologic type
RMag	Residual magnetic field, gammas
COS	Cosmic, 4π
BiAir	Atmospheric Bi, 4π
GC	Gross count, c/s

ITEM

DESCRIPTION

T ₂	T ₂ value, c/s
Rank	T ₂ standard deviation rank
Bi	Bi value, c/s
Rank	Bi standard deviation rank
K	K value, c/s
Rank	K standard deviation rank
Bi/T ₂	Ratio value
Rank	Bi/T ₂ standard deviation rank
Bi/K	Ratio value
Rank	Bi/K standard deviation rank
T ₂ /K	Ratio value
Rank	T ₂ /K standard deviation rank

GEO DATA INT. INC. SINGLE REC LISTING MILLETT										TIE LINE SN										
REC	LAT	LONG	RMAG	ALT	GEBUNT	A	K	U	T	CBS	BIAIR	GC	TL	BI	K	BI/TL	BI/K	TL/K	TEMP	BP
1	40.0176	117.0104	-254.4	428	ZNA	0	0	0	0	23	14.2	1226	39	9	134	0.231	0.067	0.291	24.2	24.79
2	40.0176	117.0104	-254.4	428	ZNA	0	0	0	0	36	14.2	1839	39	24	136	0.407	0.176	0.434	24.1	24.80
3	40.0176	117.0104	-251.3	439	ZNA	0	0	1	0	36	14.2	1705	41	4	137	0.098	0.029	0.299	24.1	24.82
4	40.0172	117.0104	-253.2	427	ZNA	0	0	0	0	26	14.2	1741	43	22	128	0.512	0.172	0.336	24.1	24.81
5	40.0165	117.0104	-254.4	448	ZNA	0	0	0	0	47	14.2	1809	51	11	136	0.216	0.081	0.375	24.1	24.84
6	40.0162	117.0104	-253.8	466	ZNA	0	0	1	0	36	14.2	1915	62	0	145	0.016	0.007	0.428	24.1	24.82
7	40.0158	117.0104	-253.2	455	ZNA	0	0	0	0	32	14.2	1926	40	15	168	0.375	0.089	0.238	24.1	24.84
8	40.0155	117.0104	-252.2	460	ZNA	0	0	0	0	38	14.2	1901	46	8	169	0.174	0.047	0.272	24.1	24.80
9	40.0152	117.0104	-252.8	457	ZNA	0	0	0	0	32	14.2	1951	57	13	159	0.228	0.082	0.358	24.0	24.82
10	40.0148	117.0104	-253.6	464	ZNA	0	0	0	0	28	14.2	2032	44	17	192	0.386	0.089	0.229	24.0	24.83
11	40.0145	117.0104	-254.0	493	ZNA	0	0	0	0	33	14.2	1943	51	22	160	0.431	0.137	0.319	24.0	24.83
12	40.0142	117.0104	-255.5	457	ZNA	0	0	0	0	34	14.2	2003	67	14	151	0.209	0.093	0.444	24.0	24.84
13	40.0138	117.0104	-252.0	462	ZNA	0	0	0	0	28	14.2	2004	45	8	155	0.178	0.052	0.290	24.0	24.83
14	40.0135	117.0104	-250.4	454	ZNA	0	0	0	0	37	14.2	1980	57	23	167	0.404	0.138	0.341	24.0	24.84
15	40.0131	117.0104	-251.3	444	ZNA	0	0	0	0	37	14.2	1922	36	14	165	0.389	0.085	0.218	24.0	24.84
16	40.0128	117.0104	-250.4	445	ZNA	0	0	0	0	33	14.2	2060	51	12	183	0.235	0.066	0.279	24.0	24.84
17	40.0125	117.0104	-250.7	441	ZNA	0	0	0	0	50	14.2	2031	48	19	174	0.396	0.109	0.276	24.1	24.85
18	40.0121	117.0104	-249.8	431	ZNA	0	0	0	0	24	14.2	1959	53	23	164	0.434	0.140	0.323	24.1	24.86
19	40.0118	117.0104	-249.6	434	ZNA	0	0	0	0	35	14.2	1961	45	22	174	0.489	0.126	0.259	24.1	24.84
20	40.0114	117.0104	-247.9	424	ZNA	0	0	0	0	35	14.2	1950	50	13	167	0.260	0.078	0.299	24.1	24.88
21	40.0111	117.0104	-248.7	441	ZNA	0	0	0	0	49	12.2	2033	49	18	181	0.367	0.099	0.271	24.2	24.84
22	40.0109	117.0104	-247.4	447	ZNA	0	0	0	0	25	12.2	2023	51	16	175	0.314	0.091	0.291	24.2	24.84
23	40.0104	117.0104	-247.5	447	ZNA	0	0	0	0	33	12.2	2067	57	16	197	0.281	0.081	0.289	24.2	24.83
24	40.0101	117.0104	-248.3	445	ZNA	0	0	0	0	33	12.2	1904	37	35	144	0.946	0.243	0.257	24.3	24.84
25	40.0098	117.0104	-247.4	446	ZNA	0	0	0	0	25	12.2	2009	49	25	178	0.510	0.140	0.275	24.3	24.81
26	40.0094	117.0104	-248.9	456	ZNA	0	0	0	0	37	12.2	1972	59	8	186	0.136	0.043	0.317	24.3	24.82
