Geology
GSB (79)-163

GJBX-163 '79

GEOLOGY

AERIAL RADIOMETRIC AND MAGNETIC SURVEY

SOCORRO

NATIONAL TOPOGRAPHIC MAP

NEW MEXICO

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

CAUTION
This is a time release report.
Do not release any part of this
publication before

Geodata International, inc.

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

metadc958320

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
SOCORRO NATIONAL TOPOGRAPHIC MAP
NEW MEXICO

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO

UNDER SMALL BUSINESS ADMINISTRATION SUBCONTRACT NO. SB308(a)77-C-508
WITH
GEO-LIFE, A JOINT VENTURE
BETWEEN
HIGH LIFE HELICOPTERS, INC.
PUYALLUP, WASHINGTON
AND
GEODATA INTERNATIONAL, INC.
DALLAS, TEXAS

September 28, 1979

GEODATA INTERNATIONAL, INC.
7035 John W. Carpenter Freeway
Dallas, Texas
Phone (214) 630-1600

TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION	1
A.	General	1
1.	Area Surveyed	1
2.	Summary of the Location, Geology and Physiography	1
B.	Operational Program	4
II	GEODATA AIRBORNE SYSTEM	7
A.	General	7
B.	Flight Recovery Methods	12
C.	Data Reduction	12
D.	Data Presentation	17
III	GEOLOGY OF THE SURVEYED AREA	19
A.	Location and General Physiography	19
B.	Geology	20
C.	Brief Description of the Geologic Units	26
D.	Radioactive Mineral Occurrences	35
IV	RESULTS OF DATA ANALYSIS	37
A.	Geologic Base Maps	37
B.	National Gamma Ray Map Series (NGRMS)	37
C.	Radiometric Stacked Profiles	37
D.	Magnetic Stacked Profile Data	38
E.	Magnetic Tapes and Listings	39
F.	Statistical and Geologically-Created Deviations in Resultant Data	39
G.	Frequency Distributions of Data for Each Geologic Type	46
H.	Microfiche Reproduction of the Single Record Reduced and Averaged Record Data	46
I.	Test Lines	46
J.	Altitude and Ground Speed Histograms	46
K.	Anomalous Data Determined from Examination of Profile Line Data	46
1.	Analysis of Histograms	47
2.	Interpretation of Radioactivity Data	47
3.	Summary and Recommendations	56

(Table of Contents Cont'd.)

APPENDIX	TITLE	PAGE
I.	Frequency Distribution of Radiation Data as a Function of Geologic Unit	AI-1
II.	Description of Magnetic Tapes and Listings	AII-1
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	AIII-1

(List of Tables Cont'd.)

LIST OF ILLUSTRATIONS		
Figure	Title	Page
1.	Index Map Showing Area Surveyed	2
2.	NTMS Indicating Flight Line Location	3
3.	Data Flow Diagram	5
4.	SIkorsky S-58T Helicopter	8
5.	Functional Block Diagram	9
6.	The Geodata Airborne System	10
7.	Typical End-of-Flight Line Dual Spectral Plot	11
8.	Computer Presentation of Typical Map Line	13
9.	Typical Map Line Showing Statistical Deviations	13

LIST OF TABLES		
Table		
1.	Geologic Unit Average Value as a Function of Map Line for ^{208}Tl (Counts/Second)	40
2.	Geologic Unit Average Value as a Function of Map Line for ^{214}Bi (Counts/Second)	41
3.	Geologic Unit Average Value as a Function of Map Line for ^{40}K (Counts/Second)	42
4.	Geologic Unit Average Value as a Function of Map Line for $^{214}\text{Bi}/^{208}\text{Tl}$ (Times 100)	43
5.	Geologic Unit Average Value as a Function of Map Line $^{214}\text{Bi}/^{40}\text{K}$ (Times 1000)	44
6.	Geologic Unit Average Value as a Function of Map Line $^{208}\text{Tl}/^{40}\text{K}$ (Times 1000)	45
7.	Geologic Units with Significant Variations from Unimodal Distributions, Based on the Analysis of the ^{208}Tl Histograms	48
8.	Summary of Anomalies	49
9.	Radioactivity Anomalies per Geologic Map Unit	50

Table	Title	Page
10.	Statistical Summary of Radioactivity Anomalies by Geologic Unit	51
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-2
AIII-2	Average Speed and Altitude Determined from Data of Appendix II	AIII-3
AIII-3	Diurnal Corrections to Map Line Data	AIII-4

"SOCORRO NATIONAL TOPOGRAPHIC MAP SURVEY"

ABSTRACT

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Socorro National Topographic Map N113-4 is presented in this report. The airborne data gathered is reduced by ground computer facilities to yield profile plots of 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. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

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 period January 29, 1978 and February 17, 1978. The survey covered a region of the state of New Mexico, identified as the Socorro National Topographic Map NI-13-4. 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 113.7 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 S58-T helicopter. Figure 2. shows flight line location.

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

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

The Socorro National Topographic Map Sheet (N.T.M.S., 1954) depicts an area in northcentral New Mexico. The area is delimited by latitudes 34°00' and 35°00' north and longitudes 106°00' and 108°00' west. The area has been classified into three physiographic provinces (Fenneman, 1930). These are: (i) the Great Plains Physiographic Province, Pecos Valley Section; (ii) the Basin and Range Physiographic Province, both the Sacramento and Mexican Highland sections; (iii) the Colorado Plateau Physiographic Province, Datil Section.

Exposures of Precambrian rocks occur in the uplands, but are not as extensive as those of the Paleozoic and younger sedimentary rocks. The Precambrian rocks are comprised of both meta-igneous and meta-sedimentary units. A major unconformity exists between the Precambrian rocks and the earliest rocks of the Paleozoic Era. Mississippian, Pennsylvanian and Permian strata crop-out extensively. Mesozoic units are a mixture of marine and terrestrial units. Near the close of the Cretaceous, the Laramide Orogeny deformed the area to the east and northeast. Early Cenozoic units result from the erosion of the peripheral highlands. Middle and Late Tertiary times were periods of intense, but sporadic, volcanic activity; lava flows, volcanics and volcano-sedimentaries are extensive. Basaltic extrusions occurred during the Quaternary, and are widespread east of the Rio Grande. Windblown silt and sand, alluvium and colluvium incompletely cover the basalts, and are thin surficial deposits over much of the map area.

Uranium deposits occur in a variety of lithologies ranging in age from Paleozoic to Tertiary.

Figure 1. Index Map Showing Area Surveyed.

FIGURE 2. NTMS Indicating Flight Line Location

B. OPERATIONAL PROGRAM

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 1⁰ latitude/2⁰ 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).

Computer profile plots of the gamma radiation and magnetic field data have been created for all surveyed map lines and tie lines. Each line has indicated on the profiled line the location of each geologic type as a function of record number. The distribution of data within each geologic unit has been calculated and is included. The scale of the profile data in this final report is 1:500,000 and the scale of the NGRMS is both 1:250,000 and 1:500,000. The bound final report containing the 1:500,000 profile data also contains the flight line map, geologic base of the pertinent NTMS and the NGRMS maps indicating the standard deviations at the scale of 1:500,000. Two sets of profiled data for each line flown are included with one set displaying magnetic field, gamma radiation and other data. The second set includes only flight line magnetic field, temperature, pressure, and altitude data, plus magnetic field data as measured at a base station. Each set contains the flight line location relative to the geologic map. All data have been located giving latitude and longitude positions in fractional degrees as made possible from visual spotting, photographic recording of the aircraft location, and from VLF/OMEGA guidance of the aircraft and recording of location on magnetic tape. Data have been acquired and processed according to the data flow shown in Figure 3.

The magnetic data tapes containing (1) raw data, (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.

The final report includes a general geologic description of the area, including descriptions of the various geologic units and correlates the airborne data to the geologic units as provided by the geologic maps. Also included is a frequency distribution study of the data as a function of the geologic units encountered over the NTMS area including the tie line data.

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

FIGURE 3. DATA FLOW DIAGRAM

SECTION II

THE GEODATA AIRBORNE SYSTEM

A. GENERAL

The Geodata Phase I Airborne System is mounted in a Sikorsky S-58T helicopter shown in Figure 4. The functional block diagram is shown in Figure 5 and the airborne system is presented in Figure 6. Seven (7) 11½" dia. by 4" thick NaI(Tl) detectors are used 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 ²¹⁴Bi 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 5 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 manner 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 7. 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 ²¹⁴Bi which allows calculation of the surface-emanated ²¹⁴Bi 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.

A proton precession magnetometer having an 0.25 gamma 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.

Figure 4. Sikorsky S-58T Helicopter N47246.

Figure 5. Functional Block Diagram

Figure 6. Geodata Airborne System

Figure 7. Typical End-of-Flight Line Spectral Plot

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 is 10.5%

The Phase I 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 solid line, with ticks representing every tenth record location, and each "circle" represents every 50th record location. Figure 8 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 CDT CRT is a data certification program which is run immediately upon receipt of the field data tapes and produces the EOFL spectral plots, Figure 7. The program identification and function is given below:

Figure 8. Computer presentation of Typical Map Line

Figure 9. Typical Map Line Showing Statistical Deviations

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

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

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

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 4×4 matrix method is used. This matrix may be formed through the use of a standard cosmic spectrum, plus the determinations of α , β , γ , f and g , 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 4×4 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, Bi1 and K1 counts per second contain the aircraft associated backgrounds caused by thorium, uranium and ^{40}K . Geodata has determined these backgrounds for this installation to be 5.5 counts per second in the ^{208}Tl energy interval due to background ^{208}Tl , 5.0 counts per second in the ^{214}Bi energy intervals due to background ^{214}Bi and 24.7 counts per second in the ^{40}K interval due to background ^{40}K . For this work, the background counting rates were determined by high altitude flights free from atmospheric ^{214}Bi . 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

$$\overline{T_{21}} = T_{21} - 5.5$$

$$\overline{B_{11}} = B_{11} - 5.0$$

$$\overline{K_1} = K_1 - 24.7$$

The $\overline{B_{11}}$ value contains counts caused by atmospheric ^{214}Bi which must be subtracted before altitude correction is applied. The 2π crystal data are used to determine the magnitude of the count to be subtracted. Since the predominant variable source affecting the 2π crystal is the atmospheric ^{214}Bi , 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 2π crystal is from 1.05 to 2.79 MeV. Within this range the aircraft background has been determined as 4.5 counts per second and the 2π cosmic count greater than 3.0 MeV must be multiplied by 1.607 to determine the cosmic count in the 1.05 to 2.79 MeV range.

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

$$BIAIR = G(X) \cdot \frac{VC - 1.607 \cos 2 - 4.5 - (k_1 \overline{T_{21}} + k_2 \overline{B_{11}} + k_3 \overline{K_1})}{(1 - k_2 G(X))}$$

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

VC is the total count, 2π , ch (91-239), c/s; COS2 is the 2π cosmic count, greater than 3.0 MeV c/s; k_1 , k_2 , k_3 are constant factors correcting for the penetration/spill of the surface emanated radiation, and are respectively, 0.09, 0.023, 0.024

$\overline{T_{21}}$, $\overline{B_{11}}$, $\overline{K_1}$ are results of data reduction, 4π , c/s

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

$$BISUR = \overline{B_{11}} - BIAIR$$

The quantities $\overline{T_{21}}$, BISUR and $\overline{K_1}$ are then corrected to an equivalent counting rate at 400 feet through the equations indicated below:

$$T_{21} = \overline{T_{21}} \cdot e^{-\mu_1 \rho (400 - x)}$$

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

$$KS = \overline{K_1} \cdot e^{-\mu_3 \rho (400 - x)}$$

where:

T_{21} , BIS , KS = respective counting rates at 400 feet caused by surface sources

ρ = air density

μ_1, μ_2, μ_3 = respective mass 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 should exist. (See Section 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.

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 superimposed 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 9.

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 ^{214}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 Average radiation concentration for each variable as a function of flight line, including the atmospheric ^{214}Bi .
- 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.

SECTION III

GEOLOGY OF THE SURVEYED AREA

A. LOCATION AND GENERAL PHYSIOGRAPHY

The aerial radiometric survey was conducted over the area of the Socorro Topographic Map Sheet (NTMS, 1954). The surveyed area is in northcentral New Mexico. It is delimited by latitudes 34°00' and 35°00' north and longitudes 106°00' and 108°00' west. Within this area are parts of Catron, Socorro, Torrance, Valencia and Bernalillo counties. The area has been classified into three physiographic provinces (Fenneman, 1930). These are (i) the Great Plains Physiographic Province, Pecos Valley Section, in the east; (ii) the Basin and Range Physiographic Province, both the Sacramento and Mexican Highland sections; and (iii) the Colorado Plateau Physiographic Province, Datil Section, in the west.

The geology and topography of the surveyed area varies dramatically from one section to the next. In the west, the area is dominated by Tertiary lava flows and volcanic rocks that comprise the Datil Section. In places, the lava flows cover the entire surface; in other locations, dissected lava remnants cap mesa formations. Volcanic plugs are scattered throughout the area. The central part of the map sheet area is characterized by basin and range topography, the western part of which is made up of isolated, dissected, block mountains, separated by aggraded desert plains. The eastern section of the basin and range topography is characterized by block mountains, raised plateaus and bolsons. The Monzano Mountains mark the eastern margin of the basin and range structure. East of the Monzano Mountains lies the Great Plains Physiographic Province. The Pecos Valley Section is characterized by old surfaces with reduced local relief.

The major drainage system is the Rio Grande, which flows north to south through the basin and range. The river has a well developed flood plain. The two major tributaries with confluences within the map sheet area are the Rio Puerco and the Rio Salado; both of which are west bank tributaries. Much of the drainage outside of the Rio Grande watershed is interior drainage to playas or bolsons.

The Socorro Map Sheet area receives a low annual rainfall, with hot summers and cool winters. The area is semi-arid with shrub or grass vegetation in the lower lands and trees in the mountains. The rural population is sparse and scattered, with ranching the major occupation. Ranch house complexes, windmills, and stock ponds are the only cultural features over much of the lower land. In some of the ranges, there are mines, particularly in the Magdalena and Socorro mountains. The Acoma, Laguna, and Puertocito Indian reservations are located in the northeast and eastern parts of the area in the Colorado Plateau country. The Isleta Indian Reservation is in the northcentral portion of the area in the Basin and Range.

The Rio Grande flows north to south, and the valley has become the route of Interstate 25, and the Atchison, Topeka and Santa Fe railroads. The largest towns of Belen and Socorro are located adjacent to the highway and railroad tracks. The interstate highway is joined from the west by U.S. Highway 60 in the south and State Highway 6 in the north. Several small towns are scattered along these roads, including Magdalena, which straddles U.S. 60. In the east, U.S. Highway 60 continues across the Basin and Range topography and is joined by State Highways 47 and 6. Mountainair and Williard are towns that are located on this route; whereas, Estancia exists to the north on State Highway 41. The density of small towns is greatest in the Rio Grande Valley. The major tributary to the Rio Grande is the Rio Puerco; most other streams are ephemeral and/or internally drained, and do not support permanent settlements.

B. GEOLOGY

Precambrian Era

Exposures of Precambrian rocks, as compared with those of the Paleozoic and younger sedimentary rocks, are not extensive. They are limited to the uplifted area of the Basin and Range Physiographic Province. In particular, within the Socorro Map Sheet area, they are exposed in the Monzano, Los Pinos, Ladrones and Magdalena mountains. In many places, the oldest units of the Precambrian section consist of a thick series of isoclinally folded and metamorphosed, igneous and sedimentary rocks. These have been changed to rhyolitic gneiss and schist, amphibolite, talc schist, greenstone, quartz mica schist, and quartzite. In some places, an older granite intruded into this series was converted to gneiss. The meta-sedimentary and meta-volcanic rocks are undivided on the geology map.

Igneous and meta-igneous Precambrian units are someplaces mapped separately. Medium-grained granite and biotite-rich granite are mapped in the Los Pinos Mountains. The Precambrian granite of the Los Pinos intrudes the Sais Quartzite, the Blue Ridge Quartzite, and Sevilleta Rhyolite. The schistosity of the granite parallels that in the other Precambrian rocks. Granitization is pronounced along its borders (Stark and Dapples, 1946). The Monte Largo Stock is described separately as being a medium-to-coarse grained, hornblende granite, which is locally gneissic. On the northern flank of the Monzano Mountains, medium-to-coarse grained granite, gneissic granite, granite gneiss and biotite gneiss crop-out. Reiche (1949) describes a massive, medium-grained granite. Some older quartzose and olivine gabbro are also present in map unit p60. West of the Rio Grande in the Ladron Mountains, Noble (1950), described a medium-to-coarse grained granite. Quartz monzonite, aplite, and pegmatite, are also differentiated in the Ladron Mountains.

It is apparent that in northcentral New Mexico, there was a period during the Precambrian when accumulation of clastic sediments, markedly quartzose, occurred. This was either preceded, or concurrent with, accumulations of basic-to-intermediate igneous rocks. It was

followed by the accumulation of rhyolitic rocks. The accumulation period was followed by deformation, metamorphism and emplacement of granitic masses with associated aplites, pegmatites, and lamprophyres. Fitzsimmons (1961) suggests that erosional intervals occurred locally; however, there is no evidence for a regional unconformity. Likewise, there is no evidence of extensive deposition of Precambrian sediments after the orogeny, which affected the regional deformation and metamorphism.

Paleozoic Era

A major unconformity exists between the Precambrian rocks and the earliest rocks which represent the Paleozoic Era. No Cambrian, Ordovician, Silurian or Devonian strata exist in the Socorro Map Sheet area. Rocks of these systems do occur in the mountains to the south of the map sheet area.

Mississippian strata are exposed in the Coyote Hills, Magdalena, Lemitar and Ladron mountains. These strata are from 0 to 150 feet thick. Variation in thickness is the result of Early Pennsylvanian, and later, erosion (Armstrong, 1963). The strata are mainly carbonate deposits and are divided into two formations, the Coloso and the Kelly. The Coloso Formation is separated from the Kelly Formation by a paraconformity. The Kelly Limestone, 0 to 75 feet thick, is of Upper Osage age; it is unconformably overlain by clastic rocks of the Pennsylvanian. Northward, in the southcentral Ladron Mountains, the Pennsylvanian strata truncate older Mississippian rocks; to the north of Ladron Peak, the Mississippian strata was removed, and Pennsylvanian strata directly overlie Precambrian rocks.

