Geology
GJBX-(80)-78

GJBX-78 '80

# Airborne Gamma-Ray Spectrometer and Magnetometer Survey

## Ophir Quadrangle
(Alaska)

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_______, _______

## Final Report
## Volume I

Prepared For The Department Of Energy
Grand Junction Office
Grand Junction, Colorado 81501
Under
Bendix Field Engineering Corporation
Grand Junction Operations, Grand Junction, Colorado
Subcontract No. 79-321-L
Project No. 40-79-4179
March 1980

GEOLOGICAL SURVEY OF WYOMING

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

AERO SERVICE
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# AIRBORNE GAMMA-RAY SPECTROMETER

# AND

# MAGNETOMETER SURVEY

## OPHIR QUADRANGLE

## (Alaska)

## FINAL REPORT

## VOLUME I

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by
AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA
HOUSTON, TEXAS

March, 1980

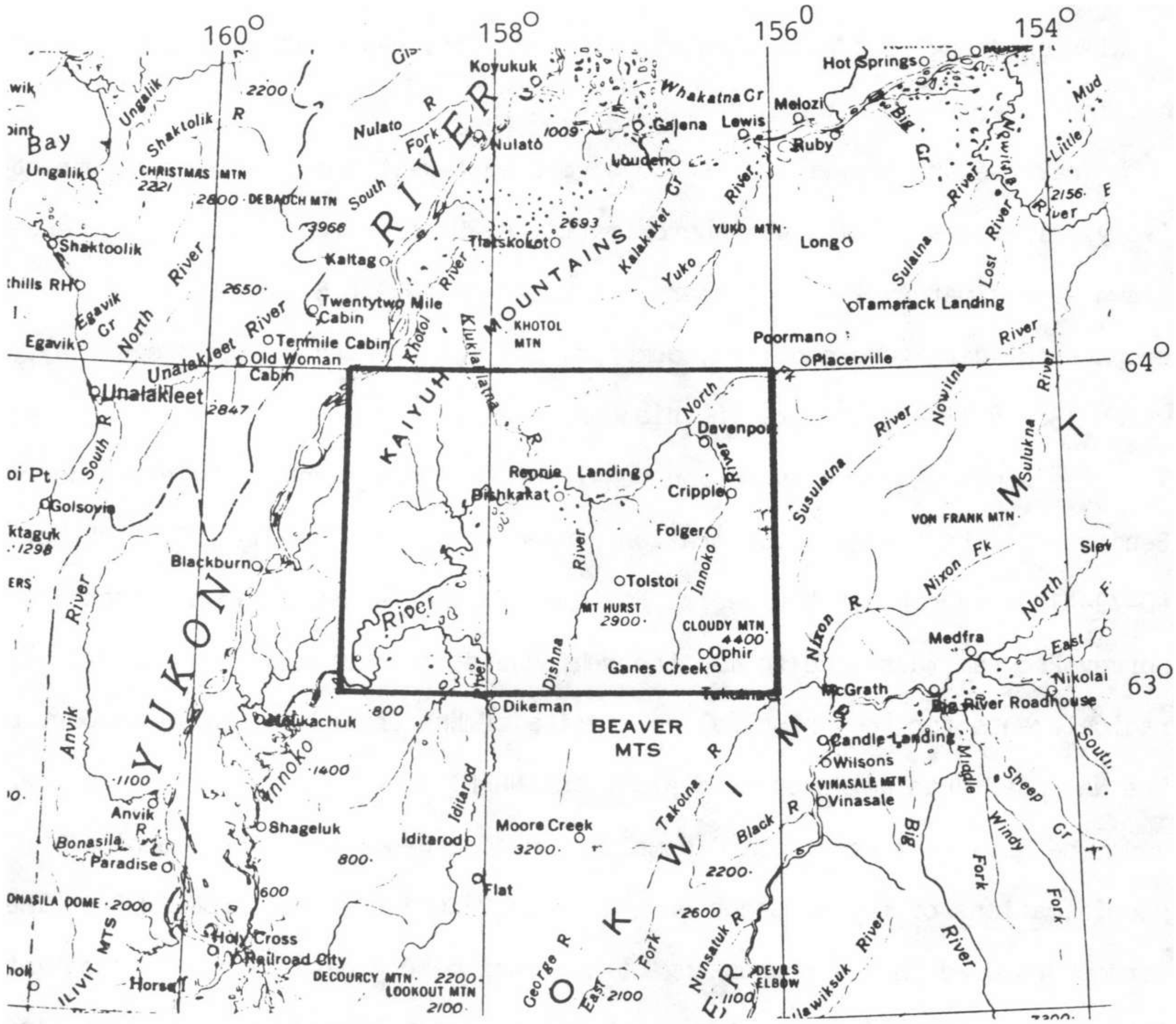


FIGURE 1

OPHIR

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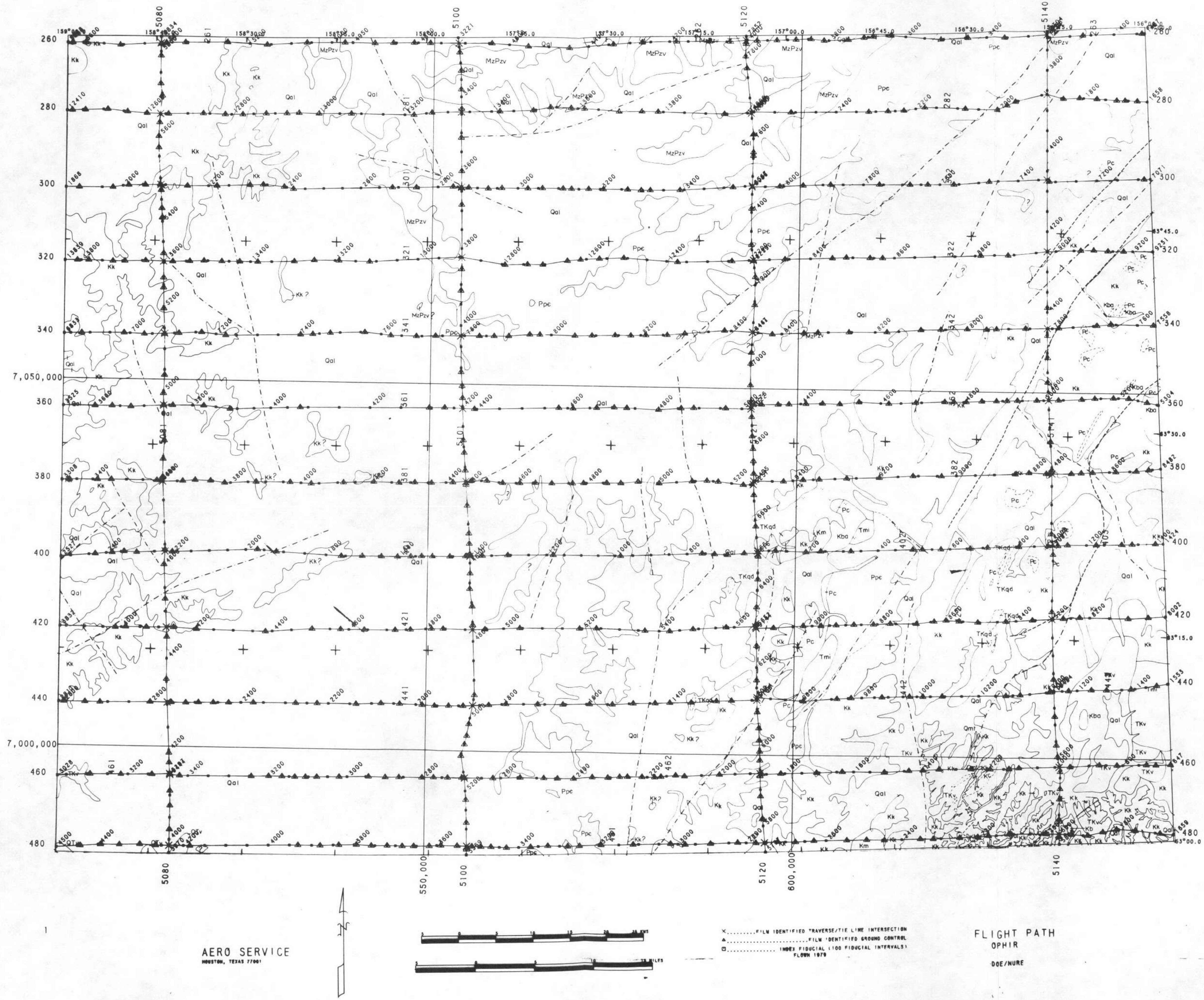
## INTRODUCTION