27	40.0091	117.0104	-246.6	434	ZNA	0	0	0	0	43	12.2	1968	40	34	162	0.850	0.210	0.247	24.4	24.85
28	40.0087	117.0104	-244.9	443	ZNA	0	0	0	0	39	12.2	1956	52	11	194	0.212	0.071	0.338	24.3	24.83
29	40.0084	117.0104	-244.5	434	ZNA	0	0	0	0	33	12.2	1958	43	15	152	0.349	0.099	0.283	24.3	24.85
30	40.0081	117.0104	-244.1	426	ZNA	0	0	0	0	32	12.2	1972	57	23	156	0.404	0.147	0.365	24.3	24.83
31	40.0077	117.0104	-244.7	427	ZNA	0	0	0	0	31	11.3	1933	58	13	158	0.224	0.082	0.367	24.3	24.86
32	40.0074	117.0104	-243.5	427	ZNA	0	0	0	0	20	11.3	1956	57	28	161	0.491	0.174	0.354	24.3	24.86
33	40.0070	117.0104	-244.1	420	ZNA	0	0	0	0	25	11.3	2073	36	26	162	0.464	0.160	0.346	24.3	24.84
34	40.0067	117.0104	-243.9	418	ZNA	0	0	0	0	32	11.3	2020	45	17	151	0.378	0.113	0.298	24.3	24.84
35	40.0064	117.0104	-244.2	421	ZNA	0	0	0	0	35	11.3	2069	53	21	184	0.396	0.114	0.288	24.3	24.84
36	40.0060	117.0104	-244.2	430	ZNA	0	0	0	0	34	11.3	2044	63	14	149	0.222	0.094	0.423	24.3	24.85
37	40.0057	117.0104	-244.0	429	ZNA	0	0	0	0	37	11.3	1948	51	17	157	0.333	0.108	0.325	24.3	24.84
38	40.0053	117.0104	-244.8	431	ZNA	0	0	0	0	31	11.3	1980	62	16	150	0.258	0.107	0.413	24.3	24.83
39	40.0050	117.0104	-243.7	429	ZNA	0	0	0	0	33	11.3	2029	46	27	180	0.587	0.150	0.256	24.3	24.82
40	40.0047	117.0104	-246.2	426	GA	0	0	1	0	37	11.3	2036	82	6	172	0.073	0.035	0.477	24.3	24.85
41	40.0043	117.0104	-245.5	429	GA	0	0	0	0	47	9.5	2071	60	22	158	0.367	0.139	0.380	24.3	24.86
42	40.0040	117.0104	-245.6	425	GA	0	0	0	0	34	9.5	2005	60	15	153	0.250	0.098	0.392	24.4	24.83
43	40.0037	117.0104	-247.4	430	GA	0	0	0	0	33	9.5	1988	52	15	181	0.288	0.083	0.287	24.3	24.84
44	40.0033	117.0104	-247.7	436	GA	0	0	0	0	27	9.5	2017	53	27	164	0.509	0.165	0.323	24.3	24.82
45	40.0030	117.0104	-249.5	428	GA	0	0	0	0	34	9.5	1967	61	9	140	0.148	0.064	0.436	24.3	24.81
46	40.0026	117.0104	-248.6	432	GA	0	0	0	0	43	9.5	2010	63	12	189	0.190	0.063	0.333	24.3	24.85
47	40.0023	117.0104	-248.4	427	GA	0	0	0	0	33	9.5	1996	63	16	184	0.254	0.087	0.342	24.3	24.83
48	40.0020	117.0104	-248.7	429	GA	0	0	0	0	31	9.5	2098	52	33	172	0.635	0.192	0.302	24.3	24.83
49	40.0016	117.0104	-249.3	427	GA	0	0	0	0	35	9.5	2004	58	21	150	0.362	0.140	0.387	24.3	24.85
50	40.0013	117.0104	-251.4	424	GA	0	0	0	0	40	9.5	2010	60	7	188	0.117	0.037	0.319	24.3	24.82
51	40.0009	117.0104	-251.2	425	GA	0	0	0	0	40	9.2	2089	76	25	164	0.329	0.152	0.463	24.3	24.83
52	40.0006	117.0104	-250.7	430	GA	0	0	0	0	34	9.2	2040	68	8	169	0.118	0.047	0.402	24.3	24.82
53	40.0003	117.0104	-251.7	432	GA	0	0	0	0	37	9.2	2011	47	23	170	0.489	0.135	0.276	24.3	24.85
54	39.9999	117.0104	-251.3	427	GA	0	0	0	0	32	9.2	2011	60	19	166	0.317	0.114	0.361	24.2	24.84
REC	LAT	LONG	RMAG	ALT	GEBUNT	A	K	U	T	CBS	BIAIR	GC	TL	BI	K	BI/TL	BI/K	TL/K	TEMP	BP
55	39.9996	117.0104	-251.7	425	GA	0	0	0	0	38	9.2	1997	44	14	185	0.318	0.076	0.238	24.2	24.83
56	39.9993	117.0104	-250.9	430	GA	0	0	0	0	28	9.2	2036	63	18	172	0.286	0.105	0.366	24.3	24.84
57	39.9989	117.0104	-252.0	425	GF	0	0	0	0	33	9.2	1976	61	22	141	0.361	0.156	0.433	24.3	24.83
58	39.9986	117.0104	-252.1	422	GF	0	0	0	0	31	9.2	2080	50	31	170	0.620	0.182	0.294	24.3	24.86