In Early Pennsylvanian time, seas invaded, and submerged the Mississippian limestones. Chert, limestone pebbles, and reddish clay from the Mississippian beds, and quartz, feldspar and mica from the Precambrian hills were mingled to form the clastic member of the Sandia Formation (Kottlowski, 1961).

In Middle Pennsylvanian time (Desmoinesian), a shallow sea covered the region. Only the highest areas were exposed to erosion. These were: (i) the Zuni Dome to the west; (ii) the Pedimal Mountain Range to the east; and (iii) the Penasco and Santa Fe mountainous islands and shoals to the north (Kottlowski, 1961). Bioclastic limestones were formed in the Desmoinesian seas, along with biohermal masses near atolls and islands.

Late Pennsylvanian time was marked by an increase in tectonic activity. Thick, coarse, clastic sediments were deposited in the Missourian and Virgillian seas. The arkosic limestone member of the Madera Group formed. The orogeny continued into Early Permian time (Wolfcamp), and is recorded in the Early Permian formations. In many places, the Pennsylvanian to Permian transition is represented only by an obscure bedding plane (Kottlowski, 1961). The Pennsylvanian outcrops occur in the Ladron Mountains, Lucero Mesa, the Monzano and Monzanita mountains.

The Permian System is a sequence of red-beds, massive light-colored sandstones, carbonate rocks, and evaporites that resulted from sedimentation in a complex of inter-related marine and terrestrial environments (Baars, 1961).

Permian strata crop-out along the Lucero Uplift, and along the eastern flank of the Monzano Mountains. The Permian rocks generally overlie the Pennsylvanian strata conformably. Transitional beds occur in the south. These are: (i) the Red Tanks Member of the Madera Formation; and (ii) the Bursum Formation. Locally, the Permian beds overlie older rocks. The Red Tanks Member and Bursum Formation are largely red-beds with thin, interbedded limestones.

The basal Permian strata, which overlie the Bursum and Madera, are the red-beds of the Abo Formation. This formation consists of reddish-brown shales, siltstones and arkosic sandstones. The sediments were deposits on a broad coastal plain, which may have been periodically inundated by marine waters in the south, where it interfingers with the Hueco Limestone.

The Abo Formation is overlain by orange-colored sandstones and siltstones of the DeChelly Sandstone (originally referred to as the Meseta Blanca Member of the Yeso Formation).

The Yeso Formation is a complex of red-beds, evaporites and thin carbonate strata; it conformably overlies the DeChelly Sandstone. The Yeso contains gypsum beds, lighter-colored red-beds and dolomites in the Lucero Mesa area. The formation, which formed in a partially restricted shallow sea, received clastics from a source area to the north (Baars, 1961).

The Glorietta Sandstone is a white, fine-to-medium grained, siliceous sandstone that is typically cross-stratified. It formed in a high energy littoral environment (Baars, 1961), with local inclusions of off-shore bar and eolian sediment. The Glorietta Sandstone is conformable with the San Andres Formation and the underlying Yeso Formation.

The San Andres Formation is composed largely of carbonate rocks in the Zuni Mountains; it changes to red-beds to the north, and evaporite deposits in the Lucero Mesa area. The formation thickens southward, and has a thickness of about 400 feet in the Lucero Uplift.

The contact between Permian and Triassic rocks is unconformable in the map sheet area. The hiatus extends throughout the last half of the Permian and into the Early and Middle Triassic.

Mesozoic Era

Epeirogenic forces were active during the Early Mesozoic, but no major orogenies occurred in the southwest (Smith, 1961). The extensive seas of the Late Paleozoic did not reappear until the Cretaceous. Much of the area was a flat plain bounded to the south by a broad belt

of low hills, to the north by the uplifted Uncompahgre positive area, and to the west by a marine shelf. Erosion predominated until the Late Triassic, when gentle, irregular warping deformed the region into basins and uplifts. The Late Triassic sediments are continental, with some marl and limestone. Exterior drainage was maintained, and no evaporite sequences occur (Smith, 1961).

The Triassic sediments of the map sheet area are predominantly fine-grained sandstone, siltstone and mudstone, with intercalated lenticular conglomerate, and coarse-grained sandstone beds. The lower section is usually coarser than the upper section, although this is not necessarily the situation in the Lucero Uplift area. In the western part of the area, the Chinle Formation is a thick sequence of red mudstone, siltstone and sandstone, with marly beds and intercalated conglomerate lenses. Sandy facies predominate in the lower third of the section from the Lucero Uplift westward (Smith, 1961).

By the end of the Triassic, the source areas had been leveled, and sedimentation stopped. Erosion may have occurred during the Early Jurassic.

The oldest Jurassic beds are massive, alternating even-bedded and cross-bedded sandstones assigned to the Entrada Formation. A lower silty facies, and an upper sandy facies, are present in the map sheet area. Locally, the upper member intertongues with the overlying Todilto Limestone; whereas, a short distance away, angularity of ten to fifteen degrees may be measured (Smith, 1961).

Where it intertongues with the Entrada, the Todilto Limestone is sandy; elsewhere the base of the unit is thin bedded, gray limestone with intercalated layers of mudstone and shale. The limestone grades upward into a massive gypsum member which thickens north of the map sheet area. In the western part of the area, several sandstone, siltstone and mudstone facies intertongue and grade upward into recognizable Morrison beds; the upper sandy facies of the Summerville is also present. Some representatives of the Summerville Formation may be present on the eastern side, but are not easily distinguished.

The Morrison Formation includes the youngest Jurassic rocks of the area. The principle unit is the Brushy Basin Member. The white sandstone member of the Lucero Mesa may be part of the Cow Springs Sandstone. The Brushy Bush Member consists of mudstone and siltstone interbedded with sandstones, which are, someplaces, coarse and conglomeratic.

In the Early Jurassic, gradual re-alignment of the depositional areas occurred; marine waters invaded the western interior. By the Middle Jurassic, a seaway extended southward, producing tidal flat and floodplain deposition. Jurassic deposition closed with the Morrison Formation. The Brushy Basin Member was a floodplain deposit, which

graded abruptly into eolian sandstone. In the map sheet area, the Mogollon Highland was a local source of eolian material; most of the eolian material was derived from more distant areas.

Cretaceous rocks are exposed over extensive areas of the western and northwestern parts of the map sheet. At first, continental sedimentation prevailed; this was followed by marine sedimentation, and then alternating marine and continental sedimentation. Finally, the seas withdrew, and continental sedimentation prevailed.

The Upper Cretaceous is represented by three formations; in ascending order, they are: the Dakota Sandstone, the Mancos Shale and the Mesaverde Formation. Locally, the Dakota Sandstone is conglomeratic at its base. This conglomeratic unit is contained within the Oak Canyon Member. Two marine sandstone tongues overlie the basal member. They are the Paquite Sandstone and the Towells Sandstone.

The Mancos Shale, in the surveyed area, is the basal part of a 2,000 foot section, which is present at the type locality in southwestern Colorado (Gadway, 1959). A southward thinning of the Mancos is due to its intertonguing relationship with the sandstones of the Mesaverde Group. The Tres Hermanos Sandstones is the most persistent sand in the Mancos, and generally occurs 180 to 270 feet above the Dakota. The sandstone is fine-to-medium grained, commonly well-bedded. The Tres Hermanos Sandstone was probably deposited in a broad shallow sea that allowed much reworking, and a relatively widespread distribution.

The Lower Gallup interval is a very complex zone of inter-related marine and non-marine deposition, and possibly erosion (Gadway, 1969). The Gallup Sandstone includes three sandstone tongues and two shale tongues in the northwestern part of the area. The complex thins to the south and east.

Above the Gallego Sandstone -- Upper Gallup -- there are a series of sand, shales and coal which appear to be continental in origin. This is identified as the Crevasse Canyon Formation. Subsequent Cretaceous deposition was dominantly continental. An unknown thickness of Mesaverde sediments were deposited before regional erosion began in Late Cretaceous or Early Tertiary (Gadway, 1959).

Cenozoic Era

Near the close of the Cretaceous, the Laramide Orogeny formed the highlands to the east and northeast of the Socorro area. There followed a period of erosion in the highlands and deposition of the Baca Formation in a broad, and as yet, incompletely defined, Eocene Basin. The Baca Basin extended from the region of the eastern highlands -- hills stretching from the Los Pinos Mountains to the Cathage area -- to a region of the Bear Mountains, north of Magdalena. This period was followed by Oligocene volcanic activity (DeBrine, et al, 1963).

The oldest Cenozoic beds are a series of predominantly red conglomerates and silty sandstones; they are known as the Baca Formation. The Baca Formation lies unconformably below the Datil Formation.

The Datil Formation is a series of agglomerates, tuffaceous sandstone, and rhyolitic and andesitic flows. Some of these units within the Datil are mapped separately. The lowest sub-unit of the Datil Formation, from the Bear Mountains westward through the Gallinas Mountains and eastward to the northern Jornada del Muerto, is a sequence of predominantly latitic volcanics and volcanic sediments; these are collectively referred to as the Spears Member. The Spears Member consists of quartz latite tuffs, breccias, agglomerates, flow breccias and volcanic sediments; east of the Rio Grande, a sequence occurs which is lithologically similar. Andesite dikes frequently intrude the latitic beds, and connect upward with flows or sills in the superimposed rhyolitic tuffs and welded tuffs.

Rhyolite tuffs, welded tuffs and minor flows are a conspicuous component of the Datil. Volcanic sediments are, locally, interbedded with the pyroclastics. The rhyolites range in thickness from 250 feet in the northern Bear Mountains to more than 600 feet in the eastern Gallinas Mountains (DeBrine *et al.*, 1963). Intrusive phases of the rhyolite occur as plugs, domes and dikes.

Andesites and basaltic andesites are prominent components of the Datil Formation in Catron County.

Unconformably overlying the Datil, in Catron County, is an extensive sequence of basalt and basaltic andesite flows and flow breccias. East of the Rio Grande, the basaltic andesites are more sparsely distributed.

The lower part of the Popotosa Formation consists of gypsiferous, red-to-brown volcanic sandstones, siltstones and silty claystone, with lenses of water-laid tuff; the upper part consists of conglomerate and sandstone. The conglomeratic pebbles are predominantly andesite and basaltic andesite; however, Precambrian granite and gneiss, Paleozoic limestone, Cretaceous sandstone, and Tertiary rhyolite tuffs and welded tuffs occur (Weber, 1963). The Popotosa Formation was deposited in the eastern part of the Baca Basin, and interfingers with the Spears Member of the Datil Formation.

During Pliocene time, a north to south-trending upland of Mesozoic and Late Paleozoic rock and scattered deposits of the Baca and Datil formations existed along the eastern edge of the area. Westward, there lay fine-grained sediments, playa beds, intrusive rocks, and flows and tuffs of the Datil-Popotosa sequence. The volcanics of the Mogollon Plateau were the principle source of sediments.

The sedimentary deposits of the Late Tertiary and Early Quaternary are the Santa Fe Group. The Santa Fe is divided into several members, based on the pebble composition of the dominant conglomerates. The oldest member is an alluvial fan deposit formed by material derived from the Datil Formation. The intermediate member is derived from the Yeso Formation. The uppermost member is a mixed-source unit, and is the most extensive of the fan deposits. Interfingering with the fan deposits, in the central part of the map area, are fine-grained floodplain or playa deposits; they are termed the Axial River Member. Interfingering with the Axial River deposits is a well-sorted sand and gravel unit, composed of material from sources external to the map sheet area. The pebbles are well-rounded, igneous and metamorphic (quartzite) lithologies deposited in a central channel of the proto Rio Grande.

Extrusive and intrusive volcanic rocks are interbedded with the Santa Fe sediments. They include two major lithologic assemblages, basalt and rhyolite. The basaltic flows and flow breccias, with associated intrusives, extend upward throughout most of the Santa Fe Sequence. They are not easily differentiated from the earlier post-Datil basaltic units, nor from the later basalts of Pleistocene age, which overlie the Santa Fe Group.

Rhyolitic tuffs, breccias, flows, volcanic domes and intrusive rocks interfinger with the basal units of the Santa Fe Group. In some places, these younger rhyolites overlie the earlier Datil rhyolites, and differentiation may not have been made.

Quaternary basaltic flows, with associated cones, are widespread in the area east of the Rio Grande (Weber, 1963). Many flows extrude onto erosion surfaces at, or close to, the present surface, and have not been buried by later deposits. Windblown silt and sand, alluvium and colluvium, incompletely cover these basalt surfaces. Cones are recognizable on each flow. Some cones are moderately eroded, others almost intact; all are considered to be of Pleistocene age.

C. BRIEF DESCRIPTION OF THE GEOLOGIC UNITS

Precambrian

p6m: Precambrian Metamorphic Rocks, Undivided

This unit includes meta-sedimentary rocks, such as quartzites and argillites; and meta-volcanic rocks, such as gneisses, schists and phyllites.

p6i: Precambrian Intrusive Rocks, Undivided

It includes granites, pegmatites, some gneiss and schist.

p6lp: Precambrian Granite of Los Pinos Mountains

This is a medium-grained granite, often with biotite.

p6ml: Precambrian Granite of the Monte Largo Stock

A massive granite, locally gneissic, with medium-to-coarse grained hornblende.

p6g: Precambrian Granite and Gneiss

A medium-to-coarse grained granite, gneissic granite, granite gneiss and biotite gneiss; mapped at the northern end of the Monzano Mountains.

p6gp: Precambrian Granite of Priest Canyon

A massive, coarse-grained biotite granite with minor quartzite and quartz schist.

p6o: Precambrian Granite of the Ojito Stock

A massive medium-grained granite; also included within the map unit are quartzose and olivine gabbro.

p6c: Precambrian Capirote Granite

A medium-to-coarse grained granite.

p6l: Quartz Monzonite of the Ladron Mountains

A coarse-grained quartz monzonite.

p6: Precambrian Rocks, Undivided

A unit of undivided Precambrian rocks.

Paleozoic

Mississippian

M: Lower Mississippian Rocks, Undivided

This undivided unit includes the Kelly Limestone.

Mississippian and Pennsylvanian

M1P: Pennsylvanian and Lower Mississippian Rocks, Undivided

An undivided unit which includes the Mississippian rocks of the Magdalena area.

Pennsylvanian

1P: Pennsylvanian Rocks, Undivided

1P is a unit of Pennsylvanian rocks, undivided.

1Ps: Sandia Formation

A Middle Pennsylvanian siltstone, sandstone and conglomerate, with minor sandy limestone.

1Pm: Madera Group, Undivided

An undivided Pennsylvanian group which, locally, includes Lower Permian rocks.

1Pml: Madera Group, Lower Part

The Madera Group; lower part includes: (i) the Los Moyos Limestone in the Monzano Mountains; and (ii) the Gray Mesa Member of the Madera Limestone in the Sierra Lucero.

Pennsylvanian and Permian

1Pmu: Madera Group, Upper Part

This predominantly Upper Pennsylvanian unit, locally, includes the Wild Cow Formation in the Monzano Mountains; the Red Tanks and Atrasado members of the Madera Limestone in the Sierra Lucero. It may include the Lower Permian Bursum Formation at some locales.

Permian

P: Permian Rocks, Undivided

This map unit is undivided.

Pb: Bursum Formation

A Lower Permian unit consisting of conglomeratic sandstone, shales and limestones. The conglomerate occurs locally.

Pa: Abo Formation

A terrestrial shale, siltstone and sandstone.

Py: Yeso Formation

The Yeso Formation has two members. The Los Vallos or Torres Member consists of gypsum, sandstone and shale. The lower member is the Maseta Blanca Sandstone.

Pm: Unknown Unit

Unit on map, but not on original legend.

Pg: Glorietta Sandstone

A Lower Permian unit of cross-bedded, quartzose sandstone.

Ps: San Andres Limestone

This unit consists of: (i) a lower evaporite unit in the Sierra Lucero to the west of the Rio Grande; (ii) a lower limestone member to the east of the Rio Grande; (iii) an upper limestone member in the Sierra Lucero; and (iv) an upper member of silty sandstone to the east of the Rio Grande.

Psg: San Andres and Glorietta Sandstone, Undivided

Mesozoic

Triassic

Trc: Chinle Formation

An Upper Triassic unit of shale and sandstone which, locally, includes the Shinarump Conglomerate Member at the base.

Jurassic

Je: Entrada Sandstone

A thick, cross-bedded sandstone of Middle Jurassic age.

Jt: Todilto Limestone

A thin, sandy, argillaceous limestone with local overlying calcareous siltstone and sandstone lenses.

Js: Summerville Formation

A unit of sandstone, siltstone and mudstone.

Jes: Summerville, Todilto and Entrada Formations, Undivided

The Summerville, Todilto and Entrada formations are undivided in this Middle Jurassic unit.

Jbz: Zuni and Bluff Sandstones, Undivided

The unit consists of the eolian Zuni Sandstone and fluvialite Bluff Sandstone.

Jm: Morrison Formation

The unit consists primarily of the Brushy Basin Member; a claystone, siltstone, sandstone and conglomerate unit.

Jz: Unknown Unit

Unit is not discussed in map legend; may be Zuni Sandstone.

Jmb: Morrison Formation, Zuni and Bluff Sandstones, Undivided

J: Upper and Middle Jurassic Rocks, Undivided

Jurassic and Cretaceous

JK: Jurassic and Cretaceous Rocks, Undivided

Cretaceous

Kd;Kdp;Ktw: Dakota Sandstone

Kd: Oak Canyon Member

The Oak Canyon Member is the basal part of the Dakota Sandstone. It is conglomeratic at its base.

Kdp: Paguate Sandstone Tongue

The Paguate Sandstone Tongue is the intermediate unit of the Dakota Sandstone.

Ktw: Twowells Sandstone Tongue

The Twowells Sandstone Tongue is the uppermost unit of the Dakota Sandstone.

Kth: Tres Hermanos Sandstone Member

The Tres Hermanos Sandstone is an Upper Cretaceous unit.

Km: Mancos Shale

A unit of shales, siltstone and minor silty sandstones.

Kg: Gallup Sandstone

The map unit includes three sandstone tongues (Gallup) and two interbedded shale tongues.

Kcc: Crevasse Canyon Formation

This is a non-marine sandstone, shale and coal. It locally contains marine shale beds of the Mancos Shale. It is mapped to the west of the Rio Grande, where it is underlain by the Gallup Sandstone.

Kmv: Mesaverde Group

This is a unit of non-marine sandstone, shales and coals. It is mapped mainly to the east of the Rio Grande.