During the months of July, August and September of 1979, Aero Service Division Western Geophysical Company of America conducted an airborne high sensitivity gamma-ray spectrometer and magnetometer survey over (10) ten 3° x 1° NTMS quadrangles of West-Central Alaska. This report discusses the results obtained over the Ophir map area.

Traverse and tie-line directions were east-west and north-south respectively. Traverse spacing was approximately 6.25 miles, while tie-lines were flown approximately 25 miles apart. A total of 13,960.5 line miles of geophysical data were acquired, compiled and interpreted during the survey, of which 1386.4 line miles are in this quadrangle.

The study was carried out on behalf of the Department of Energy under Bendix Field Engineering Corporation, Subcontract No. 79-321-L, Project No. 40-79-4179, as part of the Aerial Radiometric and Magnetic Reconnaissance Survey Program, designed to map the regional distribution of the natural radioelements for the principal rock units of the United States in support of the National Uranium Resource Evaluation (NURE) program.

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



260
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550,000
600,000
Qal
Kk
MzPzv
Ppc
Pc
Kba
TKqd
TKv
Tmi
AERO SERVICE
HOUSTON, TEXAS 77001
25 KMS
15 MILES
×.........FILM IDENTIFIED TRAVERSE/TIE LINE INTERSECTION
▲.........................FILM IDENTIFIED GROUND CONTROL
☐............... INDEX FIDUCIAL (100 FIDUCIAL INTERVALS)
FLOWN 1979
FLIGHT PATH
OPHIR
DOE/NURE


FIGURE 2

## DATA ACQUISITION

### Aircraft

The survey was carried out using a Sikorsky S-58T helicopter, registration N 95423, owned and operated by Carson Helicopters, Inc., Perkasie, Pennsylvania. The flight crew included a pilot (Carson), a navigator (Carson) and an electronic operator (Aero Service). Some of the more pertinent characteristics and specifications of the aircraft are listed below:

TABLE I

| | | |
|---|---|---|
| Aircraft | - | Sikorsky Model S-58T, Registration N 95423 |
| Engine | - | Pratt - Whitney PT 6T Twinpack |
| Take off power | - | 1875 Shaft HP. |
| Fuel Capacity | - | 350 U. S. Gal. |
| Hourly Fuel Consumption | - | 100 U. S. Gal. |
| Range Cruise Speed | - | 300 Miles |
| Rate of Climb | - | 1200 Feet per Min. |
| Service Ceiling | - | 12500 Feet |
| Maximum Gross Weight | - | 13000 Lbs. |
| Empty Weight | - | 7200 Lbs. |
| Useful Load | - | 5800 Lbs. |
| Pay Load | - | 1700 Lbs. |