APPENDIX III
PRODUCTION SUMMARY

PRODUCTION SUMMARY - SURVEY TIME PERIOD				
ML/TL	DATE FLOWN	SURVEY LINE MILES	AVERAGE SPEED/DAY	AVERAGE ALTITUDE/DAY
ML1,2TL9	October 19, 1977	282	105.7	410.4
ML3-6TL8	October 20, 1977	495	112.2	444.7
ML19-22TL3,4	October 21, 1977	564	112.9	410.4
ML13,14	October 24, 1977	213	112.4	429.9
ML7,9,10,11	October 25, 1977	426	114.25	452.0
ML8	October 26, 1977	106	115.1	428.1
ML15-18TL5,6,7	August 10, 1978	525	86.3	403.7
ML12TL1,2,6N,7	October 11, 1977	352	89.1	402.1

AIII-1

APPENDIX III

TABLE AIII-1 Test Line Results
-S58T-

UNIT	OCTOBER 1977				AUGUST 1978		
	19	20	21	24	25	10	11
PRE COS	---	67.44	72.57	62.22	70.46	29.56	30.22
POS COS	69.94	----	73.75	67.51	73.87	33.83	31.70
TI	---	82.11	77.31	75.71	81.52	48.01	45.94
TI	76.55	----	81.95	79.32	84.28	55.97	49.86
Bi	---	188.13	221.82	189.36	222.58	19.52	21.29
Bi	196.41	----	192.10	200.63	204.05	18.22	17.45
K	---	242.19	237.64	221.14	241.60	147.50	144.45
K	252.11	----	245.08	236.34	260.44	164.64	149.49
GC	---	7556.51	6219.91	8158.48	7011.76	1834.6	1876.9
GC	7262.73	----	6154.28	9096.22	7131.26	2005.5	1870.9
BiAir	---	58.39	62.37	61.42	59.37	9.35	15.96
BiAir	52.31	----	58.61	64.39	45.01	11.44	11.09
ALT	---	387.19	402.26	449.36	376.14	386.67	407.30
ALT	412.34	----	354.52	406.11	434.23	402.92	397.13

AIII-2

Note the differences in the Spectral Values between the S58T data and the Lama I data. Because of the nature of the two systems, the S58T having a wide window system and the Lama I a narrow window, it was necessary to normalize the data to the narrow windows to produce accurate geologic histograms and sigmas.

TABLE AIII-2 Average Lama I Speed and Altitude Determined from Data of Appendix II

LINE	AVERAGE SPEED, MPH	AVERAGE ALTITUDE, FT	LINE	AVERAGE SPEED, MPH	AVERAGE ALTITUDE, FT
ML1	104.45	423.35			
2	110.06	407.89			
4	116.27	469.42			
5	109.42	436.59			
6	107.61	448.48			
22	112.85	394.27			
20	113.39	401.44			
21	107.50	425.06			
19	109.67	413.68			
14	107.85	439.98			
13	116.85	419.76			
7	111.57	460.20			
9	115.57	450.66			
10	105.93	460.75			
11	124.02	436.33			
8	115.07	428.10			
3	108.17	470.21			
15W	74.80	366.24			
16W	92.34	420.25			
17W	81.56	392.55			
18W	99.68	429.10			
18E	87.20	412.79			
17E	75.44	397.80			
16E	102.87	406.35			
15E	76.69	404.34			
12E	73.21	411.59			
12E	96.34	393.80			
TL5	92.17	413.00			
6S	83.73	355.25			
1N	92.62	450.28			
2N	90.11	403.97			
2S	74.00	389.21			
1S	105.17	422.60			
7S	101.46	405.96			
7N	88.19	362.05			
6N	80.83	373.71			
9	102.59	399.90			
8	119.73	398.78			
3	119.93	410.90			
4	114.48	416.95			

AIII-3

TABLE AIII-3 Diurnal Corrections to Map Line Data

LINE	DIURNAL CORRECTIONS IN GAMMAS	LINE	DIURNAL CORRECTIONS IN GAMMAS
ML1	7		
2	-6		
4	-5		
5	-10		
6	-12		
22	9		
20	13		
21	3		
19	-13		
14	-6		
13	-11		
7	-3		
9	7		
10	-11		
11	-13		
8	2		
3	10		
15W	3		
16W	7		
17W	9		
18W	11		
18E	13		
17E	6		
16E	-2		
15E	-7		
12W	2		
12E	5		
TL5	-10		
6S	-12		
1N	8		
2N	9		
2S	11		
1S	13		
7S	-4		
7N	-6		
6	-10		
9	13		
8	12		
3	-7		
4	-10		