K: Cretaceous Rocks, Undivided

Cenozoic

Tertiary

Eocene

Tb: Baca Formation

The Baca Formation is Eocene with coarse conglomerates, red to buff sandstones and claystones. The clasts are derived from Precambrian to Triassic-aged rocks.

Oligocene

Tv: Volcanic Rocks

An undivided unit of Oligocene volcanic rocks.

Ti: Intrusive Rocks

An undivided unit of Oligocene intrusive rocks.

Tib: Intrusive Rocks

Tib is an Oligocene unit which includes andesitic, monzonitic and granitic stocks and dikes. It is dated at 27 to 30 million years B.P.

Tva: Lower Volcanic Rocks

An Oligocene unit which includes: (i) the tuff of Granite Mountain; (ii) the tuff of Nipple Mountain; and (iii) the porphyrite and andesite of White House Canyon as well as conglomerates, mud flows and sandstones. It is K-Ar dated at 33 to 37 million years B.P.

Tvb: Upper Volcanic Rocks

An Oligocene unit which includes rhyolitic tuffs from at least three caldrons, interbedded basaltic andesites to andesitic lavas, the tuff of Hells Mesa and other ash flow tuffs in the southwestern part of the map area. It is K-Ar dated at 32 to 33 million years B.P.

Tvl: Ash Flow Unit, Undivided

This undivided unit includes units Tva and Tvb, and is mapped only in the Lemitar Mountains.

Tmc: Oligocene Moat Deposits

A moat-filled deposit of the Socorro Caldron; it includes ash flow tuffs, andesitic lavas, rhyolitic domes and tuffs, landslide breccias and tuffaceous sandstones.

Tvc: An Upper Oligocene unit that includes rhyolitic tuffs of South Canyon (26m.y.), erupted from the Hop Canyon Caldron and the Lemitar Mountains (27m.y.), erupted from the Socorro Caldron. Includes some andesitic lavas locally.

Tvi: Oligocene Ash Flow Deposits

An Upper Oligocene unit which includes rhyolitic tuffs of South Canyon (26 million years, B.P.) and of the Lemitar Mountains, which were derived from the Socorro Caldron.

Oligocene and Miocene

Tac: Lava Flows

An Upper Miocene and Lower Oligocene unit which includes widespread basaltic andesites and andesites of La Jara Peak, Landvaso Reservoir and Cerritos de la Minas. The ages range from between 24 to 27 million years B.P.

Miocene

Tp: Popotosa Formation

A Miocene-aged unit of older basaltic deposits, which includes fanglomerates, mud flows, alluvial-flat and playa deposits. Andesites are interbedded in the basal part, and are dated 24 to 26 million years B.P.; whereas, the upper parts may be less than 7 million years B.P.

Tad: Miocene Lava Flows

The unit includes the Kelly Ranch Basalt, and the basaltic andesites of Council Rock, Black Butte and Kennedy Campground. The units are largely interbedded with the Popotosa Formation.

Tid: Miocene Intrusive Units

The unit includes silicic domes, flows, and tuffs along the ring fractures of the Socorro Caldron and Hop Canyon Caldron (South of Magdalena). It is K-Ar dated at 7 to 12 million years B.P. with tuffs interbedded with the Popotosa Formation.

Pliocene

Tae: Pliocene Lava Flows

Included within this unit are basaltic and andesitic flows, which are interbedded with the Sierra Ladrone Formation (QTs1) and the more widespread, northeast-trending flows in the western part of the map area. Most flows are 2.5 to 3.1 million years old.

Tie: Pliocene Intrusive Unit

This is an intrusive unit of plugs, dikes and sills associated with Pliocene lava flows.

Ts: Spring Deposits

Older spring deposits of Pliocene age, typically travertine, and overlain by the volcanic unit Tae.

Tertiary-Quaternary

Pliocene-Pleistocene

QTs1: Sierra Ladrone Formation

A Pliocene to Middle Pleistocene unit with younger basin-fill deposits; it includes alluvial fans, piedmont slope, alluvial-flat and river channel deposits. It represents early deposits of the ancestral Rio Grande. Deposition culminated in the formation of the Llano de Albuquerque some 0.5 million years ago.

QTs: Spring Deposits, Undivided

This unit includes the older and younger spring deposits of Pliocene and Pleistocene age.

QTg: Upland Gravels

Pliocene and Pleistocene gravelly deposits graded to former, high stream levels, outside of the Albuquerque basin. They may be, in part, equivalent to the Sierra Ladrone Formation (QTs1).

Quaternary

Pleistocene

Qbo: Older Basalts

A Middle and Lower Pleistocene unit which includes the andesite at Los Lunas Volcano and remnants of old basaltic rocks east of Cerro Verde.

Qbm: Intermediate Basalts

Upper and Middle Pleistocene unit which includes basalt flows of the Cat Hills and Cerro Verde fields, and a small remnant in the Malapais Valley. All flows are associated with the post-Llano de Albuquerque drainages.

Qt: Terrace Deposits

Cut and fill and strath terrace deposits along the Rio Grande, Rio Puerco, Rio Salado and their main tributary streams.

Qps: Piedmont Slope Deposits

Alluvial fan, pediment and alluvial-flat deposits; form widespread erosional surfaces in the Albuquerque-Belen and adjacent basins. Typically, they have weakly-to-moderately developed calcareous soils.

Pleistocene-Holocene

Qls: Landslide Deposits

These deposits consist of slump blocks of basalt or sandstones which cap mesas in the western half of the map area. They are typically underlain by the Chinle Formation (Trc) or Mancos Shale (Km).

Qc: Colluvial Deposits

These are locally derived slope wash, talus, and rockfall deposits. They may include some landslide debris.

Qyf: Young Fan Deposits

Alluvial fan deposits along the steep, west facing slopes of the Sandia, Monzano and Los Pinos mountains. Typically, they have developed calcareous soils.

Qby: Young Basalts

An Upper Pleistocene and Holocene unit which includes the McCartys and Laguna basalt flows of the Malapais Valley.

Qs: Younger Spring Deposits

These Quaternary spring deposits are usually associated with active springs, or occupy low topographic sites.

Qg: Shoreline Deposits

An Upper Pleistocene and Holocene unit. It is a deposit of beach gravels and interbeach-ridge sands of the Estancia Basin.

Qla: Lacustrine Deposits

An Upper Pleistocene and Holocene unit of lacustrine sediments of the Estancia Basin and San Augustin Plains.

Qal: Alluvium

A unit of alluvium of the tributary and minor streams.

Qes: Eolian Sand

A unit of stabilized sand dunes and sand sheets; stabilized by vegetation.

Holocene

Qfp: Floodplain Deposits

Modern floodplain deposits of the Rio Grande, Rio Puerco and Rio Salado.

Qea: Eolian Sand

Active sand dunes and sand sheets, unvegetated.

Qe: Eolian Sand, Undivided

Holocene sand which include both the stabilized (Qes) and active (Qea) dunes.

D. RADIOACTIVE MINERAL OCCURRENCES

Uranium deposits occur in rocks of many geologic ages and lithologic types. Bedded deposits are in many strata, ranging in age from Paleozoic to Tertiary (Chenoweth, 1976).

Uranium has been found in the Abo Formation, of Permian age, in Torrance County. The occurrences are usually in sandstone beds, and are associated with fossil plant material, iron and copper sulfides, and copper carbonates (Hilpert, 1965). The sandstone outcrops are in the Monzano Mountains.

Jurassic rocks contain the most important uranium deposits in New Mexico. In the map area, most of these deposits are in the Laguna section of Grants Mineral Belt, Valencia County. Here the Morrison Formation consists of interbedded fluvial sandstone, claystone and mudstone. In the Laguna section, the Recapture Member and the Brushy Basin Member contain uranium deposits. The Recapture has only minor sandstone units and minor deposits in this area. The Brushy Basin Member consists of greenish-gray mudstone and claystone with interbedded

sandstone and a few thin beds of limestone. A thick sandstone, the Jack-pile Sandstone, occurs in the upper part of the Brushy Basin in the Laguna area where it contains large deposits. The deposits are irregular in shape, usually elongated and parallel to paleostreams. The deposits range in size from thin pods a few feet in width and length to large masses of ore, hundreds of feet long, and tens of feet wide. The principle ore is coffinite, a uranium silicate, which is associated with a carbonaceous humate in the impregnated sandstone (Chenoweth, 1976).

The Cretaceous age Mesaverde Group is the host rock for uranium in some localities in northern New Mexico; within the map sheet area, ore has been mined from one property in the Hooks Ranch area, Socorro County. Another productive deposit within the map area is the Midnight No. 2 (NW $\frac{1}{4}$ sec.12,T.2,R.11W) in the Point Lookout Sandstone in Catron County (Hilpert, 1965) from which ore has been mined. Other deposits occur, mainly in the Mesaverde Group in Catron and western Socorro counties.

In the Hooks Ranch area, and in the Red Basin area, Catron County, the Baca Formation is a host rock to uranium deposits which have yielded ore grade material. The Eocene sedimentary rocks have yielded more than 200 tons of ore in these two counties (Chenoweth, 1976).

Uranium occurs in some vein deposits, but the veins have not equaled the bedded strata as sources of mineable ore. Much of the exploitable uranium of hydrothermal origin has been taken from a collapsed pipe structure in the sedimentary strata of Jurassic age, Valencia County, and from fault-controlled deposits, in sedimentary rocks, of Permian and Triassic ages, along the Rio Grande Trough, Socorro County (Chenoweth, 1976).

SECTION IV RESULTS OF DATA ANALYSIS

A. GEOLOGIC BASE MAPS

The Socorro 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

The profiles of Map Lines 1 - 23 and Tie Lines 1 - 10 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. T_{L} (^{208}Tl)

10 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. 5.3 c/s = 1 ppm eTh.

3. Bi (^{214}Bi)

20 C/S/div; 7-second weighted average as for T_{L} . 51.1 c/s = 1 ppm eU.

4. K (^{40}K)

45 C/S/div; 7-second weighted average as for T_{L} . 77.1 c/s = 1%K.

5. BiAir

20 C/S/div; 50 -second average.

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 3.00 MeV (GC)

450 C/S/div; no averaging

8. $^{214}\text{Bi}/^{208}\text{Tl}$ Ratio (Bi/ T_{L})

.40 /div; 7-second weighted averaging as for T_{L} .

9. $^{214}\text{Bi}/^{40}\text{K}$ Ratio (Bi/K)

.20 /div; 7-second weighted averaging as for T_{L} .

10. $^{208}\text{Tl}/^{40}\text{K}$ Ratio (T_{L} /K)

.05 /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, 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

1 degree celsius/division; no averaging.

3. Barometric Pressure

0.25 inches mercury/division; no averaging.

4. Base Station - Magnetic Field

10 gammas/div; no averaging

5. Residual Magnetic Field

20 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.

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

where the standard deviation is σ , 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 ON FOLLOWING PAGE.

	LP	LPM	LPML	LPMU	LPS	J	JBZ	JE	JES	JK	JM	JMR	JS	JT	JZ	K	KCC	KD	KDP		KG	KH	KMV	KTH	KTW	M	MLP	P	PA	PB	PC	PEC	PEG	PEGP	PET	PEL	PELP	PEM	PEML	
ML 1	81																	40	ML 1			46	45						22		79									
ML 2	55			41													45		ML 2		46	41							41		90									
ML 3				33															ML 3										47		135									
ML 4																			ML 4										53		75									
ML 5	72																		ML 5										44		174									
ML 6				27	43												47		ML 6		45								49	38	86									
ML 7	41		29		37														ML 7										57		119									
ML 8			25		41														ML 8		58	52	73						54											
ML 9				101	67												57		ML 9		66	57	60						115	97		62			109	57				
ML10				18	36												58	50	ML10		59	51		55					52	44		85				87	82			
ML11				31	34												58	42	ML11		50	55		49	53				48	59		100						77		
ML12			26	29	32												56	35	ML12		50	51		49					50	59					121					
ML13		52	21	23													55	42	ML13		45	51							47	42										
ML14																	53	45	ML14		45	51			40				49									40		
ML15				34													51		ML15		55	38			42													44		
ML16				30		36											47		ML16		51	50							48									44		
ML17			16	41	21	32											48	53	ML17		57	52			48				54									41		
ML18			22	47	17	41											44	46	ML18		54	58																51		
ML19			38	40	27	34											58	37	ML19		55	56			41															
ML20			29	43		26									21		50	24	34 ML20		37	41			43														43	
ML21			27	41	31	23			27						43		41	38	ML21		49																		22	
ML22			29	42	26		20		20		33				42		46	29	ML22		60	42	55		36														40	
ML23				39			25		22								44		ML23			50	36		46															
TL 1																	52	45	TL 1		46	42						51						127						
TL 2																	49		TL 2		58	52												111						
TL 3																	51	36	TL 3		57	54																		
TL 4																			TL 4			61																		
TL 5				28															TL 5																					
TL 6									27		34								TL 6										45											
TL 7				31															TL 7																					
TL 8				39	26														TL 8										46											
TL 9				47															TL 9										42	39					98			52	60	
TL10																			TL10																					

40a

Table 1. Geologic Unit Average Value as a Function of Map Line for ^{208}Tl (Counts/Second)

40b

	PEO	PG	PM	PS	PSG	PY	QAL	QBM	QBO	QBY	QC	QE	QEA	QES	QFP	QG	QLA	QLS	QPS	
ML 1		19		29		25	36				65	29			60				75	ML 1
ML 2		20		36		31	41					38			61		51		66	ML 2
ML 3		21		34		30	43					37			54		28		89	ML 3
ML 4		25		36	28	37	49					39			61		30		65	ML 4
ML 5		22		34		35	57					42			65				61	ML 5
ML 6		24		26		31	59								47				56	ML 6
ML 7		22		36		32	58					42			45				70	ML 7
ML 8		22	34	46		38	47					42			44				52	ML 8
ML 9		35	25	90		71	55					42			40				46	ML 9
ML10		20	54	45		36	51								50			40	53	ML10
ML11		42	21	42		39	49								40				46	ML11
ML12		30		30		46	45				39	47			50				51	ML12
ML13				19		41	44				43	30			41	35	30		47	ML13
ML14				21		40	39				50	33			47	33	37		42	ML14
ML15				24		34	46				43	35			44	44	42		34	ML15
ML16				29		27	44				36	34		35	46	35	41		38	ML16
ML17				17		24	46				48	46		39	47	46	43		41	ML17
ML18				29		38	41	49	46	20	53	38	34	37	44	47	45		36	ML18
ML19	63			42	17	26	47	48	59	19	46	35		38	43	48	43		49	ML19
ML20	63			41			44	42		19	46	33		41	43	48	41		46	ML20
ML21							36	40		23	38	34	41	34	54	47	43		46	ML21
ML22							39	37		29	38	38	39		47		45		46	ML22
ML23		32		26		91	43			29	48								46	ML23
TL 1		27					53			29		30						42	49	TL 1
TL 2							47					47					59	33	53	TL 2
TL 3							36					47							66	TL 3
TL 4				27			44	48			47	49						48	73	TL 4
TL 5			24	38		31	42	33				38	48	45	55			45	58	TL 5
TL 6							45	43				31			42			51	73	TL 6
TL 7		15		20		31	41											51	45	TL 7
TL 8		16		24		34	31											51	51	TL 8
TL 9		20		31		30	52											53	53	TL 9
TL10		25		38			47				37	31				37	40	49	49	TL10

40c

QS	QT	QTG	QTS	QTSL	OYF	TAC	TAD	TAE	TR	TI	TIR	TID	TIF	TMC	TP	TRC	TS	TV		TVA	TVR	TVC	TVL
	37	73		25			64	79	43			94			59	42		98	ML 1	75			
		63		35					27			51		41	68	42		58	ML 2	59	63		
		64		69		63				228				88	24		150	ML 3	47	69			
		65		44		78		49	37					91				ML 4	89	75			
		63		74		146								81				ML 5	50	89	72		
		67	42	61		76		42	73	26				69		27		ML 6	40	82	90		
41		46	53			88			50	34				76		42		ML 7	44	95			
51		70	39	42	96	81			47					64		58		ML 8	45	90			
		66	26	65	66	54			44	62				50		48		ML 9	43				
		51	40	43	61			34	46	58								ML10	47				
	38		54	38	71			38							75	42		ML11	43				
37		50		41	77			45		19						45		ML12					
38		59		37	40			40		23						45		ML13					
42				35	69			45								53		ML14					
42			25	34	50			45								42		ML15					
		48	25	33	59		36	43								45		ML16					
		41		35	61		49	39		57						44	33	ML17					
		53		36	63			42									33	ML18					
57	35			42	48			43										ML19					
	38	37		37	57			42									43	39	ML20				
	34	45		37	35			42											ML21				
		40		42	38			31											ML22				
37				39									29						ML23				
						148			42	41									TL 1	31	92		
		42						44											TL 2	43	90		
		67				85		48	43	54									TL 3	60	75		
			27	45				34				69			87	41			TL 4	59	89	59	
46				44											96	32			TL 5			62	
				37													40		TL 6				
																			TL 7				
	41				53														TL 8				
																			TL 9				
																			TL10				

40d

40e

	IP	LPM	LPML	LPML	IPS	J	J8Z	JE	JES	JK	JM	JMB	JS	JT	JZ	K	KCC	KD	KDP	
ML 1	117																	131		ML 1
ML 2	186				110													94		ML 2
ML 3					107															ML 3
ML 4																				ML 4
ML 5	171																			ML 5
ML 6				84	106												75			ML 6
ML 7	132		99		83															ML 7
ML 8			62		71															ML 8
ML 9				142	94												144			ML 9
ML10				93	104												130	83		ML10
ML11				107	126												125	88		ML11
ML12			105	98	98												119	79		ML12
ML13		133	109	109													116	115		ML13
ML14																	113	97		ML14
ML15				106													114			ML15
ML16				99		67											110			ML16
ML17			98	129	96	113											101	146		ML17
ML18			87	126	80	67											102	96		ML18
ML19			128	126	93	66											126	85		ML19
ML20			101	108		52									24		90	51	90	ML20
ML21			96	127	65	57			87						103		121	84		ML21
ML22			98	122	135		54		67		87				87		136	85		ML22
ML23				117			71		117									92		ML23
TL 1																	110	91		TL 1
TL 2																	93			TL 2
TL 3						61	37		36								112	66		TL 3
TL 4																				TL 4
TL 5				125					121		135							122		TL 5
TL 6																				TL 6
TL 7				143														147		TL 7
TL 8				138	124															TL 8
TL 9				139																TL 9
TL10																				TL10