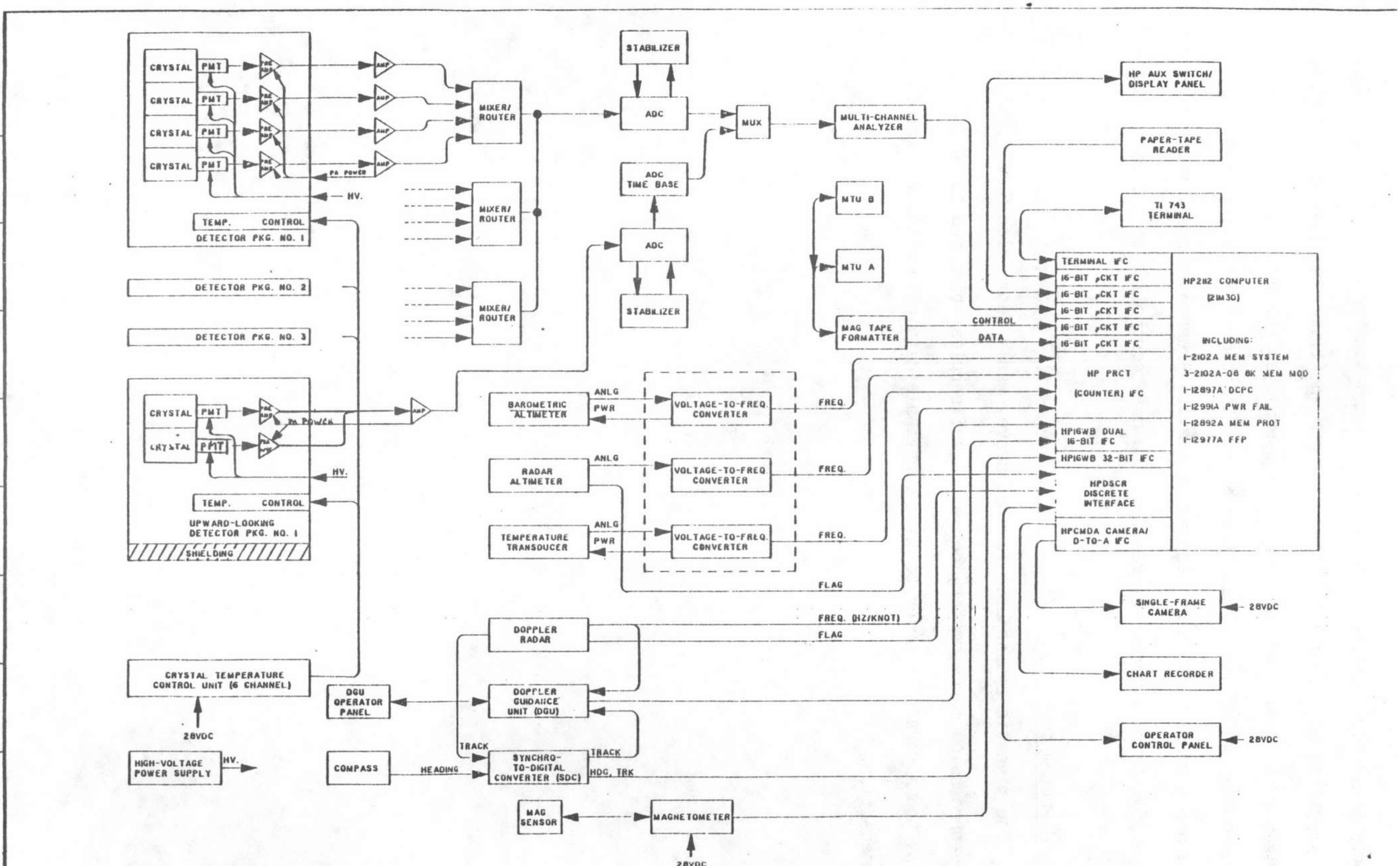
Gamma-Ray Spectrometer System

The survey was conducted using Aero Service's HISENS Airborne Gamma-ray Spectrometer 3000-F System, shown in block diagrammatic form in Figure 3, page 5.

The primary detector package consists of 13 logs of 4" x 4" x 15" of Polyscin(R), NaI(Tl), each log hermetically sealed in a stainless steel container and coupled to a high quality photo-multiplier tube. The logs are assembled in three slabs of respectively 4, 4 and 5 logs each. Each slab is enclosed in a heated and thermally stabilized container. Total volume of the primary detector is 3120 cubic inches (51.13 liters). The upward looking ($2\pi$) detector consists of two 4" x 4" x 16" logs of Polyscin(R), NaI(Tl), also hermetically sealed in a steel container and coupled to high quality photo-multiplier tubes. The two logs are enclosed as a slab in the same container that houses the slab of 5 logs of Polyscin. The upward looking crystals are mounted on top of the $4\pi$ sensor, separated by a 0.75" slab of lead shielding, in order to obtain the prescribed shielding effect of 85% @ 3000KeV.