AIII-4

SPEED AND ALTITUDE HISTOGRAMS

BIBLIOGRAPHY

- Axelrod, D.L., 1965, Mio-Pliocene Floras from West Central Nevada: California University, Department of Geological Science, Bulletin, v. 33, p. 321.
- Bonham, H.F., 1970, Geologic Map and Sections of a Part of the Shoshone Mountains, Lander, and Nye Counties, Nevada: Nevada Bureau of Mines Map 38.
- Brew, D.A., 1963, Synorogenic Sedimentation of Mississippian Age, Eureka Quadrangle, Nevada: unpublished PH.D thesis, Stanford University.
- Dott, R.H., 1955, Pennsylvanian Stratigraphy of Elko and Northern Diamond Ranges, Northeastern Nevada: Am. Association of Petroleum Geologists Bulletin, v. 39, No. 77, pp. 2211-2305.
- Fenneman, W.W., 1931, Physiography of western United States: New York, McGraw-Hill Book Co., Inc., 534 p.
- Garside, L.J., 1973, Radioactive Mineral Occurrences in Nevada: Nevada Bureau of Mines and Geology, Bulletin 81, p. 121.
- Gilluly, J. and O. Gates, 1965, Tectonic and igneous geology of the Northern Shoshone Range, Nevada: U.S. Geological Survey, Professional Paper, No. 465.
- Kleinhampl, F.J. and J.I. Ziony, 1967, Preliminary Geologic Map of Northern Nye County, Nevada: U.S. Geological Survey, open File Map, NBM 15.
- Lovering, T.G., 1954 Radioactive Deposits of Nevada: U.S. Geological Survey, Bulletin, No. 1009-C, p. 106.
- Merriam, C.W. and C.A. Anderson, 1942, Reconnaissance Survey of the Roberts Mountains, Nevada: Geological Society of America Bulletin, v. 53, No. 12, pt. 1, pp. 1675-1727.
- Muller, S.W., Ferguson, H.G., and R.J. Roberts, 1951, Geology of the Mount Tobin quadrangle, Nevada: U.S. Geological Survey, Geological Quad. Map, G Q-7.
- N.T.M.S. (1955), National Topographic Map Series Millett Sheet, Nevada: Map, Western United States, NJ 11-2, Series V502, scale 1:250,000, revised 1971.
- Roberts, R.J., and R.E. Lehner, 1955, Additional Data on the Age and Extent of the Roberts Mountain Thrust Fault, North Central Nevada (Abs): Geological Society of America Bulletin, v. 66, No. 12, pt. 2, p. 1661.
- Roberts, R.J., Montgomery, J.M., and R.E. Lehner, 1967, Geology and Mineral Resources of Eureka County, Nevada: Nevada Bureau of Mines Bulletin 64.
- Roberts, R.J., 1964, Paleozoic Rocks: Mineral and Water Resources of Nevada: Nevada Bureau of Mines Bulletin 64, pp. 22-25.
- Ross, C.C., 1961, Geology and Mineral Deposits of Mineral County Nevada: Nevada Bureau of Mines, Bulletin 58, p. 98.
- Siberling, N.J., 1972, Geologic Events during Permo-Triassic time along the Pacific Margin of the United States: Logan, A. and Hills L.V. eds., International Permian-Triassic Conference Volume: Alberta Soc. Petroleum Geologists Bull., Calgary.
- Sharp, R.J., 1956, Uranium in Volcanic Rocks of the Basin and Range Province: Pahe, L.R., and others, Contributions to the Geology of Uranium and Thorium: U.S. Geological Survey Professional Paper 300, pp. 79-83.
- Speed, R.C., 1962, Layered picrite-anorthositic Gabbro, West Humboldt Range, Nevada: Mineralogical Society of America, Special Paper, No. 1.
- Staatz, M.H. and H.L. Bauer, Jr., 1954, Gamma Group; Lovering, T.G., Radioactive Deposits of Nevada: U.S. Geological Survey Bulletin 1009-C, pp. 76-77.
- Stager, H.K., 1977, Geology and Mineral Deposits of Lander County, Nevada; Part II, Mineral Deposits: Nevada Bureau of Mines and Geology, Bulletin 88, p. 106.
- Stewart, J.H. and E.H. McKee, 1977, Geology and Mineral Deposits of Lander County, Nevada; Part I Geology: Nevada Bureau of Mines and Geology, Bulletin 88, p. 106.
- Willden R., and R.C. Speed, 1974, Geology and Mineral Deposits of Churchill County, Nevada: Nevada Bureau of Mines and Geology. Bulletin 83, p. 95.