41a

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

KG	KM	KMV	KTH	KTW	M	MIP	P	PA	PB	PC	PEC	PEG	PEGP	PEI	PEL	PELP	PEM	PENL
	144	156						116		118								
	133	95						115		152								
								126		230								
								132		184								
								84		268								
	114							117	101	139								
								107		231								
78	79	111						85							117	93		
144	121	122						176	137		117					138		
113	92		92					77	112		189				204	144		
132	123		129	171				108	102	249					237	164		
100	90		105					82	89			105						
94	105							89	98								101	
80	104			76				104									100	
122	79			75													114	
101	100							107									100	
118	111			85				126									107	
118	112																	
113	116			77														
93	98			75													109	
118																	45	
130	83	127		85													135	
	108	121		115														
95	114							87						231				
115	97													216				
109	115																	
126																		
								135										
								143										
	119	143										246					146	174

41b

	PEO	PG	PM	PS	PSG	PY	QAL	QBM	QRO	QBY	QC	QE	QEA	QES	QFP	QG	QIA	QIS	QPS		
ML 1		85		104		104	109				8R	35			190				121	ML 1	
ML 2		56		84		73	75					47			137		62		98	ML 2	
ML 3		56		78		68	73					45			131		37		155	ML 3	
ML 4		62		82	99	86	86					46			137		18		92	ML 4	
ML 5		52		77		79	90					52			127				81	ML 5	
ML 6		53		55		70	98								114				71	ML 6	
ML 7		35		54		56	117					102			123				117	ML 7	
ML 8		43	107	67		59	93					89			89				78	ML 8	
ML 9		48	109	124		104	113					116			107				91	ML 9	
ML10		44	119	80		61	112								99			68	106	ML10	
ML11		65	94	76		84	109								108				99	132	ML11
ML12		48		61		75	90				53	84			96				116	96	ML12
ML13				66		90	91				97	84			115		75	70	104	101	ML13
ML14				54		81	85				148	84			119	109	97		74	102	ML14
ML15				92		87	115				107	104			142	103	103		83	124	ML15
ML16				80		84	108				75	93		89	108	85	109		68	106	ML16
ML17				87		99	120				113	113			116	135	109	100	125	125	ML17
ML18	141			93		98	104	111	83	64	104	99	71		90	122	115	123	85	127	ML18
ML19	131			104	95	85	119	119	125	19		116			102	144	108	110	97	126	ML19
ML20	166			109		101	98			30	79	85			110	83	102		85	104	ML20
ML21						92	110			35					123	114	127	142	113	122	ML21
ML22						98	83			37	137	115	92		85	137	135	119	111	130	ML22
ML23		66		67		171	118			48	130	111	120		129			123	96	123	ML23
TL 1		43					107			47	103								88		TL 1
TL 2							89					57							86	96	TL 2
TL 3							70					98						120	55	116	TL 3
TL 4				86			107	112			84	123							162		TL 4
TL 5			103	112		115	140	138											153		TL 5
TL 6							150	107					130	173	132	156			225		TL 6
TL 7		66		100		97	87					80			102				133		TL 7
TL 8		75		86		124	118												156		TL 8
TL 9		76		97		89	146												139		TL 9
TL10		94		117			159				112	110					129	151	166		TL10

41c

US	OT	OTG	QTS	QTSL	OYF	TAC	TAD	TAE	TR	TI	TIR	TID	TIF	TMC	TP	TRC	TS	TV			TVA	TVB	TVC	TVL
	141	104		128			99	170	151			224			138	128		173	ML 1		99			
		76		89					82			109		117	116	81		106	ML 2		74	70		
		87		158		107				309					175	55		225	ML 3		91	97		
		95		109		151		116	97						141				ML 4		144	99		
		88		138		226									131				ML 5		54	128	197	
		78	51	103		117		92	90	43					101	58			ML 6		48	95	274	
	107		76	98		129			87	14					127	115			ML 7		59	123		
	84	93	86	86	119	123			61						95	72			ML 8		50	100		
		112	77	141	104	132			104	134					154	122			ML 9		84			
		74	83	79	81			73	84	104									ML10		73			
	81		135	91	124			110							198	92			ML11		122			
	56	96		98	111			88								93			ML12					
	78	102		110	84			76		66						92			ML13					
	72			85	169			86								104			ML14					
	68		95	107	115			89								105			ML15					
		102	89	93	127		88	84								96			ML16					
		98		120	119		127	75		136						130	88		ML17					
		131		96	113			84									73		ML18					
				121	123			91								101			ML19					
131	132			94	137			88								115	98		ML20					
	104	117		131	79			112											ML21					
		141		107	131			107								160			ML22					
	133			119									119			129			ML23					
						315			96	101									TL 1		56	168		
								82											TL 2		75	147		
		92						84	103	131									TL 3		131	164		
		150				185									187	86			TL 4		126	194	114	
			136	122				91				204			276	116			TL 5				191	
				138															TL 6					
				100															TL 7					
	108				156														TL 8					
																			TL 9					
																			TL10					

41d

41e

	IP	IPM	IPML	IPMU	IPS	J	JBZ	JE	JES	JK	JM	JNB	JS	JT	JZ	K	KCC	KD	KDP		KG	KM	KMV	KTH	KTW	M	MLP	P	PA	PB	PE	PEC	PEG	PEGP	PEI	PEL	PELP	PEM	PEML
ML 1	269																	103	ML 1		115	135						50		252									
ML 2	496			74													122	ML 2		128	132							66		258									
ML 3				54														ML 3										72		371									
ML 4																		ML 4										78		316									
ML 5	259																	ML 5										73		314									
ML 6				53	128												197	ML 6			97							86	71	217									
ML 7	106		66		112													ML 7										93		290									
ML 8			54		97													ML 8		157	132	231						132								339	147		
ML 9				270	220												170	ML 9		158	177	140						357	255		158						263		
ML 10				50	83												150	ML 10		156	126							88	79		250				268		213		
ML 11				70	104												148	ML 11		145	129		159	133				110	92		260				272		255		
ML 12				55	67	97											132	ML 12		132	131		91					95	117										
ML 13	175		40	53													137	ML 13		143	130							94	88									117	
ML 14																	138	ML 14		135	122				86			113										121	
ML 15				69													117	ML 15		144	91				114													118	
ML 16				59		81											120	ML 16		135	117							111										105	
ML 17			29	96	44	96											120	ML 17		138	130				127			95										125	
ML 18			39	108	30	104											90	ML 18		138	143																		
ML 19			92	91	52	81											168	ML 19		145	149				93														143
ML 20			63	98		83										59	136	ML 20		147	129				124														66
ML 21			59	95	72	63			100							152	114	ML 21		125																			133
ML 22			70	96	75		109		134		85					150	166	ML 22		146	99	165													308				
ML 23				92			104		106								113	ML 23		133	149														298				
TL 1																	147	TL 1		142	130							125											
TL 2																	126	TL 2		140	154																		
TL 3																	161	TL 3		147	147																		
TL 4																		TL 4			104																		
TL 5				54														TL 5											121										
TL 6																		TL 6																					
TL 7				59														TL 7											68										
TL 8				88														TL 8											70	82					298			139	192
TL 9				97														TL 9																					
TL 10																		TL 10																					

42a

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

42b

	PeO	PG	PM	PS	PSG	PY	QAL	QBM	QBO	QBY	QC	QE	QEA	QES	QFP	QC	OLA	OLS	OPS	
ML 1		68		77		77	135				232	193			219				285	ML 1
ML 2		63		106		95	169					199			217		217		249	ML 2
ML 3		75		99		101	172					196			161		199		297	ML 3
ML 4		87		120	90	116	189					211			184		193		267	ML 4
ML 5		96		120		98	194					196			188				223	ML 5
ML 6		101		122		114	192								163				210	ML 6
ML 7		91		130		115	174					192			189				223	ML 7
ML 8		74	96	141		131	177					231			187				204	ML 8
ML 9		192	40	279		232	173					161			198				178	ML 9
ML10		53	128	138		113	161								168			140	177	ML10
ML11		131	34	121		123	150								162			132	192	ML11
ML12		77		90		141	131				135	176			160			121	177	ML12
ML13				43		118	106				154	144			150	115	121	138	130	ML13
ML14				51		126	114				176	140			155	118	126	108	131	ML14
ML15				57		84	135				99	164			145	133	135	96	146	ML15
ML16				68		73	134				194	159		158	147	123	131	83	140	ML16
ML17				38		79	142				148	164		167	149	145	139	111	152	ML17
ML18	155			64		94	142	147	76	60	136	148	169	160	153	146	133	92	160	ML18
ML19	156			96	52	115	132	148	126	61	136	162		156	156	136	139	95	159	ML19
ML20	194			116			140	133		64	140	159		149	120	141	135	159		ML20
ML21							122	146		62				172	148	139	138	131	149	ML21
ML22							130	113		66	171	158	155	172	153	136	150	129	162	ML22
ML23							134			74	195	149	181		160		157	123	163	ML23
TL 1		73		54		244				80	159							123	163	ML23
TL 2		84					168					180						110	173	TL 2
TL 3							178					116					212	93	182	TL 3
TL 4							125				94	196						273	192	TL 4
TL 5			51	63		91	128	108									109	192	192	TL 5
TL 6				92			173	150				162	157	175	171			322	163	TL 6
TL 7		75		50		76	144					157			150			163	163	TL 7
TL 8		66		65		111	97											126	126	TL 8
TL 9		62		87		85	118											126	126	TL 9
TL10		54		115			129				102	100				109	121	123	123	TL10

42c

QS	QT	QTG	QTS	QTS1	QYF	TAC	TAD	TAE	TB	TI	TIB	TID	TIE	TWC	TP	TRC	TS	TV			TVA	TVB	TVC	TVL
	150	250		64			215	376	141			330			117	87		334	ML 1		254			
		222		93					111			266		440	261	114		176	ML 2		225	222	337	
		223		289		308									393	108		356	ML 3		139	229		
		235		129											335				ML 4		297	241		
		220		230		471									310				ML 5		197	287	314	
		234	196	226		227		119	243	97					248	72			ML 6		173	256	227	
156		157	189		253				187	153					250	117			ML 7		185	282		
189	211	133	142	308	246				190						232	136			ML 8		172	249		
	205	78	216	231	196				185	146					157	117			ML 9		178			
	198	131	191	180					157	166									ML10		143			
182		165	163	237											166	66			ML11		193			
118	168		163	243					154		70					93			ML12					
118	188		142	101					137		111					104			ML13					
107			126	223					127							132			ML14					
98		61	137	140					128							85			ML15					
	153	47	135	198			79	115								96			ML16					
	114		145	165			147	99		149						134	100		ML17					
146	174		145	162				109									82		ML18					
	163	156	151	176				110											ML19					
	168	117	151	189				120									104		ML20					
	168	117	154	96				106											ML21					
	173	164	174	127				162											ML22					
			165																ML23					
						270													TL 1		126	225		
									112	175	170								TL 2		156	227		
		116							111	185									TL 3		190	224		
		217				227					144								TL 4		187	239	190	
			81	156				103				442			283	79			TL 5				450	
168				173											563	72			TL 6					
				144															TL 7					
	114				152														TL 8					
																			TL 9					
																			TL10					

42d

42e

	LP	LPM	LPML	LPML	LPS	J	JBZ	JE	JES	JK	JM	JMB	JS	JT	JZ	K	KCC	KD	KDP		KG	KM	KMV	KTH	KTW	M	MIP	P	PA	PR	PE	PEC	PEG	PEGP	PEI	PEL	PELP	PEM	PEML		
ML 1	145																	327		ML 1		315	346						524		151										
ML 2	336			266														205		ML 2		291	228						283		171										
ML 3				358																ML 3									281		170										
ML 4																				ML 4									247		254										
ML 5	267																			ML 5									192		173										
ML 6				331	246												157			ML 6		253							245	265	164										
ML 7	337		372		226															ML 7									186		224										
ML 8			254		181															ML 8		140	168	153					159								109	178			
ML 9				139	141													254		ML 9		222	215	204					152	145		187							168		
ML10				515	294													227	163	ML10		194	180		169				149	254		224				237		166			
ML11				354	370													222	207	ML11		262	222		264	322			231	172		249				200		212			
ML12			419	346	301													217	236	ML12		203	175		214				176	150											
ML13	268		541	498														212	272	ML13		212	205						191	233									254		
ML14																		214	212	ML14		184	201			188			212										239		
ML15				332														227		ML15		226	213			178													266		
ML16				344		187												235		ML16		203	199						223										250		
ML17		628	323	464	348													214	273	ML17		212	217			178			235										227		
ML18		416	280	477	163													234	209	ML18		221	196																		
ML19		336	332	350	201													227	230	ML19		214	209			186															
ML20		363	272		201													182	205	ML20		247	273			173													257		
ML21		367	318	207	252				362									294	220	ML21		242																	213		
ML22		340	312	525			281		333		269							304	318	ML22		219	194	231		233													397		
ML23			325				293		525										215	ML23		221	349		250											184	194				
TL 1																		215	198	TL 1		209	265					170													
TL 2																		191		TL 2		199	187																		
TL 3						188	129		162			180						219	184	TL 3		194	213																		
TL 4																				TL 4																					
TL 5			448						464		420								291	TL 5									319												
TL 6																				TL 6																					
TL 7			461																312	TL 7									312												
TL 8			389	481																TL 8									286	379								294	289		
TL 9			298																	TL 9																					
TL10																				TL10																					

43a
Table 4. Geologic Unit Average Value as a Function of
Map Line for $^{214}\text{Bi}/^{208}\text{Tl}$ (Times 100)

43b

	PG	PM	PS	PSG	PY	QAL	QBM	QBO	QBY	QC	QE	QEA	QES	QFP	QG	OLA	OLS	QPS	
ML 1	439		391		427	331				133	122			316				165	ML 1
ML 2	292		237		237	193					123			275		128		149	ML 2
ML 3	270		231		235	178					114			246		133		173	ML 3
ML 4	250		235	353	243	188					114			223		63		138	ML 4
ML 5	241		233		231	169					121			199				129	ML 5
ML 6	240		214		228	175								243				125	ML 6
ML 7	164		150		190	217					247			272				176	ML 7
ML 8	206	342	149		155	198					209			205				152	ML 8
ML 9	137	445	136		148	214					277			265				203	ML 9
ML10	211	314	198		171	224								205		177		201	ML10
ML11	156	442	209		222	225								274				219	ML11
ML12	156		238		168	201				135	197			192				230	ML12
ML13			352		231	210				224	278			285	214	226		220	ML13
ML14			256		195	225				300	256			263	334	266		176	ML14
ML15			431		257	264				253	300			327	237	244		242	ML15
ML16			284		301	254				209	283		255	242	247	263		178	ML16
ML17			518		511	269				237	257		306	288	243	238		317	ML17
ML18	245		345		268	261	228	186	340	204	263	215	243	285	248	275		244	ML18
ML19	275		259	568	328	263	253	210	109	341	341		272	343	227	252		271	ML19
ML20	274		269			242	235		155	170	256			250	219	267		211	ML20
ML21						266	278		205				302	274	266	347		247	ML21
ML22						267	223		173	363	338	220	252	273	285	277		239	ML22
ML23						303			163	347	302	306		285		285		253	ML23
TL 1	207		261		192				154	211								191	TL 1
TL 2	160					199					190					205		195	TL 2
TL 3						192					207				208	168		226	TL 3
TL 4			319			191					248							255	TL 4
TL 5		458	300		426	354	431			178					271	276		311	TL 5
TL 6						337	253				342	358	297	288				298	TL 6
TL 7	426		528		325	214					265			246				308	TL 7
TL 8	475		369		368	390												265	TL 8
TL 9	375		324		303	280									344	378		265	TL 9
TL10	369		312		336					301	354							342	TL10

43c

QS	QT	QTG	QTS	QTSL	QYF	TAC	TAD	TAE	TB	TI	TIB	TID	TIF	TMC	TP	TRC	TS	TV		TVA	TVB	TVC	TVL
	381	142		503			158	216	351			244			235	304		181	ML 1	138			146
		118		256					298			219		281	188	193		190	ML 2	129	111		
		138		230		169				138					202	221		153	ML 3	203	141		
		142		246		203		241	261						149				ML 4	159	132		
		136		191		156									158				ML 5	106	141	274	
		115	125	170		144		231	120	176					144	218			ML 6	113	119	301	
262		166	192		153				173	41					176	293			ML 7	131	128		
164	130	223	218	124	152				134						147	127			ML 8	112	115		
	169	303	244	158	242				242	218					311	252			ML 9	199			
	148	207	183	136				219	188	184									ML10	160			
		251	241	174											264	224			ML11	283			
214		195		242	150											207			ML12				
152	176			305	214					281						207			ML13				
211				245	249											193			ML14				
173			404	323	233											251			ML15				
161		213	376	291	214		244									215			ML16				
		237		347	196		258									316	275		ML17				
		247		271	195												229		ML18				
230	371			305	255											248			ML19				
	228	250		255	239											288	263		ML20				
	311	262		355	236														ML21				
		365		260	340											707			ML22				
	359			314								413				371			ML23				
						213				229	247								TL 1	188	185		
								187											TL 2	175	164		
		221						173	241										TL 3	220	225		
		222				218				241									TL 4	215	216	194	
			531	273				263				296				216	212		TL 5			313	
298				314												290	368		TL 6				
				270													328		TL 7				
	264				298														TL 8				
																			TL 9				
																			TL10				