The preamplifiers, which with the photo-multipliers provide virtually the total signal amplification, are also enclosed in the thermally stabilized packages, to ensure maximum signal stability. The output of the preamplifiers is fed into the amplifiers, whose main function is to shape the incoming pulses into a bipolar gaussian form.

The mixer-router, the 50 MHz Wilkinson ramp analog to digital converter and the multi-channel analyzer of both the primary and $2\pi$ spectrometer systems are commercially available units, supplied by Canberra Industries. The data from the two spectrometers are output to the data controller, formed by a Hewlett Packard 21 MX minicomputer system, which stores the data, formats them, outputs them on tape and compares the tape recorded data with the data stored in memory. Additional data recorded on tape are radar altitude, baro-

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Litton HOUSTON, TEXAS 77042

| DWN | DATE | TITLE | SIZE | DRAWING NO. | REV | SHEET |
|---|---|---|---|---|---|---|
| CHKD | | BLOCK DIAGRAM, | B | 230-548-002 | | |
| APVD | 12/26 | HISENS AGRS 3000F SYSTEM | | | | |

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

FIGURE 3

metric pressure, atmospheric temperature, magnetometer data, real time, gamma-ray spectrometer system live-time and other ancillary data such as additional navigational data. Two tape drives were employed and automatic switching between the two occurs as each tape ends. Additional ancillary equipment includes a cathode ray tube display, a Clevite Brush 6-channel analog recorder and a 35mm frame camera, triggered by the data controller at a preset interval.

Magnetometer

The magnetic sensor used for the survey was a Geometrics G-803 proton free-precession magnetometer, housed in a fiberglass bird and towed 75 feet below the aircraft in order to assure reliable data with minimal aircraft compensation.

## PRODUCTION SUMMARY

The 3° x 1° NTMS quadrangle of Ophir, Alaska, was surveyed as part of a subcontract covering the nine quadrangles of Norton Bay, Nulato, Ruby, Unalakleet, Ophir, Medfra, Iditarod, McGrath and Sleetmute. An extension to the same subcontract covered the reconnaissance survey of the 3° x 1° NTMS quadrangle of Kantishna River and the detailed survey of the Four Corners area, located at the four corners of the Ruby, Kantishna River, Medfra and Mt. McKinley quadrangles. The main subcontract covered the flying of a total of 11,925.7 line miles of geophysical data, of which 1386.4 miles are in the Ophir quadrangle. The extension subcontract covered the flying of 1346.8 line miles of reconnaissance surveying and 688 line miles of detailed survey.

The main bases of operation were, for the original subcontract, Galena, Alaska, in the Nulato quadrangle, for the northern portion of the survey, and McGrath, Alaska, in the McGrath quadrangle, for the southern portion of the survey. For the additional subcontract Manley, Alaska, in the Kantishna River Quadrangle was used as the main base of operations.

Throughout the survey extensive use was made of the many small landing strips distributed within the area. A small, twin engine fixed wing aircraft was used to ferry fuel supplies to these landing strips. These fuel caches were then subsequently used to allow refuelling stops by the helicopter.

The first production flight was made on July 12, 1979. The final production flight of the original subcontract was flown on September 12, 1979. Maps covering the survey areas of the additional subcontract were received in McGrath on September 18, 1979, on which day the helicopter was ferried to Manley, Alaska. The last production flight of the additional subcontract was flown on September 27, 1979.

Between July 12 and September 12, the end of the flying of the original subcontract, a total 67 sorties were made on 27 production days. Total flying time of the helicopter amounted to 191.6 hours. Fourteen days were lost due to aircraft repair and maintenance, mainly because of an engine failure in the beginning of the survey and a fracture of the tail rotor near the end of the survey. Inclement weather prevented production on 21 days and one (1) day of production was lost due to inadequate fuel supplies in McGrath.