GEODATA INTERNATIONAL, INC.
7095 JOHN W. CARPENTER FRWY. DALLAS, TEXAS 75247
NATIONAL GAMMA RAY MAP SERIES

122°	120°	118°	116°	114°
42°	ALTURAS	YTA	MC DERMITT	WELLS
41°	SUSANVILLE	LOVELOCK	WINNEMUCA	ELKO
39°	CHICO	RENO	MILLETT	ELY
38°

MILLETT, NEVADA
GEOLOGY
REF. NTMS, NJ II-2
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

GEODATA INTERNATIONAL, INC.
7035 JOHN W. CARPENTER PRKY. DALLAS, TEXAS 75247
NATIONAL GAMMA RAY MAP SERIES

LEGEND
"X" INDICATES FILM VERIFIED POINTS

MILLETT, NEVADA
FLIGHT BASE

GEODATA INTERNATIONAL, INC.
7035 JOHN W. CARPENTER FRWY. DALLAS, TEXAS 75247
NATIONAL GAMMA RAY MAP SERIES

MILLETT, NEVADA
208 TI ± STANDARD DEVIATIONS

GEODATA INTERNATIONAL, INC.
7800 JOHN W. CARPENTER FRYE DALLAS, TEXAS 75247
NATIONAL GAMMA RAY MAP SERIES

MILLETT, NEVADA
214 BI ± STANDARD DEVIATIONS

GEODATA INTERNATIONAL, INC.
7000 JOHN E. CARPENTER FRYE, DALLAS, TEXAS 75247
NATIONAL GAMMA RAY MAP SERIES

MILLETT, NEVADA
214 Bi/208 T ± STANDARD DEVIATIONS

GEODATA INTERNATIONAL, INC.
7035 JOHN W. CARPENTER FRWY DALLAS, TEXAS 75247

MILLETT, NEVADA
208 J1/40K ± STANDARD DEVIATIONS

ML 2

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 2 MILLETT

117°00'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 3 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MILES

117°00'

ML 3

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 3 MILLETT

117°00'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 4 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MILES

117°00'