43d

43e

	LP	LPM	LPML	LPNU	LPS	J	JBZ	JE	JES	JK	JM	JMA	JS	JT	JZ	K	KCC	KD	KDP		KG	KM	KMV	KTH	KTW	M	MIP	P	PA	PB	PC	PEC	PEG	PEGP	PEI	PEL	PELP	PEN	PEML		
ML 1	447																	1268	ML 1		1260	1173						2325		486											
ML 2	374			1608														770	ML 2		1050	718						1780		652											
ML 3				2107															ML 3									1806		629											
ML 4																			ML 4									1752		628											
ML 5	930																		ML 5									1163		1000											
ML 6				1657	846												382		ML 6		1205							1411	1420	642											
ML 7	1250		1717		797														ML 7									1159		912									347	811	
ML 8			1175		784														ML 8		511	711	504					657													
ML 9				522	430												877		ML 9		934	703	890					497	545		829								530		
ML10				2114	1393												898	506	ML10		734	781		579				963	1488		755					763	651				
ML11				1808	1339												877	1502	ML11		941	978		947	1301			1050	1124		974					896	672				
ML12				2061	1632	1018											940	1390	ML12		779	697		1147				926	890												
ML13	975		3086	2676													882	779	ML13		677	841						996	1122										906		
ML14																	843	1156	ML14		618	884			880			948											994		
ML15				1733													1011		ML15		877	884			660														1048		
ML16				1722		926											982		ML16		775	868						981											1151		
ML17				3706	1431	2388	1236										894	1124	ML17		878	880			692			1393											1055		
ML18				2493	1324	2697	652										1164	854	ML18		866	800																			
ML19				1439	1471	2091	859										771	876	ML19		817	805			881																
ML20				1752	1221		654									419	670	703	530	ML20		642	931			599														777	
ML21				1718	1462	993	926			923						680	1082	752	ML21		970																		688		
ML22				1429	1473	1991		541		501		1085				581	841	764	ML22		895	847	776		867											753			1409		
ML23					1449			697		1125								871	ML23			895	851		1057										727						
TL 1																	764	785	TL 1		694	880						700													
TL 2																	756		TL 2		836	637																			
TL 3							740	452		372			393				713	732	TL 3		747	791																			
TL 4																			TL 4			1219																			
TL 5				2398						1658		1504						983	TL 5									1153													
TL 6																			TL 6																						
TL 7				2422														1542	TL 7									2166													
TL 8				1981	3269														TL 8									1737	1800					828				1182	916		
TL 9				1491															TL 9																						
TL10																			TL10																						

44a

Table 5. Geologic Unit Average Value as a Function of
Map Line for $^{214}\text{Bi}/^{210}\text{Pb}$ (Times 1000)

44b

	PEO	PG	PM	PS	PSG	PY	QAL	QBM	QBO	QBY	QC	QE	QEA	QES	QFP	QG	QLA	QLS	QPS	
ML 1		1288		1484		1411	1017				373	184			949				453	ML 1
ML 2		1010		850		814	465					234			661		284		407	ML 2
ML 3		802		861		701	454					224			846		187		506	ML 3
ML 4		791		714	1113	763	505					213			758		95		333	ML 4
ML 5		619		685		890	523					265			703				342	ML 5
ML 6		559		475		635	567								699				338	ML 6
ML 7		470		433		520	722					538			654				546	ML 7
ML 8		667	1393	493		452	540					393			557				398	ML 8
ML 9		253	3016	442		445	689					743			541				521	ML 9
ML10		877	1972	659		545	740								601			489	629	ML10
ML11		505	2728	735		692	747								684			852	694	ML11
ML12		634		841		546	750				397	491			614			985	599	ML12
ML13				1629		796	966				630	595			782	663	580	757	808	ML13
ML14				1086		639	842				848	618			783	938	776	719	841	ML14
ML15				1936		1072	889				1129	641			999	783	779	909	893	ML15
ML16				1257		1179	847				385	596		574	750	705	825	881	797	ML16
ML17				2379		1451	880				803	697			710	919	768	735	1262	ML17
ML18	1063			1602		1385	788	767	1146	1387	805	715	425	567	823	793	941	1009	829	ML18
ML19	962			1235	2523	748	949	837	1023	356	670	729		670	939	801	800	1065	813	ML19
ML20	853			947		754	750			465	564	544			754	700	737	662	671	ML20
ML21						775	779			611				721	805	942	1042	884	858	ML21
ML22						802	746			578	818	751	600	500	913	995	804	854	821	ML22
ML23						934				665	684	761	661		815		787	804	771	ML23
TL 1		1127		1390		721				588	659								476	TL 1
TL 2		523				656						319						796	565	TL 2
TL 3						505						848					571	673	620	TL 3
TL 4				1547		546				811		909	762						592	TL 4
TL 5			2399	1224		1472	1267	1303										1209	895	TL 5
TL 6						889	725												741	TL 6
TL 7		906		2199		1363	613					815	1106	764	944				840	TL 7
TL 8		1340		1422		1138	1384					519			697				964	TL 8
TL 9		1330		1173		1058	1259												1112	TL 9
TL10		1778		1034		1240					1098	1113					1191	1264	1360	TL10

44c

QS	QT	QTG	QTS	QTSL	QYF	TAC	TAD	TAE	TR	TI	TIB	TID	TIE	TMC	TP	TRC	TS	TV	ML 1	TVA	TVR	TVC	TVL
	950	416		2236			470	475	1069			688			539	1542		581	ML 1	400			
		337		1021					763			416			445	730		703	ML 2	334	319		
		394		565		352				818				451	509			631	ML 3	923	427		
		398		882		552		839	818					408					ML 4	512	440		
		379		635		483								420					ML 5	266	435	630	
		329	264	468		509		894	355	482				407	834				ML 6	264	374	1208	
722		494	532			512			462	92				515	1094				ML 7	304	430		
452		448	660	754	388	490			321					426	533				ML 8	285	406		
		547	1064	704	454	678			570	928				1020	1114				ML 9	472			
		377	637	413	463				556	658									ML10	536			
		830	576	525											1297	1422			ML11	630			
451		597		604	472				572		551								ML12				
484		549		808	842				560		590								ML13				
692				709	775				694										ML14				
707			1631	803	842				702										ML15				
		687	2080	743	642		1148		744										ML16				
		875		885	724		874		776										ML17				
		792		687	728				800										ML18				
896		765		826	706				841										ML19				
		541	601	630	744				775										ML20				
		645	1010	884	835				1088										ML21				
		876		635	1145				667										ML22				
		775		741									1114						ML23				
						1184				551	596								TL 1	459	762		
									746										TL 2	481	647		
		799							765	561									TL 3	680	726		
		683				807					921								TL 4	694	811	603	
			2055	821					942			460							TL 5			425	
818				824															TL 6				
				702		1065													TL 7				
		939																	TL 8				
																			TL 9				
																			TL10				

44d

44e

	LP	LPM	LPML	LPML	LPS	J	JBZ	JE	JES	JK	JM	JMB	JS	JT	JZ	K	KCC	KD	KDP		KG	KM	KMV	KTH	KTW	M	MLP	P	PA	PR	PC	PEC	PEG	PEGP	PET	PEL	PELP	PEM	PEML	
ML 1	305																	386	ML 1		401	338						451		322										
ML 2	111			597														372	ML 2		360	315						631		370										
ML 3				617															ML 3									663		369										
ML 4																			ML 4									708		244										
ML 5	316																		ML 5									609		568										
ML 6				514	340												242		ML 6		471							577	536	395										
ML 7	388		471		345														ML 7									622		407										
ML 8			468		449														ML 8		375	413	323					415									321	427		
ML 9				378	305												344		ML 9		424	333	434					327	382		436							319		
ML10				414	461												395	307	ML10		383	450		350				629	580		342					323		391		
ML11				496	358												406	702	ML11		357	441		355	404			460	656		389					453		307		
ML12			482	464	339												439	576	ML12		388	395		535				537	571											
ML13		342	572	511													418	285	ML13		319	405						536	481					304						
ML14																	394	543	ML14		339	441						455											358	
ML15				516													455		ML15		387	426			467			455											432	
ML16				514		471											422		ML16		419	409			379				458										398	
ML17			598	445	503	353											414	414	ML17		396	413						596										443		
ML18			605	468	566	400											499	407	ML18		301	388																457		
ML19			438	456	591	431											352	381	ML19		260	348			473															
ML20			490	450		327											371	307	ML20		398				349													304		
ML21			475	458	497	380			273								369	343	ML21		415	432	342															336		
ML22			420	455	384		189		151		406						283	252	ML22		386																	330		
ML23				442			245		210								404		ML23		424	340																		
TL 1																	361	392	TL 1		334	333						410												
TL 2																	398		TL 2		424	340																		
TL 3																	326	398	TL 3		388	371																		
TL 4																			TL 4			600																		
TL 5																			TL 5																					
TL 6																			TL 6																					
TL 7				540					359		376								TL 7																					
TL 8				526														492	TL 8																					
TL 9				487	686														TL 9																			406	317	
TL10				498															TL10																					

45a

Table 6. Geologic Unit Average Value as a Function of Map Line for $^{208}\text{Tl}/^{232}\text{Th}$ (Times 1000)

45b

	PEO	PG	PM	PS	PSG	PY	QAL	QBM	QBO	QBY	QC	QF	QEA	QES	QFP	QG	QLA	QLS	QPS		
ML 1		297		388		334	293				278	153			303				270	ML 1	
ML 2		346		357		343	244					191			293		228		267	ML 2	
ML 3		295		372		305	252					187			345		143		294	ML 3	
ML 4		312		309	321	322	267					184			348		156		243	ML 4	
ML 5		248		292		390	295					212			351				262	ML 5	
ML 6		242		221		284	309								288				269	ML 6	
ML 7		262		287		283	336					219			240				309	ML 7	
ML 8		317	390	331		298	273					188			268				260	ML 8	
ML 9		185	676	322		301	330					269			206				259	ML 9	
ML10		411	564	336		328	343								300			285	309	ML10	
ML11		326	620	354		319	339								251			378	287	ML11	
ML12		409		352		330	391					292	263		315			434	312	ML12	
ML13				479		351	479					281	214		279	313	254	348	339	ML13	
ML14				425		320	380					287	244		308	279	300	405	359	ML14	
ML15				439		418	355					459	222		310	331	317	369	364	ML15	
ML16				446		385	345					186	214		319	288	318	494	353	ML16	
ML17				460		301	335					342	282		234	320	318	310	410	350	ML17
ML18	428			482		503	308	337	616	365	396	270	204		236	295	321	343	417	334	ML18
ML19	341			466	430	234	374	337	487	330		221			246	281	358	318	403	318	ML19
ML20	326			354			317	323		315	333	213			306	318	275	314	322	ML20	
ML21						300	281			311					244	296	351	302	356	295	ML21
ML22						307	339			352	227	223	270	203	351	351	292	358	298	ML22	
ML23		530		539		373	320	339		409	197	258	216		298		289	377	311	ML23	
TL 1		327					327			381	312								251	TL 1	
TL 2							266					170						387	289	TL 2	
TL 3							288					410					280	405	281	TL 3	
TL 4				484			342	347			511	331							239	TL 4	
TL 5			515	425		347	359	308										442	320	TL 5	
TL 6							265	291				241	313	257	333				237	TL 6	
TL 7		213		420		429	290					199			287				283	TL 7	
TL 8		279		392		313	350												320	TL 8	
TL 9		363		369		356	449												420	TL 9	
TL10		482		337			369				362	316				344	336		398	TL10	

45c

QS	QT	QTG	QTS	QTSI	QVF	TAC	TAD	TAE	TR	TI	TIB	TID	TIF	TMC	TP	TRC	TS	TV		TVA	TVB	TVC	TVL
	251	295		439			297	218	306			284			226	514		318	ML 1	294			326
		284		406					251			194		94	265	373		373	ML 2	260	285		
		285		243		209									227	228		418	ML 3	411	305		
		278		372		274		352	311	604					274				ML 4	309	321		
		274		326		310									276				ML 5	252	310	230	
		286	216	271		335		378	292	274					280	381			ML 6	227	319	400	
270		295	285			346			266	223					303	375			ML 7	228	337		
274		336	297	326	312	321			245						293	428			ML 8	255	358		
		325	350	298	286	278			238	430					326	442			ML 9	243			
		257	309	224	339			258	302	353									ML10	338			
211		336		237	300			262							485	662			ML11	223			
327		316		254	315			291		312						523			ML12				
324		314		268	398			299		212						499			ML13				
419				294	309			359								427			ML14				
437			415	253	360			354								501			ML15				
		322	560	259	298		469	383								476			ML16				
		373		255	376		340	408								339	337		ML17				
		320		253	390			404									415		ML18				
391	205			281	278			396								533			ML19				
	238	240		252	311			356								403	398		ML20				
	206	390		251	366			410											ML21				
		246		245	326			194								269			ML22				
216				239										271		360			ML23				
						555			242	243									TL 1	248	413		
		362						400											TL 2	277	396		
		307				370		449	235	381						378			TL 3	311	327		
			374	300				352				156			312	547			TL 4	321	374	311	
272				262											174	449			TL 5			140	
				263													520		TL 6				
	359				360														TL 7				
																			TL 8				
																			TL 9				
																			TL10				

45d

45e

- (1) $\sigma_{Tl} = \sqrt{Tl_{\Sigma} - Tl_1}$; Test does not fail if $Tl_1 \geq 1.5 \sigma_{Tl}$
- (2) $\sigma_{Bi} = \sqrt{Bi_{\Sigma} - Bi_{SUR}}$; Test does not fail if $Bi_1 \geq 1.5 \sigma_{Bi}$
- (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.

Unusually extensive distributions of ²¹⁴Bi and ²⁰⁸Tl anomalies on ML9E were recognized during the data processing. The extensive anomalies appeared not to be representative of the local geologic units and were not displayed by other map lines in the same vicinity. After analysis of this data, by comparison with data gathered during the same time period, and from inspection of corresponding tie/map line crossings, the suspected data were found to be at the level indicated. Factors that caused this magnitude of change are unknown; further analysis and discussion of the ML9E data was not incorporated into the remainder of the report, or included in Tables 8, 9 and 10.

Relationship of Geologic Map Units to Radioactivity Anomalies

Quaternary Geologic Units: Qps,Qls,Qyf,Qby,Qg,Qla,Qal,Qfb,Qe

²⁰⁸Tl Anomalies

Fifty percent of the ²⁰⁸Tl anomalies occur in eight Quaternary units; the eight Quaternary units occupy some forty-three percent of the Socorro map area. Most of the anomalies are in the Qps (16), Qal (9), and Qla (5) units which occupy seventeen, thirteen and one percent of the map area, respectively. None of the ²⁰⁸Tl anomalies coincide with "negative" ratio anomalies. Nearly all the anomalies are believed to be the result of lithologic changes within a map unit. Some placer deposits with monazite-rich gravels may exist. Such deposits would most likely be derived from felsic intrusives.

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)
pG	261	101
lPs	313	48
Pa	1564	None
Py	5034	66,91
Pg	855	None
Ps	9154	72
Pm	470	37
J	270	None
Kd	728	None
Ktw	304	53
Kmv	263	None
Tb	979	None
Tv	403	85,121
Ti	275	42
Tva	2860	None
Tvb	2882	None
Tac	812	None
QTs	360	None
QTg	2054	None
Qbm	1052	56
Qt	276	None
Qc	606	62
Qyb	1116	82
Qg	612	53

TABLE 8. Summary of Anomalies

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML1E		Qps,3820-2860;Qfp,3860-3880;	Qps,3930;QTs1,3950,3965-3970,3975,3995-4030;Py,4060-4070;Ps,4090-4115,Tb,4250-4260;Qa1,4720,4770;Py,5020;Ps,5080,5225-5230.
ML1W	Qa1,440-445;QTs1,480-515;Qps,570-610,625-650;Qtg,1280-1300;Qps-1510-1660;	Qps,250-285;Qa1,590,710-715;Tid,320-325;Qps,505-510,535-540,635-640;	
ML2E			
ML2W	Qe,3325;Q1a,3375,3400;pe,4090-4100;Q1a,4220-4230,4240-4250,4280-4300,4310-4345;Qa1,4350-4360;		
ML3E		Pa,3155-3160;	1Pmu,3135-3140;Py,3155;Pa,3160;QTs1,3190-3210;
ML3W	Qa1,080-120;Qps,480-495,515-580;Ti,655-675;Qps,680-705,720-730,1130-1140,1160-1170;QTg,2170-2175;	Qps,525-540,550-555,565-580,675-700,710-715;Ti,640-645,655-660;	
ML4E		Tva,2480-2485;	
ML4W			Tp,4000-4010;
ML5E	Tva,5585;Qa1,5600-5625;	Tva,5585-5590;	Qa1,5500-5510;
ML5W	Qa1,4230-4250;Qps,4250-4300;QTs1,4300-4315;Tp,4335-4350,4360-4375;Tvb,4930;Tvb,5010-5020;Qtg,5020-5030,5260-5265;	Qa1,4230-4240;Qps,4255-4270;QTs1,4295-4320;Tp,4320-4340;Tva,4350;Tvb,4400-4415,4930-4945;	
ML6E	Tva,5860-5875;	Tva,5965-5975;	Tae,5675-5680;
ML6W	QTs1,8430-8440;Tvb,7270;Kcc,7570;Qa1,7850-7870;Tvb,7930-7935;	Qps,7270-7275;	

(TABLE 8. Cont'd.)

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML7E	Qa1,350-370;	Qa1,355-360;	
ML7W	Qps,230-240;Tva,700-710,1160-1170;Qps,1480-1490;	Qps,235-240;Tva,690-710,1225-1230;Tvb,720-725;	
ML8E	Qyf,2920-2940;		
ML8W	Tb,2540-2550;Tva,2670,2670-2680,2830-2840,2855-2870;		Tva,2350;
ML9E		Pa,700-720;QTs1,225-240;	
ML9W	Km,1175	Kg,1230-1235;Kcc,2070-2090,2115-2130,2140-2145;	Qps,400,415,435-450;QTs1,710;Kcc,2070-2100,2015,2190-2195;Tb,2235;
ML10E			
ML10W	p6m,3950;p6c,3890-3910;p6m,3910-3930;	Kcc,2380-2385,2435-2440,2480;	[Qfb,4390;] Kcc,2385,2435,2480,Trc,3610,3630,
ML11E			
ML11W	Qts,615-630;	p6m,465-470;Py,650-660;Km,1240-1245;	
ML12E	Py,2150-2155;		
ML12W			Kcc,2475;Kg,2680;
ML13E			[Qg,4460;]
ML13W		Kcc,1885-1890;	Qps,580,610;1Pm1,715;Trc,910;
ML14E			
ML14W			Qps,3720;
ML15E		Qfp,30-40;	Qe,225;Qfb,025-040;
ML15W		Qa1,5-10;	QTs1,275;Ps,630-650,865;Tae,1740-1745;
ML16E			
ML16W			

(TABLE 8. Cont'd.)