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -23

ALT
100 FT/DIV

ML 4 MILLETT

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000 1010 1020 1030 1040 1050 1060 1070 1080 1090 1100 1110 1120 1130 1140 1150 1160 1170 1180 1190 1200 1210 1220 1230 1240 1250 1260 1270 1280 1290 1300 1310 1320 1330 1340 1350 1360 1370 1380 1390 1400 1410 1420 1430 1440 1450 1460 1470 1480 1490 1500 1510 1520 1530 1540 1550 1560 1570 1580 1590 1600 1610 1620 1630 1640 1650 1660 1670 1680 1690 1700 1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110 2120 2130 2140 2150 2160 2170 2180 2190 2200 2210 2220 2230 2240 2250 2260 2270 2280 2290 2300 2310 2320 2330 2340 2350 2360 2370 2380 2390 2400 2410 2420 2430 2440 2450 2460 2470 2480 2490 2500 2510 2520 2530 2540 2550 2560 2570 2580 2590 2600 2610 2620 2630 2640 2650 2660 2670 2680 2690 2700 2710 2720 2730 2740 2750 2760 2770 2780 2790 2800 2810 2820 2830 2840 2850 2860 2870 2880 2890 2900 2910 2920 2930 2940 2950 2960 2970 2980 2990 3000 3010 3020 3030 3040 3050 3060 3070 3080 3090 3100 3110 3120 3130 3140 3150 3160 3170 3180 3190 3200 3210 3220 3230 3240 3250 3260 3270 3280 3290 3300 3310 3320 3330 3340 3350 3360 3370 3380 3390 3400 3410 3420 3430 3440 3450 3460 3470 3480 3490 3500 3510 3520 3530 3540 3550 3560 3570 3580 3590 3600 3610 3620 3630 3640 3650 3660 3670 3680 3690 3700 3710 3720 3730 3740 3750 3760 3770 3780 3790 3800 3810 3820 3830 3840 3850 3860 3870 3880 3890 3900 3910 3920 3930 3940 3950 3960 3970 3980 3990 4000 4010 4020 4030 4040 4050 4060 4070 4080 4090 4100 4110 4120 4130 4140 4150 4160 4170 4180 4190 4200 4210 4220 4230 4240 4250 4260 4270 4280 4290 4300 4310 4320 4330 4340 4350 4360 4370 4380 4390 4400 4410 4420 4430 4440 4450 4460 4470 4480 4490 4500 4510 4520 4530 4540 4550 4560 4570 4580 4590 4600 4610 4620 4630 4640 4650 4660 4670 4680 4690 4700 4710 4720 4730 4740 4750 4760 4770 4780 4790 4800 4810 4820 4830 4840 4850 4860 4870 4880 4890 4900 4910 4920 4930 4940 4950 4960 4970 4980 4990 5000 5010 5020 5030 5040 5050 5060 5070 5080 5090 5100 5110 5120 5130 5140 5150 5160 5170 5180 5190 5200 5210 5220 5230 5240 5250 5260 5270 5280 5290 5300 5310 5320 5330 5340 5350 5360 5370 5380 5390 5400 5410 5420 5430 5440 5450 5460 5470 5480 5490 5500 5510 5520 5530 5540 5550 5560 5570 5580 5590 5600 5610 5620 5630 5640 5650 5660 5670 5680 5690 5700 5710 5720 5730 5740 5750 5760 5770 5780 5790 5800 5810 5820 5830 5840 5850 5860 5870 5880 5890 5900 5910 5920 5930 5940 5950 5960 5970 5980 5990 6000 6010 6020 6030 6040 6050 6060 6070 6080 6090 6100 6110 6120 6130 6140 6150 6160 6170 6180 6190 6200 6210 6220 6230 6240 6250 6260 6270 6280 6290 6300 6310 6320 6330 6340 6350 6360 6370 6380 6390 6400 6410 6420 6430 6440 6450 6460 6470 6480 6490 6500 6510 6520 6530 6540 6550 6560 6570 6580 6590 6600 6610 6620 6630 6640 6650 6660 6670 6680 6690 6700 6710 6720 6730 6740 6750 6760 6770 6780 6790 6800 6810 6820 6830 6840 6850 6860 6870 6880 6890 6900 6910 6920 6930 6940 6950 6960 6970 6980 6990 7000 7010 7020 7030 7040 7050 7060 7070 7080 7090 7100 7110 7120 7130 7140 7150 7160 7170 7180 7190 7200 7210 7220 7230 7240 7250 7260 7270 7280 7290 7300 7310 7320 7330 7340 7350 7360 7370 7380 7390 7400 7410 7420 7430 7440 7450 7460 7470 7480 7490 7500 7510 7520 7530 7540 7550 7560 7570 7580 7590 7600 7610 7620 7630 7640 7650 7660 7670 7680 7690 7700 7710 7720 7730 7740 7750 7760 7770 7780 7790 7800 7810 7820 7830 7840 7850 7860 7870 7880 7890 7900 7910 7920 7930 7940 7950 7960 7970 7980 7990 8000 8010 8020 8030 8040 8050 8060 8070 8080 8090 8100 8110 8120 8130 8140 8150 8160 8170 8180 8190 8200 8210 8220 8230 8240 8250 8260 8270 8280 8290 8300 8310 8320 8330 8340 8350 8360 8370 8380 8390 8400 8410 8420 8430 8440 8450 8460 8470 8480 8490 8500 8510 8520 8530 8540 8550 8560 8570 8580 8590 8600 8610 8620 8630 8640 8650 8660 8670 8680 8690 8700 8710 8720 8730 8740 8750 8760 8770 8780 8790 8800 8810 8820 8830 8840 8850 8860 8870 8880 8890 8900 8910 8920 8930 8940 8950 8960 8970 8980 8990 9000 9010 9020 9030 9040 9050 9060 9070 9080 9090 9100 9110 9120 9130 9140 9150 9160 9170 9180 9190 9200 9210 9220 9230 9240 9250 9260 9270 9280 9290 9300 9310 9320 9330 9340 9350 9360 9370 9380 9390 9400 9410 9420 9430 9440 9450 9460 9470 9480 9490 9500 9510 9520 9530 9540 9550 9560 9570 9580 9590 9600 9610 9620 9630 9640 9650 9660 9670 9680 9690 9700 9710 9720 9730 9740 9750 9760 9770 9780 9790 9800 9810 9820 9830 9840 9850 9860 9870 9880 9890 9900 9910 9920 9930 9940 9950 9960 9970 9980 9990 10000 10010 10020 10030 10040 10050 10060 10070 10080 10090 10100 10110 10120 10130 10140 10150 10160 10170 10180 10190 10200 10210 10220 10230 10240 10250 10260 10270 10280 10290 10300 10310 10320 10330 10340 10350 10360 10370 10380 10390 10400 10410 10420 10430 10440 10450 10460 10470 10480 10490 10500 10510 10520 10530 10540 10550 10560 10570 10580 10590 10600 10610 10620 10630 10640 10650 10660 10670 10680 10690 10700 10710 10720 10730 10740 10750 10760 10770 10780 10790 10800 10810 10820 10830 10840 10850 10860 10870 10880 10890 10900 10910 10920 10930 10940 10950 10960 10970 10980 10990 11000 11010 11020 11030 11040 11050 11060 11070 11080 11090 11100 11110 11120 11130 11140 11150 11160 11170 11180 11190 11200 11210 11220 11230 11240 11250 11260 11270 11280 11290 11300 11310 11320 11330 11340 11350 11360 11370 11380 11390 11400 11410 11420 11430 11440 11450 11460 11470 11480 11490 11500 11510 11520 11530 11540 11550 11560 11570 11580 11590 11600 11610 11620 11630 11640 11650 11660 11670 11680 11690 11700 11710 11720 11730 11740 11750 11760 11770 11780 11790 11800 11810 11820 11830 