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
ML17E	Qe,300-320;	QTs,5-40	QTs,010-040;
ML17W	Kg,1810;	Tae,1190;J,1330-1335;Kd,1405-1410,1425-1430;	QTs1,080;P,745;
ML18E	1Pmu,1970-1980,2000-2020,2090-2095;		Qfb,2865-2870;
ML18W			Qby,2350-2355;
ML19E	Qps,1275-1280;	1Pmu,885-890;1Pm1,760-765;	1Pmu,880,Qe,270-275;
ML19W	Kcc,1820-1825;Qe,080-090;		Qa1,020;Qe,460;Tae,740,1350-1365;Q1s,1430-1445;
ML20E			[1Pmu,2400] 1Pmu,2670;
ML20W	Trc,3600-3615;Q1s,2720-2730,2750-2760;		QTs,4000-4020;Qa1,4020-4040;
ML21E		1Pmu,1660-1665;	QTg,2260-2270;
ML21W		Q1s,1780-1785;	QTs1,155-170,475;Qa1,1300-1310;Q1s,1960;Qby,2230;
ML22E		1Pmu,1005-1015;	1Ps,525,540-550;Qps,260,370;QTg,380-390;
ML22W	Qby,2720;Qfb,4260;	Trc,3545-3560;	Jes,3540-3560;Trc,3560-3570;Tae,4530;
ML23E	1Pmu,1645-1655;Qa1,345-350;	Qe,80-90;	Qe,60;QTs1,125,150;1Pmu,1230,1240,1360;Qps,1075-1090;
ML23W	Qby,3760;	p6i,4060-4070;	
TL1	Qby,4300-4320;Tvb,6380-6410;Tac,6465-6480	Tvb,6400-6410,6440-6450;	
TL2		Kg,3560-3570;	
TL3	Km,890;Qps,010-040,075-090;	Tva,560-590;Qps,025,075-080;	Tvb,525;Qps,200-220 ;
TL4	Qa1,120-130;Qps,140-160;	QTg,250-270,325-375;	Trc,1355-1360;
TL5		Qps,080-115;Qa1,120-130 Qps,130-160,230-260;	Qa1,1520-1550;Py,1780-1810;Qa11960-1965,1975-1980,Jm,1990-2000;Pb,2030-2040;

(TABLE 8. Cont'd.)

	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
TL6		Qps,225-240,300-330, 460-470;Qa1,715- 730;	Qfb,1525
TL7		Qts1,,4655-4660;Qps, 4660-4675;1Pmu,5015;	1Pmu,5015-5020,5040; Ps,5160,5170,5350-5390;
TL8		Py,2980;	Qa1,3310,3320-3325, 2475;
TL9		Py,8880-8890;Pg,9415- 9425	Ps,9380-9400,9530- 9545
TL10		Ps,5740,6380,6530-6535; Qa1,7030-7050,7075- 7080,7210-7240;	

(....) Denotes Negative Anomaly

TABLE 9. Radioactivity Anomalies per Geologic Map Unit

Geologic Map Unit	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
pEm	2	1	0
pEi	0	1	0
pEc	1	0	0
pE	1	0	0
1Ps	0	0	2
1Pm1	0	2	1
1Pmu	4	4	8 [1]
Pb	0	0	1
Pa	1	1	1
Py	1	3	5
Ps	0	4	10
Pg	0	1	0
Trc	1	1	5
Jes	0	0	1
Jm	0	0	1
J	0	1	0
Kd	0	3	0
Km	2	1	0
Kg	1	2	1
Kcc	2	7	7
Tb	1	0	2
Ti	1	2	0
Tva	7	7	1
Tvb	5	5	1
Tac	1	0	0
Tp	2	1	1
Tid	0	1	0
Tae	0	1	5
QTs1	3	3	12
QTs	1	1	2
QTg	4	2	2
Qps	16	23	12
Q1s	2	1	3
Qyf	1	0	0
Qby	3	0	2
Qg	0	0	0 [1]
Q1a	5	0	0
Qa1	9	11	12
Qfb	1	2	3 [1]
Qe	3	1	4

(....) Denotes Negative Anomaly

TABLE 10. Statistical Summary of Radioactivity Anomalies

Geologic Unit	²⁰⁸ Tl	²¹⁴ Bi	²¹⁴ Bi/ ²⁰⁸ Tl
Quaternary			
No. of Units with Anomalies	8	5	6 [2]
No. of Anomalies	40	38	36 [2]
Quaternary - Tertiary			
No. of Units with Anomalies	3	3	3
No. of Anomalies	8	6	16
Tertiary			
No. of Units with Anomalies	6	6	5
No. of Anomalies	17	17	10
Mesozoic			
No. of Units with Anomalies	4	6	5
No. of Anomalies	6	15	15
Paleozoic			
No. of Units with Anomalies	3	5	7 [1]
No. of Anomalies	6	15	28 [1]
Precambrian			
No. of Units with Anomalies	3	2	0
No. of Anomalies	4	2	0
Total Sample			
No. of Units with Anomalies	27	27	26 [3]
No. of Anomalies	81	92	105 [3]

(....) Denotes Negative Anomaly

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

Forty-two percent of the ^{214}Bi anomalies and thirty-four percent of the "positive" ratio anomalies occur in five and six, respectively, of the Quaternary units; these units occupy some forty to forty-one percent of the Socorro map area. The units Qps (23) and Qal (11) have the greatest number of ^{214}Bi anomalies as well as the greatest number of "positive" ratio anomalies. These two units occupy some seventeen and thirteen percent of the map area, respectively. Only one of the ^{214}Bi anomalies coincides with a ratio anomaly; the occurrence is in the Qfb unit - modern floodplain deposits, at ML15E, stations 30-40. Most of the anomalies are thought to be associated with intra-unit changes in lithology; some may be epigenetically concentrated uranyl ions from either ground water or from evaporation sinks.

Quaternary-Tertiary Geologic Units: QTsl,QTs,Qtg

^{208}Tl Anomalies

Ten percent of the ^{208}Tl anomalies occur in three Quaternary-Tertiary units; these units occupy some seven percent of the Socorro map area. The anomalies are fairly evenly distributed according to the area extent of each unit. None of the anomalies coincide with "negative" $^{214}\text{Bi}/^{208}\text{Tl}$ anomalies. They are mainly associated with intra-unit changes in lithology.

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

Approximately seven percent of the ^{214}Bi and fifteen percent of the "positive" ratio anomalies occur in the three Quaternary-Tertiary units, which cover some seven percent of the Socorro map area. One of the ^{214}Bi anomalies coincides with a ratio anomaly; the coincidence occurs in the QTs unit at ML17E, stations 10-40. The anomaly may be associated with uranyl ion precipitation, either from ground water or surface water.

Tertiary Geologic Units: Tb,Ti,Tva,Tvb,Tac,Tp,Tid,Tae

^{208}Tl Anomalies

Twenty-one percent of the ^{208}Tl anomalies occur in six Tertiary units, which occupy some eight percent of the Socorro map area. The ^{208}Tl anomalies are largely concentrated in the Tva (7) and Tvb (5) units, which occupy some five percent of the map area. Both the Tva and Tvb units contain a variety of volcanic lithologies, and it is the intra-unit changes in lithology that are responsible for the ^{208}Tl anomalies.

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

Approximately eighteen percent of the ^{214}Bi anomalies and ten percent of the "positive" ratio anomalies occur in six and five, respectively, of the Tertiary units; these units occupy some nine percent of the Socorro map area. None of the ^{214}Bi anomalies coincide with "positive" ratio anomalies. Some of the ^{214}Bi anomalies may be associated with vein formations, mineralization in faulted, fractured and brecciated areas, or with supergenetically formed precipitates in the Tb unit.

Mesozoic Geologic Units: Trc,Jes,Jm,J,Kd,Km,Kg,Kcc

^{208}Tl Anomalies

Approximately seven percent of the ^{208}Tl anomalies occur in four Mesozoic units: Trc (1), Km (2), Kg (1), and Kcc (2); these four units occupy some ten percent of the Socorro map area. None of the ^{208}Tl anomalies coincide with ratio anomalies. They are not considered to be significant.

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

Approximately sixteen percent of the ^{214}Bi anomalies and fourteen percent of the positive ratio anomalies occur in six and five, respectively, of the Mesozoic units. These Mesozoic units occupy some eleven and nine percent, respectively, of the Socorro map area. Most of the ^{214}Bi anomalies occur in the Kcc unit (7); whereas, most of the "positive" ratio anomalies occur in the Kcc (7) and Trc (5) units. Four ^{214}Bi anomalies coincide with ratio anomalies. These coincidences are for the Kcc unit (3) at: ML9W, stations 2070-2090; ML10W, stations 2380-2385; ML10W, station 2435; and for the Trc unit (1) at ML22W, station 3560. These may well be supergenetically formed mineral deposits from ground water precipitated in pore spaces in the sandstone units.

Paleozoic Geologic Units: 1Ps,1Pml,1Pmu,Pb,Pa,Py,Ps,Pg

^{208}Tl Anomalies

Seven percent of the ^{208}Tl anomalies occur in three Paleozoic units; these units occupy some nine percent of the map area. Most of the ^{208}Tl anomalies occur in the 1Pmu unit (4), which occupies some three percent of the Socorro map area. None of the ^{208}Tl anomalies coincide with "negative" ratio anomalies. Most are associated with intra-unit changes in lithology.

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

Fifteen percent of the ^{214}Bi anomalies and twenty-seven percent of the "positive" ratio anomalies occur in six and seven, respectively, of the Paleozoic units. The Paleozoic units occupy some seventeen to eighteen percent of the Socorro map area. The Ps (4), Py (3) and 1Pmu (4) units have the highest aggregates of ^{214}Bi anomalies, as well as the highest aggregates for the $^{214}\text{Bi}/^{208}\text{Tl}$ anomalies. Coincidences of ^{214}Bi with "positive" ratio anomalies occur for the 1Pmu unit at TL7, stations 5015, for the Pa unit at ML3E, stations 3155-3160. These may well represent either hypogenetically or supergenetically formed deposits.

Precambrian Geologic Units: p6m,p6i,p6c,p6

^{208}Tl Anomalies

Five percent of the ^{208}Tl anomalies occur in three Precambrian units; p6m (2), p6c (1), p6 (1). The three units cover some one to two percent of the Socorro map area. None of the anomalies coincide with "negative" ratio anomalies, and most probably represent intra-unit changes in lithology.

^{214}Bi and $^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

None of the ratio anomalies and only two percent of the ^{214}Bi anomalies occur in the Precambrian units. The two ^{214}Bi anomalies are not considered to be particularly significant.

Relationship of Radioactivity Anomalies to Known Occurrences of Radioactive Minerals

Catron County

^{214}Bi anomalies in the Kcc unit on ML9W, stations 2070-2150, and ML10W, stations 2370-2480, are in the vicinity of the uranium deposits of the Red Basin area (Chenoweth, 1976). The ^{214}Bi anomalies on ML9W may be associated with the Baca Formation, which crops-out immediately to the south of the Kcc unit. It is of interest to note that the anomalies on ML9W, stations 2070-2090, and on ML10W, stations 2380-2385 and 2435, do coincide with "positive" ratio anomalies.

Socorro County

^{214}Bi anomalies on ML7W, stations 690-725, in the Tva and Tvb units, and on ML9W, stations 1230-1235, in the Kg unit, are in the Hook Ranch area (Chenoweth, 1976), where uranium mineralization is known to occur in the Mesaverde Group (Kmv) and the Baca Formation (Tb).

^{214}Bi anomalies on ML1W, ML5W, and ML7W, between TL5 and TL6, are in an area of uranium mineralization associated with veins in fault-controlled deposits on the western flank of the Rio Grande Trough (Chenoweth, 1976). The geologic units in this area vary in age from Precambrian to Quaternary.

Relationship of Radioactivity Anomalies to Cultural Features

^{208}Tl Anomalies

Immediately to the east of the town of Magdalena, on ML3W, stations 645-730, there are extensive ^{208}Tl anomalies.

^{214}Bi Anomalies

Extensive ^{214}Bi anomalies occur to the east of the town of Magdalena on ML3W, stations 635-725, and to the south of the town of Socorro on ML1E, ML1W, and TL6. An anomaly on ML15E, stations 030-040, is immediately to the south of the town of Belen.

$^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

A ratio anomaly on ML15E, stations 030-040, is situated immediately south of the town of Belen. Ratio anomalies on ML20W, stations 4000-4040, and TL5, stations 1775-1810, are close to the small settlement of Garcia, a railroad track, and a major highway.

Trends

^{208}Tl Anomalies

The distribution of ^{208}Tl anomalies is very uneven throughout the area of the Socorro map sheet. Large portions of the map are devoid of ^{208}Tl anomalies; e.g., the southeastern quadrant, and most of the northeastern quadrant. Three major clusters of ^{208}Tl anomalies appear in the southcentral portion of the map area, between TL5 and TL6 and south of ML9, there is a group of ^{208}Tl anomalies associated with the western flank of the Rio Grande Trough, the Sierra Landrones, and the basin area to the west of Socorro Peak. A second cluster of ^{208}Tl anomalies occurs in the northern Magdalena Mountains, and in the Bear Mountains between TL4 and TL5 and south of ML8W. A smaller cluster occurs in a basin area to the south of the Gallinas Mountains, in the vicinity of TL3 and south of ML3W.

^{214}Bi Anomalies

The ^{214}Bi anomalies are unevenly distributed throughout the map sheet area. Most of the ^{214}Bi anomalies are concentrated between TL4 and TL7, to the south of ML10. Two major clusters are discernible. One cluster is in the vicinity of TL6, to the south of ML6, and corresponds with the western flank of the Rio Grande Trough. The second lies between TL4 and TL5 to the south of ML4, in the northern and western peripheral area of the Magdalena Mountains.

$^{214}\text{Bi}/^{208}\text{Tl}$ Anomalies

As is the situation with the ^{214}Bi and with the ^{208}Tl characters, the ratio anomalies are also unevenly distributed throughout the map sheet area. Several clusters of ratio anomalies are apparent. The westernmost cluster in the vicinity of TL1, between ML7W and ML10W, coincides with the Red Basin area, and in particular with the Kcc and Tb units. In the northcentral portion of the map area, in the vicinity of TL5, to the north of ML19W, a cluster of ratio anomalies coincides with the Mesa Lucero and Mesa Redonda areas. To the south, between TL4 and TL5, and between ML12W and ML15W, a group of ratio anomalies occurs in the vicinity of the Sierra Lucero and its adjacent basins. Between TL6 and TL7, to the south of ML6E, there are a group of anomalies associated with the eastern flank of the Rio Grande Trough, and the arroyo dissected land to the east. The final cluster is in the northeastern quadrant, in the vicinity of TL8, to the north ML21; this area includes the western flank of the Monzano Mountains, and part of the basin area to the west.

3. Summary and Recommendations

Fifty percent of the ^{208}Tl anomalies and forty-two percent of the ^{214}Bi anomalies occur in Quaternary units. The Quaternary units occupy greater than forty percent of the map sheet area. Most of the ^{208}Tl anomalies, and many of the ^{214}Bi anomalies, are thought to be the result of intra-unit changes in geology. None of the ^{208}Tl anomalies coincide with ratio anomalies; only one of the ^{214}Bi anomalies, in the Quaternary units, coincides with a ratio anomaly.

The distribution of the ^{208}Tl and ^{214}Bi anomalies is very uneven. Large portions of the Socorro map sheet area are devoid of anomalies. Clusters of ^{208}Tl anomalies occur to the west of the Rio Grande Trough in the Socorro Peak area, in the northern Magdalena Mountains, in the Bear Mountains, and south of the Gallinas Mountains. Clusterings of ^{214}Bi anomalies occur to the west of the Rio Grande Trough, in the Socorro Peak latitudes, and in the northern and western peripheral areas of the Magdalena Mountains.

^{214}Bi anomalies coincide with areas of known uranium mineralization in the Red Basin area (Chenoweth, 1976); the anomalies exist over the Kcc unit, but may be associated with the neighboring Baca Formation. These ^{214}Bi anomalies also coincide with ratio anomalies.

^{214}Bi anomalies coincide with two areas of known uranium mineralization in Socorro County: (i) the Hook Ranch area (Chenoweth, 1976), and (ii) on the western flank of the Rio Grande Trough. The mineralization in the Hook Ranch area tends to be supergenetically-formed in sedimentary units of Cretaceous and Oligocene age; whereas, the mineralization west of the Rio Grande Trough is usually hypogenetically-formed in rocks varying in age from Precambrian to Quaternary.

APPENDIX I

FREQUENCY DISTRIBUTION OF RADIATION DATA

AS A FUNCTION OF GEOLOGIC UNIT

T _L		B _I		K		B _I /T _L		B _I /K		T _L /K		NO. EVENTS	GEOL. UNIT
σ	̄	σ	̄	σ	̄	σ	̄	σ	̄	σ	̄		
25.0983	72.8	38.5214	133.5	118.5653	270.5	0.9720	2.0515	0.3943	0.6064	0.0910	0.2981	91.0	LP
12.6615	52.1	25.7002	133.3	67.3965	175.8	0.7404	2.6882	0.6776	0.9755	0.1337	0.3426	38.0	LPM
7.8280	26.3	20.8585	97.7	21.1125	55.2	1.4051	4.0097	1.0823	2.0658	0.1613	0.5131	547.0	LPML
12.5142	40.8	26.9901	121.2	34.4507	90.4	1.1173	3.1997	0.6708	1.5180	0.1134	0.4741	3671.0	IPMU
14.2630	35.0	28.0147	98.0	54.1620	88.9	1.4233	3.1893	0.9861	1.5223	0.1578	0.4569	313.0	LPS
7.4374	31.6	24.5320	66.6	17.9449	82.5	0.7755	2.1601	0.3176	0.8299	0.0824	0.3887	270.0	J
5.3936	23.9	19.9477	64.3	17.4443	104.4	0.9741	2.7840	0.2246	0.6335	0.0687	0.2348	242.0	JBZ
6.9153	25.0	33.8427	91.6	21.1211	101.4	1.7432	3.8962	0.5297	0.9842	0.0880	0.2573	158.0	JES
8.4884	34.0	30.4120	104.0	15.5273	87.5	1.2902	3.2057	0.4056	1.2265	0.0959	0.3962	92.0	JM
3.1897	21.9	10.5450	38.6	16.1796	100.0	0.5604	1.8069	0.1137	0.3938	0.0581	0.2252	42.0	JMB
10.4366	36.7	37.3378	76.3	43.7511	124.4	0.6795	1.9588	0.1780	0.5803	0.0567	0.3094	34.0	JZ
10.0985	54.0	28.7852	116.7	27.8331	139.9	0.5653	2.2005	0.2794	0.8684	0.1031	0.4001	5118.0	KCC
12.0488	40.3	33.6362	89.9	32.7095	106.7	0.7600	2.2634	0.4107	0.8886	0.1328	0.3946	728.0	KD
3.3615	34.5	9.0554	90.0	10.2940	170.2	0.2207	2.6050	0.0688	0.5300	0.0234	0.2033	6.0	KDP
10.7575	55.0	25.7096	110.4	22.4325	142.3	0.5166	2.0512	0.2218	0.7955	0.0805	0.3924	2143.0	KG
10.6445	51.6	28.1492	107.1	33.9364	130.3	0.7163	2.1293	0.3383	0.8707	0.1107	0.4153	1830.0	KM
14.3036	54.7	22.0529	122.6	40.9987	161.3	0.9063	2.4378	0.2527	0.8109	0.0923	0.3475	263.0	KMV
6.0054	51.8	19.5832	106.8	30.3344	133.5	0.5094	2.1008	0.2757	0.8521	0.0973	0.4058	24.0	KTH
8.2389	41.8	29.9707	86.6	25.6480	110.5	0.6201	2.0824	0.2653	0.7998	0.0797	0.3882	304.0	KTW
16.1943	51.7	34.2090	112.6	61.3155	102.9	0.8727	2.3003	0.6193	1.2888	0.1699	0.5580	1564.0	PA
22.8331	55.8	29.4234	116.4	68.6662	117.4	1.0523	2.3516	0.5772	1.2168	0.1490	0.5214	184.0	PH
43.7002	103.8	64.3682	180.0	94.1063	291.9	0.5803	1.8417	0.2893	0.6515	0.1045	0.3631	261.0	PE
22.5463	74.7	66.5236	158.8	72.3069	195.7	0.4728	2.0784	0.3483	0.8631	0.1340	0.4115	110.0	PEC
16.8039	88.9	73.1332	173.0	49.6693	282.6	0.6923	1.9452	0.2567	0.6271	0.0390	0.3173	94.0	PEGP
22.6065	120.4	36.4661	225.0	40.1403	304.3	0.2302	1.8903	0.0942	0.7418	0.0533	0.3951	156.0	PET
27.1978	106.4	40.6088	223.0	56.2311	270.8	0.3825	2.1675	0.1534	0.8382	0.0943	0.3961	77.0	PETI
14.6287	109.0	16.4435	117.2	29.1247	339.2	0.2123	1.0924	0.0551	0.3476	0.0338	0.3212	25.0	PELP
23.4007	50.8	46.2637	114.8	74.9539	141.2	1.0611	2.4694	0.6261	0.9781	0.1301	0.3952	1313.0	PEM
7.0142	60.8	21.4508	174.7	18.2184	192.1	0.3969	2.8930	0.1362	0.9161	0.0388	0.3177	44.0	PEML
16.0324	54.8	30.4693	136.4	48.8449	159.0	0.9262	2.6849	0.5050	0.9771	0.0806	0.3604	194.0	PEO
9.0516	26.0	20.4405	58.6	34.6871	90.0	1.1816	2.4848	0.4601	0.7742	0.1010	0.3107	855.0	PG
19.3264	29.1	24.8983	106.2	55.1685	62.2	1.4674	4.3093	1.1858	2.3801	0.1747	0.5402	470.0	PM
17.4872	38.4	30.3944	87.3	54.6767	116.9	1.1365	2.5508	0.5502	0.9056	0.1015	0.3477	9154.0	PS
6.6541	20.6	16.7301	96.6	32.0195	64.3	1.4055	5.0348	1.5827	2.0958	0.2148	0.3973	33.0	PSC
13.7625	36.6	30.3793	84.2	41.4151	114.9	1.1149	2.4963	0.4209	0.8129	0.0936	0.3291	5034.0	PY
16.2368	44.8	39.9588	104.9	52.4790	145.4	0.9893	2.5007	0.5692	0.7977	0.1135	0.3213	14667.0	QAL
7.5892	42.9	25.5035	104.8	25.7867	137.9	0.7170	2.4973	0.2143	0.7789	0.0620	0.3178	1052.0	QAM
8.6094	53.2	24.9115	105.4	32.4088	102.5	0.3846	1.9892	0.2812	1.0820	0.1153	0.5490	40.0	QBO
15.2323	25.3	31.8840	40.7	40.1247	71.1	0.9703	1.6653	0.4899	0.5904	0.0898	0.3610	1404.0	QBY
10.5983	46.6	28.5320	103.2	42.9258	144.3	0.8060	2.3018	0.2959	0.7738	0.1141	0.3483	606.0	QC
8.4395	36.2	34.1137	88.1	32.3917	165.5	1.0335	2.4997	0.2747	0.5681	0.0605	0.2247	3322.0	QE
6.9571	38.7	42.0535	98.8	12.3212	167.4	0.8739	2.5362	0.2781	0.5990	0.0555	0.2334	61.0	QEA
5.9963	38.6	23.8773	104.4	15.0478	166.1	0.6710	2.7467	0.1664	0.6367	0.0404	0.2341	729.0	QES
12.1137	48.5	34.3696	124.9	36.6573	126.6	0.7405	2.6607	0.2475	0.7923	0.0724	0.3036	3928.0	QFP
8.2847	41.3	28.1184	110.2	18.8569	162.4	0.7206	2.7281	0.2795	0.8942	0.0541	0.3278	612.0	QG
9.2854	41.3	41.9737	108.6	34.7969	146.3	1.0539	2.6680	0.3799	0.8084	0.0681	0.2917	1375.0	QLA
9.7845	41.2	32.1351	90.8	32.6895	111.9	0.8113	2.2471	0.3722	0.8591	0.1019	0.3860	2445.0	QLS
21.7077	55.9	47.3285	115.1	73.0422	189.8	0.8149	2.1616	0.3327	0.6700	0.0810	0.3064	18385.0	QPS
5.2491	57.4	8.4979	131.3	6.5846	146.8	0.3060	2.3088	0.0692	0.8963	0.0417	0.3912	8.0	QS
7.0872	41.6	29.3906	92.2	34.1806	154.2	0.8420	2.2805	0.2060	0.6179	0.0840	0.2943	276.0	QT
18.8487	62.3	40.0697	100.4	49.0208	210.8	0.6417	1.6597	0.2233	0.4982	0.0585	0.2871	2054.0	QTG
12.6965	35.5	37.5883	101.0	49.1769	108.4	1.7653	3.2383	0.8255	1.1981	0.0926	0.3542	360.0	QTS
15.0494	42.3	33.0884	109.7	48.0343	160.1	0.9102	2.7429	0.3077	0.7372	0.0696	0.2718	5536.0	QTSI
14.7107	55.8	38.3004	136.7	51.3640	164.7	0.7892	2.5645	0.3078	0.8917	0.0636	0.3490	1116.0	QYF
34.5044	89.6	81.9925	170.7	70.3744	255.3	0.5020	1.8908	0.3093	0.6830	0.1128	0.3556	812.0	TAC
13.6852	50.1	24.7548	113.0	52.0671	147.3	0.5371	2.3342	0.2852	0.8460	0.0811	0.3591	96.0	TAD
9.3172	44.3	26.5229	89.5	47.9342	121.3	0.6151	2.0640	0.2511	0.7779	0.0768	0.2822	2440.0	TAE
13.0927	46.1	32.5156	82.3	32.5793	184.8	0.7593	1.8574	0.1926	0.4561	0.0541	0.2501	979.0	TB
81.8242	83.9	101.5901	139.1	102.9568	186.2	0.6458	1.9013	0.2768	0.7229	0.1540	0.3945	275.0	TI
18.1788	56.6	49.5872	128.1	85.3997	290.8	0.6122	2.3023	0.1091	0.4411	0.0401	0.1966	169.0	TID
3.6565	29.7	22.2072	119.7	11.6819	110.1	1.1446	4.1336	0.2976	1.1145	0.0415	0.2718	22.0	TIF
7.3808	41.9	51.8189	117.3	29.3610	440.7	0.2431	2.8157	0.0241	0.2657	0.0134	0.0943	7.0	TMC
20.3976	73.4	51.9696	139.0	114.4734	280.5	0.6930	1.9531	0.2634	0.5413	0.0767	0.2807	1477.0	TP
11.5793	43.7	37.5827	103.9	35.5391	98.2	1.5950	2.5516	0.5981	1.1581	0.1444	0.4768	1709.0	TRC
8.4339	34.5	20.9788	81.5	28.2668	90.1	0.6913	2.4512	0.3120	0.9659	0.0745	0.3965	92.0	TS
27.0896	92.9	46.6874	162.9	141.9266	306.9	0.5490	1.8270	0.2413	0.6048	0.0875	0.3310	403.0	TV
21.2489	44.4	40.3252	65.0	52.9718	172.2	0.6825	1.4920	0.2654	0.3914	0.0820	0.2566	2860.0	TVA
25.7038	84.4	47.9806	117.7	62.2486	252.4	0.4592	1.4130	0.1943	0.4739	0.0739	0.3347	2882.0	TVB
26.2464	85.3	45.9624	166.9	86.9300	317.6	0.8218	2.1288	0.2060	0.5552	0.0852	0.2822	92.0	TVC

AI-1 Summary of Average and Standard Deviation Values for the NTMS as a Function of Geologic Unit

A1

A2

A7

A8

A13

A14

SOCORRO

SOCORRO

A 17

A 18

A21

A22

NO. OF EVENTS

R23

R24

A25

A26

SOCORRO

SOCORRO

R 35

R 36

A 47

A 48

A49

A50

A55

A56

A57

A58

A59

A60

A61

A62

A63

A64

R67

R68

SOCORRO

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

Line Number	Character Number
1234567890123456789012345678901234567890123456789012	
11	4 I1 AERIAL SYSTEM IDENTIFICATION CODE
12	5 A20 AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
13	6 I3 BFEC CALIBRATION REPORT NUMBER
14	7 F6.3 4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
15	
16	8 F6.3 2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
17	
18	9 I3 NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
19	10 I3 NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
20	11 I3 NUMBER OF FLIGHT LINES ON THIS TAPE
21	12 I4 FIRST FLIGHT LINE NUMBER ON THIS TAPE
22	13 I6 FIRST RECORD NUMBER OF FIRST FLIGHT LINE
23	14 I3 JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE WAS COLLECTED
24	
25	15-17 I4,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 I4 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
17	
18	8 F6.1 IN CPS PER PERCENT K FOR FIRST SYSTEM
19	
20	9 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE
21	
22	9 F6.1 IN CPS PER PPM EQUIVALENT U
23	
24	9 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
25	
26	10 I6 IN CPS PER PPM EQUIVALENT TH
27	
28	11 F6.3 BLANK FIELD (999999)
29	
30	12 F6.3 4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
31	
32	13 F6.3 2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
33	
34	13 I3 NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
35	
36	14 I3 NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM
37	
38	15-24 (SAME) REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
39	
40	* * *
41	* * *
42	* * *
43	
44	85-94 (SAME) REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
45	
46	95 I3 NUMBER OF FLIGHT LINES ON THIS TAPE
47	
48	96 I4 FIRST FLIGHT LINE NUMBER ON THIS TAPE
49	
50	97 I6 FIRST RECORD NUMBER OF FIRST FLIGHT LINE
51	
52	98 I3 JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
53	
54	99-101 I4,I6,I3 REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
55	
56	* * *
57	* * *
58	* * *
59	
390-392	I4,I6,I3 REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS TAPE
	FORMAT FOR SINGLE RECORD REDUCED DATA RECORD (THIRD THRU LAST BLOCK)
	ITEM FORMAT DESCRIPTION
	1 I1 AERIAL SYSTEM IDENTIFICATION CODE
	2 I4 FLIGHT LINE NUMBER
	3 I6 RECORD IDENTIFICATION NUMBER
	4 I6 GMT TIME OF DAY (HHMMSS)
	5 F8.4 LATITUDE TO FOUR DECIMAL PLACES IN DEGREES

Line Number	Character Number
1234567890123456789012345678901234567890123456789012	
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	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		
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 I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
31		
32	14 I3	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 I3	NUMBER OF FLIGHT LINES ON THIS TAPE
40	96 I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
41	97 I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42	98 I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS COLLECTED
43		
44	99-101 I4,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 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	1234567890123456789012345678901234567890123456789012	
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		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		

Line Number 12345678901234567890123456789012345678901234567890123456789012

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 12345678901234567890123456789012345678901234567890123456789012

1 05 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)
2
3 STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)
4
5 FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6
7 ITEM FORMAT DESCRIPTION
8 1 A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9 2 A20 NAME OF SUBCONTRACTOR
10 3 I4 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11 4 I6 NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS

Line Number 12345678901234567890123456789012345678901234567890123456789012

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

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

T₂
Rank
Bi
Rank
K
Rank
Bi/T₂
Rank
Bi/K
Rank
T₂/K
Rank

DESCRIPTION

T₂ value, c/s
T₂ standard deviation rank
Bi value, c/s
Bi standard deviation rank
K value, c/s
K standard deviation rank
Ratio value
Bi/T₂ standard deviation rank
Ratio value
Bi/K standard deviation rank
Ratio value
T₂/K standard deviation rank

1 GEODATA INT. INC. SINGLE REC LISTING SOCORRO

TIE LINE 1

REC	LAT	LONG	RMAG	ALT	GEOUNT	A	K	U	T	COS	BIAIR	GC	TL	BI	K	BI:TL	BI:K	TL:K	TEMP	BP
4161	35.0081	107.9391	186.3	391	ZNA	0	0	0	0	119	41.9	1280	27	69	105	2.556	0.657	0.257	6.9	21.07
4162	35.0081	107.9391	187.8	484	ZNA	0	0	0	0	127	44.1	1880	40	85	112	2.125	0.759	0.357	6.9	21.37
4163	35.0081	107.9391	182.8	450	ZNA	0	0	0	0	123	43.3	1794	37	64	121	1.730	0.529	0.306	6.9	21.38
4164	35.0077	107.9391	185.3	428	ZNA	0	0	0	0	125	42.8	1815	35	82	122	2.343	0.672	0.287	6.9	21.38
4165	35.0070	107.9391	185.4	415	ZNA	0	0	0	0	113	42.5	1763	50	28	116	0.560	0.241	0.431	6.9	21.39
4166	35.0066	107.9391	183.2	412	ZNA	0	0	0	0	124	42.4	1864	50	85	105	1.700	0.810	0.476	6.9	21.39
4167	35.0063	107.9391	181.8	409	ZNA	0	0	0	0	118	42.3	1962	40	92	121	2.300	0.760	0.331	6.9	21.39
4168	35.0059	107.9391	177.5	409	ZNA	0	0	0	0	120	42.3	1854	37	105	95	2.838	1.105	0.389	6.9	21.40
4169	35.0056	107.9391	174.9	428	ZNA	0	0	0	0	103	42.8	1968	47	111	125	2.362	0.888	0.376	6.9	21.40
4170	35.0052	107.9391	171.7	448	ZNA	0	0	0	0	121	43.3	2046	50	119	90	2.380	1.322	0.556	6.9	21.41
4171	35.0049	107.9391	166.3	460	ZNA	0	0	0	0	117	43.6	2076	45	34	186	0.756	0.183	0.242	6.9	21.41
4172	35.0045	107.9391	164.2	460	ZNA	0	0	1	0	116	43.6	2117	84	15	151	0.179	0.099	0.556	6.9	21.42
4173	35.0041	107.9391	161.3	451	ZNA	0	0	0	0	124	43.4	2130	75	49	118	0.653	0.415	0.636	6.9	21.42
4174	35.0038	107.9391	158.9	427	ZNA	0	0	0	0	112	42.8	2095	48	104	130	2.167	0.800	0.369	6.9	21.44
4175	35.0034	107.9391	157.2	403	ZNA	0	0	0	0	109	42.2	2012	68	37	138	0.544	0.268	0.493	6.9	21.45
4176	35.0031	107.9391	154.6	382	ZNA	0	0	0	0	123	41.7	1899	49	101	108	2.061	0.935	0.454	6.9	21.45
4177	35.0027	107.9391	150.7	366	ZNA	0	0	0	0	114	41.3	2021	49	98	162	2.000	0.605	0.302	6.9	21.46
4178	35.0024	107.9391	147.1	355	PA	0	0	0	0	124	41.0	2030	49	111	120	2.265	0.925	0.408	6.9	21.47
4179	35.0020	107.9392	143.8	353	PA	0	0	0	0	130	40.9	1976	49	95	111	1.939	0.856	0.441	6.9	21.48
4180	35.0016	107.9392	138.6	365	PA	0	0	0	0	112	41.2	1980	57	76	143	1.333	0.531	0.399	6.9	21.49
4181	35.0013	107.9392	137.7	380	PA	0	0	0	0	117	41.6	2031	48	67	137	1.396	0.489	0.350	6.9	21.49
4182	35.0009	107.9392	134.8	392	PA	0	0	0	0	118	41.9	2024	56	88	108	1.571	0.815	0.519	6.9	21.50
4183	35.0006	107.9392	131.0	388	PA	0	0	0	0	120	41.8	2094	50	72	132	1.440	0.545	0.379	6.9	21.51
4184	35.0002	107.9392	126.4	366	PA	0	0	0	0	110	41.3	1967	45	115	115	2.556	1.000	0.391	6.9	21.52
4185	34.9999	107.9392	124.1	347	QBY	0	0	0	0	109	40.8	1985	57	113	99	1.982	1.141	0.576	6.9	21.53
4186	34.9995	107.9392	121.3	338	QBY	0	0	0	0	122	40.5	1977	56	74	136	1.321	0.544	0.412	6.9	21.54
4187	34.9992	107.9392	118.9	345	QBY	0	0	0	0	119	40.7	1996	52	49	157	0.942	0.312	0.331	6.9	21.55
4188	34.9988	107.9392	114.8	361	QBY	0	0	0	0	115	41.1	2025	50	110	107	2.200	1.028	0.467	6.9	21.56
4189	34.9984	107.9392	111.9	367	QBY	0	0	1	0	118	41.3	1982	62	6	144	0.097	0.042	0.431	6.9	21.57
4190	34.9981	107.9392	109.4	363	QBY	0	0	0	0	116	41.2	1995	52	103	119	1.981	0.866	0.437	6.9	21.58
4191	34.9977	107.9392	106.2	354	QBY	0	0	0	0	127	41.0	1973	46	79	123	1.717	0.642	0.374	6.9	21.59
4192	34.9974	107.9392	103.5	344	QBY	0	0	0	0	122	40.7	1926	47	98	130	2.085	0.754	0.362	6.9	21.60
4193	34.9970	107.9392	101.0	347	QBY	0	0	0	0	111	40.8	2011	56	109	120	1.946	0.908	0.467	6.9	21.61
4194	34.9967	107.9392	98.4	363	QBY	0	0	0	0	105	41.2	2033	55	92	128	1.673	0.719	0.430	7.0	21.63
4195	34.9963	107.9392	95.7	386	QBY	0	0	0	0	120	41.8	1996	62	60	138	0.968	0.435	0.449	7.0	21.64
4196	34.9959	107.9392	93.5	409	QBY	0	0	0	0	108	42.3	2171	57	108	130	1.895	0.831	0.438	7.0	21.65
4197	34.9956	107.9392	90.7	416	QBY	0	0	0	0	124	42.5	2089	48	91	119	1.896	0.765	0.403	7.0	21.67
4198	34.9952	107.9392	89.3	405	QBY	0	0	0	0	118	42.2	2167	48	81	181	1.688	0.448	0.265	7.0	21.68
4199	34.9949	107.9392	86.7	392	QBY	0	0	0	0	116	32.7	2120	38	145	123	3.816	1.179	0.309	7.0	21.69
4200	34.9945	107.9392	84.4	379	QBY	0	0	0	0	111	32.4	2148	40	133	158	3.325	0.842	0.253	7.0	21.71
4201	34.9942	107.9392	81.1	368	QBY	0	0	0	0	121	32.2	2085	47	148	127	3.149	1.165	0.370	7.0	21.72
4202	34.9938	107.9392	79.2	360	QBY	0	0	0	0	116	32.0	2178	36	185	162	5.139	1.142	0.222	7.0	21.73
4203	34.9935	107.9392	74.8	358	QBY	0	0	0	0	113	32.0	2179	46	141	157	3.065	0.898	0.293	7.0	21.73
4204	34.9931	107.9392	72.2	354	QBY	0	0	0	0	116	31.9	2210	55	124	174	2.255	0.713	0.316	7.0	21.74
4205	34.9927	107.9392	70.0	351	QBY	0	0	0	0	100	31.9	2213	72	93	152	1.292	0.612	0.474	7.0	21.74
4206	34.9924	107.9392	68.2	348	QBY	0	0	0	0	114	31.8	2269	70	109	153	1.557	0.712	0.458	7.0	21.75
4207	34.9920	107.9392	64.7	346	QBY	0	0	0	0	111	31.8	2296	77	93	146	1.208	0.637	0.527	7.0	21.76
4208	34.9917	107.9392	63.6	347	QBY	0	0	0	0	106	31.8	2300	65	132	174	2.031	0.759	0.374	7.0	21.76
4209	34.9913	107.9392	61.7	346	QBY	0	0	0	0	110	31.8	2346	54	93	223	1.722	0.417	0.242	7.0	21.76
4210	34.9910	107.9392	58.5	348	PCI	0	0	0	0	103	31.8	2512	81	131	185	1.617	0.708	0.438	7.0	21.76
4211	34.9906	107.9392	54.5	349	PCI	0	0	0	0	119	31.8	2693	58	202	205	3.483	0.985	0.283	7.0	21.76
4212	34.9902	107.9392	52.8	350	PCI	0	0	0	0	108	31.8	2890	94	99	271	1.053	0.365	0.347	7.0	21.77
4213	34.9899	107.9392	51.4	345	PCI	0	0	0	0	111	31.7	2905	87	161	247	1.851	0.652	0.352	7.1	21.77
4214	34.9895	107.9392	49.7	344	PCI	0	0	0	0	111	31.7	3040	87	217	219	2.494	0.991	0.397	7.1	21.77
4215	34.9892	107.9392	47.2	346	PCI	0	0	0	0	113	31.8	2984	78	180	278	2.308	0.647	0.281	7.1	21.76
4216	34.9888	107.9392	46.2	349	PCI	0	0	0	0	113	31.8	3061	103	152	251	1.476	0.606	0.410	7.1	21.76
4217	34.9885	107.9392	41.5	352	PCI	0	0	0	0	110	31.9	3156	106	217	251	2.047	0.865	0.422	7.1	21.76
4218	34.9881	107.9393	38.0	355	PCI	0	0	0	0	118	26.9	3203	82	193	278	2.354	0.694	0.295	7.1	21.76
4219	34.9878	107.9393	34.7	355	PCI	0	0	0	0	111	27.0	3307	102	176	283	1.725	0.622	0.360	7.1	21.76
4220	34.9874	107.9393	33.0	361	QBY	0	0	0	0	117	27.1	3324	111	127	323	1.144	0.393	0.344	7.1	21.76
4221	34.9870	107.9393	31.4	361	QBY	0	0	0	0	107	27.1	3320	99	168	337	1.697	0.499	0.294	7.1	21.75