11840 11850 11860 11870 11880 11890 11900 11910 11920 11930 11940 11950 11960 11970 11980 11990 12000 12010 12020 12030 12040 12050 12060 12070 12080 12090 12100 12110 12120 12130 12140 12150 12160 12170 12180 12190 12200 12210 12220 12230 12240 12250 12260 12270 12280 12290 12300 12310 12320 12330 12340 12350 12360 12370 12380 12390 12400 12410 12420 12430 12440 12450 12460 12470 12480 12490 12500 12510 12520 12530 12540 12550 12560 12570 12580 12590 12600 12610 12620 12630 12640 12650 12660 12670 12680 12690 12700 12710 12720 12730 12740 12750 12760 12770 12780 12790 12800 12810 12820 12830 12840 12850 12860 12870 12880 12890 12900 12910 12920 12930 12940 12950 12960 12970 12980 12990 13000 13010 13020 13030 13040 13050 13060 13070 13080 13090 13100 13110 13120 13130 13140 13150 13160 13170 13180 13190 13200 13210 13220 13230 13240 13250 13260 13270 13280 13290 13300 13310 13320 13330 13340 13350 13360 13370 13380 13390 13400 13410 13420 13430 13440 13450 13460 13470 13480 13490 13500 13510 13520 13530 13540 13550 13560 13570 13580 13590 13600 13610 13620 13630 13640 13650 13660 13670 13680 13690 13700 13710 13720 13730 13740 13750 13760 13770 13780 13790 13800 13810 13820 13830 13840 13850 13860 13870 13880 13890 13900 13910 13920 13930 13940 13950 13960 13970 13980 13990 14000 14010 14020 14030 14040 14050 14060 14070 14080 14090 14100 14110 14120 14130 14140 14150 14160 14170 14180 14190 14200 14210 14220 14230 14240 14250 14260 14270 14280 14290 14300 14310 14320 14330 14340 14350 14360 14370 14380 14390 14400 14410 14420 14430 14440 14450 14460 14470 14480 14490 14500 14510 14520 14530 14540 14550 14560 14570 14580 14590 14600 14610 14620 14630 14640 14650 14660 14670 14680 14690 14700 14710 14720 14730 14740 14750 14760 14770 14780 14790 14800 14810 14820 14830 14840 14850 14860 14870 14880 14890 14900 14910 14920 14930 14940 14950 14960 14970 14980 14990 15000 15010 15020 15030 15040 15050 15060 15070 15080 15090 15100 15110 15120 15130 15140 15150 15160 15170 15180 15190 15200 15210 15220 15230 15240 15250 15260 15270 15280 15290 15300 15310 15320 15330 15340 15350 15360 15370 15380 15390 15400 15410 15420 15430 15440 15450 15460 15470 15480 15490 15500 15510 15520 15530 15540 15550 15560 15570 15580 15590 15600 15610 15620 15630 15640 15650 15660 15670 15680 15690 15700 15710 15720 15730 15740 15750 15760 15770 15780 15790 15800 15810 15820 15830 15840 15850 15860 15870 15880 15890 15900 15910 15920 15930 15940 15950 15960 15970 15980 15990 16000 16010 16020 16030 16040 16050 16060 16070 16080 16090 16100 16110 16120 16130 16140 16150 16160 16170 16180 16190 16200 16210 16220 16230 16240 16250 16260 16270 16280 16290 16300 16310 16320 16330 16340 16350 16360 16370 16380 16390 16400 16410 16420 16430 16440 16450 16460 16470 16480 16490 16500 16510 16520 16530 16540 16550 16560 16570 16580 16590 16600 16610 16620 16630 16640 16650 16660 16670 16680 16690 16700 16710 16720 16730 16740 16750 16760 16770 16780 16790 16800 16810 16820 16830 16840 16850 16860 16870 16880 16890 16900 16910 16920 16930 16940 16950 16960 16970 16980 16990 17000 17010 17020 17030 17040 17050 17060 17070 17080 17090 17100 17110 17120 17130 17140 17150 17160 17170 17180 17190 17200 17210 17220 17230 17240 17250 17260 17270 17280 17290 17300 17310 17320 17330 17340 17350 17360 17370 17380 17390 17400 17410 17420 17430 17440 17450 17460 17470 17480 17490 17500 17510 17520 17530 17540 17550 17560 17570 17580 17590 17600 17610 17620 17630 17640 17650 17660 17670 17680 17690 17700 17710 17720 17730 17740 17750 17760 17770 17780 17790 17800 17810 17820 17830 17840 17850 17860 17870 17880 17890 17900 17910 17920 17930 17940 17950 17960 17970 17980 17990 18000 18010 18020 18030 18040 18050 18060 18070 18080 18090 18100 18110 18120 18130 18140 18150 18160 18170 18180 18190 18200 18210 18220 18230 18240 18250 18260 18270 18280 18290 18300 18310 18320 18330 18340 18350 18360 18370 18380 18390 18400 18410 18420 18430 18440 18450 18460 18470 18480 18490 18500 18510 18520 18530 18540 18550 18560 18570 18580 18590 18600 18610 18620 18630 18640 18650 18660 18670 18680 18690 18700 18710 18720 18730 18740 18750 18760 18770 18780 18790 18800 18810 18820 18830 18840 18850 18860 18870 18880 18890 18900 18910 18920 18930 18940 18950 18960 18970 18980 18990 19000 19010 19020 19030 19040 19050 19060 19070 19080 19090 19100 19110 19120 19130 19140 19150 19160 19170 19180 19190 19200 19210 19220 19230 19240 19250 19260 19270 19280 19290 19300 19310 19320 19330 19340 19350 19360 19370 19380 19390 19400 19410 19420 19430 19440 19450 19460 19470 19480 19490 19500 19510 19520 19530 19540 19550 19560 19570 19580 19590 19600 19610 19620 19630 19640 19650 19660 19670 19680 19690 19700 19710 19720 19730 19740 19750 19760 19770 19780 19790 19800 19810 19820 19830 19840 19850 19860 19870 19880 19890 19900 19910 19920 19930 19940 19950 19960 19970 19980 19990 20000 20010 20020 20030 20040 20050 20060 20070 20080 20090 20100 20110 20120 20130 20140 20150 20160 20170 20180 20190 20200 20210 20220 20230 20240 20250 20260 20270 20280 20290 20300 20310 20320 20330 20340 20350 20360 20370 20380 20390 20400 20410 20420 20430 20440 20450 20460 20470 20480 20490 20500 20510 20520 20530 20540 20550 20560 20570 20580 20590 20600 20610 20620 20630 20640 20650 20660 20670 20680 20690 20700 20710 20720 20730 20740 20750 20760 20770 20780 20790 20800 20810 20820 20830 20840 20850 20860 20870 20880 20890 20900 20910 20920 20930 20940 20950 20960 20970 20980 20990 21000 21010 21020 21030 21040 21050 21060 21070 21080 21090 21100 21110 21120 21130 21140 21150 2116