AII-15

1 GEODATA INT. INC. AVERAGE REC LISTING SOCORRO

TIE LINE 1

RCN	GEO UNIT	A	K	U	T	LONG	BI/TL RANK	LAT	BI/K RANK	RMAG	TL/K RANK	COS	BIAIR	GC
4161	ZNA	0	0	0	0	107.9391	2.556-0	35.0081	0.600-0	186.3	0.235-0	119	41.9	1280
4162	ZNA	0	0	0	0	107.9391	2.125-0	35.0081	0.697-0	187.8	0.328+0	127	44.1	1880
4163	ZNA	0	0	0	0	107.9391	1.730-0	35.0081	0.489-0	182.8	0.282-0	123	43.3	1794
4164	ZNA	0	0	0	0	107.9391	1.705-0	35.0077	0.547-0	185.3	0.321+0	125	42.8	1815
4165	ZNA	0	0	0	0	107.9391	1.625-0	35.0070	0.559-0	185.4	0.344+0	113	42.5	1763
4166	ZNA	0	0	0	0	10								

APPENDIX III
PRODUCTION SUMMARY

APPENDIX III

PRODUCTION SUMMARY - SURVEY TIME PERIOD

ML/TL	DATE FLOWN	SURVEY LINE MILES	AVERAGE SPEED/DAY	AVERAGE ALTITUDE/DAY
ML1-6W	January 29, '78	341	106	423
ML7-8W,7-12E	January 30, '78	455	114	435
ML9-16W	February 1, '78	455	114	413
ML17-22W,21-22E,T16,7N	February 2, '78	558	114	405
ML(13-20,23)E				*
6E;TL5	February 3, '78	638	112	403
ML4-5E	February 7, '78	114	114	393
ML2-3E	February 9, '78	114	114	410
TL1-4;ML23W	February 10, '78	333	105	421
ML1E;TL8,10,9N,(7,9)S	February 17, '78	298	113	399
*Total Mileage		3306		*

*Note: The survey began on January 29, 1978 and was completed on February 17, '78

AIII-1

TABLE AIII-1 Test Line Results

UNIT	Jan '78		Feb '78							
	29	30	1	2	3	7	9	10	17	
PRE COS	67.3	69.4	68.5	70.1	71.7	72.3	68.7	70.4	68.7	
POS COS	66.6	*	69.6	70.8	73.0	70.1	69.5	72.5	68.9	
T1	59.7	57.9	60.8	57.4	61.0	57.3	60.9	61.8	56.3	
T1	60.6	----	60.1	58.7	61.3	58.9	60.5	62.6	59.1	
B1	141.5	130.2	138.5	133.5	136.3	112.6	142.0	137.7	135.0	
B1	133.6	-----	129.8	135.5	130.2	115.8	130.0	139.8	131.1	
K	193.1	194.2	203.8	197.1	201.6	203.4	206.6	196.1	190.7	
K	205.5	----	205.4	198.8	205.6	199.1	200.6	203.9	192.4	
GC	2640	2670	2566	2723	2674	2652	2539	2730	2899	
GC	2646	----	2558	2673	2622	2523	2531	2710	2844	
B1Air	63.3	73.1	72.1	44.3	34.4	76.2	20.3	43.5	36.7	
B1Air	60.9	----	55.6	50.3	47.2	81.5	48.4	41.4	44.9	
ALT	407	404	401	385	395	397	403	407	392	
ALT	397	-----	416	398	370	416	416	376	375	

* Rain at Test Line Location

AIII-2

TABLE AIII-2 Average S58T Speed and Altitude Determined from Data of Appendix II

LINE	AVERAGE SPEED, MPH	AVERAGE ALTITUDE, FT	LINE	AVERAGE SPEED, MPH	AVERAGE ALTITUDE, FT
1E	112	402	T1	94	409
1W	94	428	T2	91	407
2E	114	406	T3	119	424
2W	114	453	T4	120	447
3E	114	414	T5	119	400
3W	101	422	T6	117	407
4E	119	397	T7N	120	397
4W	116	415	T7S	110	388
5E	109	390	T8	110	397
5W	94	387	T9	109	417
6E	123	403	T10	118	396
6W	120	443			
7E	116	444			
7W	105	423			
8E	118	454			
8W	112	434			
9E	112	424			
9W	107	423			
10E	124	436			
10W	119	437			
11E	112	428			
11W	108	392			
12E	114	440			
12W	119	420			
13E	117	403			
13W	111	402			
14E	103	397			
14W	116	416			
15E	109	408			
15W	114	409			
16E	110	404			
16W	116	404			
17E	109	395			
17W	107	387			
18E	110	427			
18W	116	417			
19E	102	385			
19W	107	399			
20E	113	417			
20W	116	418			
21E	114	414			
21W	112	415			
22E	111	403			
22W	116	392			
23E	114	397			
23W	100	378			

AIII-3

TABLE AIII-3 Diurnal Corrections to Map Line Data

LINE	DIURNAL CORRECTIONS IN GAMMAS	LINE	DIURNAL CORRECTIONS IN GAMMAS
1E	8	T1	10
1W	11	T2	1
2E	-12	T3	8
2W	11	T4	6
3E	-14	T5	5
3W	2	T6	6
4E	-12	T7N	-15
4W	-2	T7S	-11
5E	-14	T8	-7
5W	-9	T9	11
6E	-11	T10	10
6W	-11		
7E	9		
7W	12		
8E	10		
8W	6		
9E	12		
9W	8		
10E	-6		
10W	10		
11E	-9		
11W	12		
12E	-11		
12W	6		
13E	-11		
13W	-2		
14E	-7		
14W	-7		
15E	-6		
15W	-11		
16E	2		
16W	-12		
17E	6		
17W	12		
18E	11		
18W	7		
19E	12		
19W	-1		
20E	9		
20W	-7		
21E	9		
21W	-11		
22E	8		
22W	-12		
23E	8		
23W	8		

*Note: Magnetic heading corrections required are -3.56 gammas westerly correction, +3.56 gammas easterly correction, & 1.0 gammas northerly correction, and -1.0 gammas S/C.

AIII-4

BIBLIOGRAPHY

- Armstrong, A.K. (1963), Biostratigraphy and Paleocology of the Mississippian System, Westcentral New Mexico: in Socorro Region: New Mexico Geological Society, Fourteenth Field Conference, p. 112-122.
- Baars, D.L. (1961), Permian Strata of Central New Mexico: in Albuquerque Country: New Mexico Geological Society, Twelfth Field Conference, p. 113-120.
- Chenoweth, W.L. (1976), Uranium Resources of New Mexico: in Tectonics and Mineral Resources of Southwestern North America: New Mexico Geological Society, Special Publication No. 6, p. 218.
- DeBrine, B., Spiegel, Z., and William, D. (1963), Cenozoic Sedimentary Rocks in Socorro Valley, New Mexico: in Socorro Region: New Mexico Geological Society, Fourteenth Field Conference, p. 123-131.
- Fenneman, N.W. (1931), Physiography of Western United States: New York, McGraw-Hill Book Co., Inc., p.534.
- Gadway, K. (1959), Cretaceous Sediments of the North Plains and Adjacent Areas, McKinley, Valencia and Catron Counties, New Mexico: in Guidebook of Westcentral New Mexico: New Mexico Geological Society, Tenth Field Conference, p. 31-84.
- Hilpert, L.S. (1965), Uranium: in Mineral and Water Resources of New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin, 87, p. 209-226.
- Kottowski, F.E. (1961), Pennsylvanian Rocks in Northcentral New Mexico: in Albuquerque Country: New Mexico Geological Society, Twelfth Field Conference, p. 97-104.
- Noble, E.A. (1950), Geology of the Southern Ladron Mountains, Socorro County, New Mexico: unpublished M.S. thesis, University of New Mexico, 72p.
- N.T.M.S. (1954), National Topographic Map Series, Socorro Sheet: U.S. Geological Survey, Map, Western United States, N113-4, Series V502, scale 1:250,000, revised 1970.
- Reiche, P. (1949), Geology of the Monzanita and north Monzano Mountains, New Mexico: Geological Society of America, Bulletin, v.60, p. 1183-1212.

(Bibliography Cont'd.)

- Smith, C.T. (1961), Triassic and Jurassic Rocks of the Albuquerque Area: in Albuquerque Country: New Mexico Geological Society, Twelfth Field Conference, p. 121-128.
- Stark, J.T. and Dapples, E.C. (1946), Geology of the Los Pinos Mountains, New Mexico: Geological Society of America, Bulletin, v.57, p. 1121-1172.
- Weber, R.H. (1963), Cenozoic Volcanic Rocks of Socorro County: in Socorro Region: New Mexico Geological Society, Fourteenth Field Conference, p. 132-143.

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

NATIONAL GAMMA RAY MAP SERIES

SOCORRO, NEW MEXICO
GEOLOGY

REF. NTMS, NI 13-4

PREPARED FOR

U.S. DEPARTMENT OF ENERGY

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

LEGEND

X" INDICATES FILM VERIFIED POINTS"

SOCORRO, NEW MEXICO
FLIGHT BASE
REF NTMS, NI 13-4
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
208 T ± STANDARD DEVIATIONS
REF NTMS, NI 13-4
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
214 BI ± STANDARD DEVIATIONS
REF NTMS, NI 13-4
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
40 K ± STANDARD DEVIATIONS
REF NTMS, NI 13-4
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
214 Bi / 208 T ± STANDARD DEVIATIONS
REF NTMS, NI 13-4
PREPARED FOR
U S DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
 $^{214}\text{Bi}/^{40}\text{K} \pm \text{STANDARD DEVIATIONS}$
REF NTMS, NI 13-4
PREPARED FOR
U.S. DEPARTMENT OF ENERGY

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

SOCORRO, NEW MEXICO
208 $\pm 1/40$ K $\pm$ STANDARD DEVIATIONS
REF NTMS, NI 13-4
PREPARED FOR
U. S. DEPARTMENT OF ENERGY

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 1E SOCORRO

106°30'

0 5 10 15 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 3E SOCORRO

106°30'

0 5 10 15 MILES

ML 3

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 3W SOCORRO

107°30'

MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

10 C/S/DIV

10 C/S/DIV

ML 4E SOCORRO

106°30'

0 5 10 15 20 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 4

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 4W SOCORRO

107°30'

ML 4

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

T_L
10 C/S/DIV

H: T
100 FT/DIV

ML 5E SOCORRO

106°30'

0 10 20 30 40 50 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 5E SOCORRO

106°30'

0 5 10 15 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
150 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 6E SOCORRO

106°30'

0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 13

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 6E SOCORRO

106°30'

5 0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 7E SOCORRO

106°30'

0 5 10 15 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ML
10 FT/DIV

ML 8E SOCORRO

106°30'

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

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 9E SOCORRO

06°30'

0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 9E SOCORRO

106°30'

0 5 10 15 MILES

ML 9

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 9W SOCORRO

107°30'

MILES

ML 9

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 13

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 9W SOCORRO

107°30'

0 10 20 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

SC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIIR
20 C/S/DIV

✓
45 C/S/DIV

BI
50 C/S/DIV

BI
50 C/S/DIV

ML 10E SOCORRO

106°30'

0 10 20 30 40 50 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 10W SOCORRO

107°30'

0 10 20 30 40 50 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 10W SOCORRO

107°30'

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

ML 11

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 11W SOCORRO

107°30'

MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 12E SOCORRO

106°30'

0 5 10 15 20 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 13

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 12E SOCORRO

106°30'

0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 13

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 12W SOCORRO

107°30'

0 5 10 15 20 MILES

ML 13

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIRIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

BI
20 C/S/DIV

BI
20 C/S/DIV

ML 13E SOCORRO

106°30'

0 5 10 15 20 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 13E SOCORRO

106°30'

0 5 10 15 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 14E SOCORRO

106°30'

0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 16E SOCORRO 106°30' 0 5 10 15 20 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 16E SOCORRO

106°30'

0 5 10 15 MILES

ML 16

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 13

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 16W SOCORRO

107°30'

0 5 10 15 20 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 17E SOCORRO

106°30'

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 19E SOCORRO

106°30'

MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 20E SOCORRO 106°30' 0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

ML 20E SOCORRO

106° 30'

0 5 10 15 MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 21E SOCORRO 106°30' 0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 21W SOCORRO

107°30'

MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 22E SOCORRO

106°30'

MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIRIR
20 C/S/DIV

K
45 C/S/DIV

SI
20 C/S/DIV

TI
20 C/S/DIV

FT
100 FT/DIV

ML 22W SOCORRO

107°30'

MILES

107° 30'

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIRIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

ML 23E SOCORRO

106°30'

0 5 10 15 MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

TL
100 FT/DIV

TL 2

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 2 SOCORRO

34°30'

TL 2

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 2 SOCORRO

34°30'

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 3 SOCORRO

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 MILES 34°30'

TL 3

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 3 SOCORRO

34°30' MILES

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 4

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 4

SOCORRO

34°30'

TL 5

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIK
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
15 C/S/DIV

TL
100 FT/DIV

TL 5 SOCORRO

0 5 10 15 20 MILES

34°30'

TL 5

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 5

SOCORRO

34°30'

WILES

TL 6

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 6 SOCORRO

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

34°30'

TL 6

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 6 SOCORRO

34°30'

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 7S SOCORRO

TL 7N SOCORRO

34°45'

TL 8

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

TL
100 FT/DIV

TL 8 SOCORRO

0 10 20 MILES 34°30'

TL 9

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 9 SOCORRO 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 MILES 34°30'

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 9

SOCORRO

WILES 34°30'

TL 10

TL/K
.05 /DIV

BI/K
.20 /DIV

BI/TL
.40 /DIV

GC
450 C/S/DIV

RMAG
100 GAMMAS/DIV
BASE = -300

BIAIR
20 C/S/DIV

K
45 C/S/DIV

BI
20 C/S/DIV

TL
10 C/S/DIV

ALT
100 FT/DIV

TL 10 SOCORRO 34°30' MILES

RMAG
20 GAMMA/DIV
BASE = -1000

BMAG
10 GAMMA/DIV
BASE = 51730

PRESSURE
0.25 IN HG/DIV
BASE = 19

TEMP
1 DEG C/DIV
BASE = -7

ALT
100 FT/DIV

TL 10 SOCORRO 34°30'