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 5 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MILES

117°00'

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

RLT
130 FT/DIV

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 BRMS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 6 MILLETT

0 10 20 MILES

117°00'

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
6 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
33 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 7 MILLETT

117°00'

ML 7

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 7 MILLETT

0 10 20 30 MILES

117°00

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 8 MILLETT

117°00'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 10 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MILES

117°00'

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 10 MILLETT

0 10 20 MILES

117°00'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 11 MILLETT

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 11 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 MILES

117°00'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAUSS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 12W MILLETT

117°30'

MILES

ML 12

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 000000/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 12E MILLETT

116°30'

MILES

ML 12

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 12E MILLETT

116°30'

MILES

ML 14

117°00'

ML 14 MILLETT

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 15W MILLETT

117°30'

MILES

ML 15

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 15E MILLETT

0 5 10 15 20 25 30 MILES

116°30'

ML 16

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 16W MILLETT

117°30' 0 10 20 30 40 50 60 70 80 90 100 110 120 MILES

ML 16

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 16W MILLETT

117° 30'

ML 16

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

R MAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

116°30'

ML 16E MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 MILES

ML 16

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 16E MILLETT

0 10 20 30 MILES

116°30'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = 300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 17W MILLETT

RMAG
25 GAMMA/DIV
BASE = -1500

RMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.49 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 17W MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
MILES

ML 17

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
75 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 17

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
4 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

MI 17E MILLFTT

0 10 20 30 40 50 MILES

116°30'

ML 18

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 18

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 18E MILLETT

116°30'

MILES

ML 18

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
1 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 18E MILLETT

0 10 20 MILES

116°30'

ML 19

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TFMP
3 DEG C/DIV
BASE = -25

A.T.
100 FT/DIV

ML 19 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

117°00'

ML 20

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 RMAGS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 20 MILLETT

117°00'

ML 20

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 20 MILLETT

0 5 10 15 MILES

117°00'

ML 21

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BI AIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

ML 21 MILLETT

0 10 20 MILES

ML 21

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

ML 21 MILLETT

0 5 10 15 MILES

117°00'

ML 22

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

4MAG
25 GAMMA/DIV
BASE = -1500

3MAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 1S MILLETT

39°15'

MILES

TL 1

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 1N MILLETT

0 10 20 30 40 50 60 70 80 90 100 MILES

TL 1

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
1 DEG C/DIV
BASE = -25

1.5 F/DIV

39°30'

TL IN MILLETT

0 5 10 15 MILES

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 2S MILLETT

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

39°15'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
.000 C/S/DIV

GC
100 GAMMAS/DIV
BASE = -300

BIIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 2N MILLETT

0 10 20 30 40 50 MILES

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.10 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 2N MILLETT

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 3 MILLETT

39°30'

0 5 10 15 MILES

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.10 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 3 MILLETT

39° 30'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

REG
1000 C/S/DIV
BASE = -300

BIRIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 4 MILLETT

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN. HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 5

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 5 MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 MILES

39°30'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

T
100 FT/DIV

TL 6S MILLETT

39°15'

TL 6

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

EMAS
.00 GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

IL
15 C/S/DIV

ALT
100 FT/DIV

TL 6N MILLETT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 MILES

39°45'

TL/K
.04 /DIV

BI/K
.04 /DIV

BI/TL
.08 /DIV

GC
1000 C/S/DIV

... GAMMAS/DIV
BASE = -300

BIAIR
5 C/S/DIV

K
35 C/S/DIV

BI
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 7N MILLETT

0 10 20 30 MILES

TL 7

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 7N MILLETT

0 5 10 15 MILES

39°45'

TL 8

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
3 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 8 MILLETT

0 5 10 MILES

39° 30'

TL 9

TL/K
0.04 /DIV

BI/K
0.04 /DIV

BI/TL
0.08 /DIV

GC
1000 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BI/IR
5 C/S/DIV

K
35 C/S/DIV

B
5 C/S/DIV

TL
15 C/S/DIV

ALT
100 FT/DIV

TL 9 MILLETT

0 5 10 15 20 MILES

39°15'

TL 9

RMAG
25 GAMMA/DIV
BASE = -1500

BMAG
5 GAMMA/DIV
BASE = 51765

PRESSURE
0.40 IN HG/DIV
BASE = 21

TEMP
2 DEG C/DIV
BASE = -25

ALT
100 FT/DIV

TL 9 MILLETT

39° 30' 0

WILES