For the original contract average production per hour actual flying time was 62.2 miles. An average of 441.7 line miles of data was acquired each actual production day. When counted over the entire 78 days duration of the survey, average production was 152.9 line miles per day.

The flying of the extension survey mileage was accomplished on September 27, 1979. The extension survey took a total of ten (10) production flights on four (4) days. A total of 1346.8 line miles of reconnaissance data and 688 line miles of detailed survey data were gathered in 33.4 hours of flying. Inclement weather prevented production flying during five (5) days. Average production for the extension subcontract was 60.92 line miles per hour actual flying time. Progress averaged 508.7 line miles of data per production day and 226.1 line miles over the duration of the extension survey.

Time lost due to electronic equipment repair or maintenance during both the original survey and its extension was negligeable. A complete summary of daily production for both the original survey and its extension is given in Table II, page 9.

The projected spacing for the Ophir quadrangle was 6.25 miles for traverse lines and 25 miles for tie lines. The specified terrain clearance for the survey was 400 feet. Figure 4 shows a histogram of the terrain clearance of the aircraft as recorded by the radar altimeter. The histogram

# T A B L E II

## DAILY PRODUCTION SUMMARY

### Ophir Quadrangle

| DATE | BASE | ACTIVITY | FLIGHT NO. |
|---|---|---|---|
| 07/12/79 | Galena, Alaska | Production | 2,3,4 |
| 07/13/79 | Galena, Alaska | Production | 5,6 |
| 07/14/79 | Galena, Alaska | Aircraft engine repair | |
| 07/15/79 | Galena, Alaska | Aircraft engine repair | |
| 07/16/79 | Galena, Alaska | Aircraft engine repair | |
| 07/17/79 | Galena, Alaska | Aircraft engine repair | |
| 07/18/79 | Galena, Alaska | Aircraft engine repair | |
| 07/19/79 | Galena, Alaska | Aircraft engine repair | |
| 07/20/79 | Galena, Alaska | Aircraft engine repair | |
| 07/21/79 | Galena, Alaska | Engine test | |
| 07/22/79 | Galena, Alaska | Production | 8,9 |
| 07/23/79 | Galena, Alaska | Rain | |
| 07/24/79 | Galena, Alaska | Rain | |
| 07/25/79 | Galena, Alaska | Production | 10,11 |
| 07/26/79 | Galena, Alaska | Production | 12,14,15 |
| 07/27/79 | Galena, Alaska | Production | 16,17 |
| 07/28/79 | Galena, Alaska | Production | 18 |
| 07/29/79 | Galena, Alaska | Rain | |
| 07/30/79 | Galena, Alaska | Production | 19 |
| 07/31/79 | Galena, Alaska | Rain | |
| 08/01/79 | Galena, Alaska | Rain | |
| 08/02/79 | Galena, Alaska | Production | 20 |
| 08/03/79 | Galena, Alaska | Production | 21,22,23,24,25 |
| 08/04/79 | Galena, Alaska | Rain | |
| 08/08/79 | Galena, Alaska | Rain | |
| 08/08/79 | Galena, Alaska | Rain, ferry to McGrath | |
| 08/08/79 | McGrath, Alaska | Rain | |
| 08/09/79 | McGrath, Alaska | High wind, turbulence | |
| 08/10/79 | McGrath, Alaska | Production | 27,28 |
| 08/11/79 | McGrath, Alaska | Production | 29,30 |
| 08/12/79 | McGrath, Alaska | Production | 31,32 |
| 08/13/79 | McGrath, Alaska | Production | 33,34,35 |
| 08/14/79 | McGrath, Alaska | Rain | |
| 08/15/79 | McGrath, Alaska | Production | 36,37 |
| 08/16/79 | McGrath, Alaska | Rain | |
| 08/17/79 | McGrath, Alaska | Rain | |
| 08/18/79 | McGrath, Alaska | Production | 38 |
| 08/19/79 | McGrath, Alaska | Rain | |
| 08/20/79 | McGrath, Alaska | Rain | |

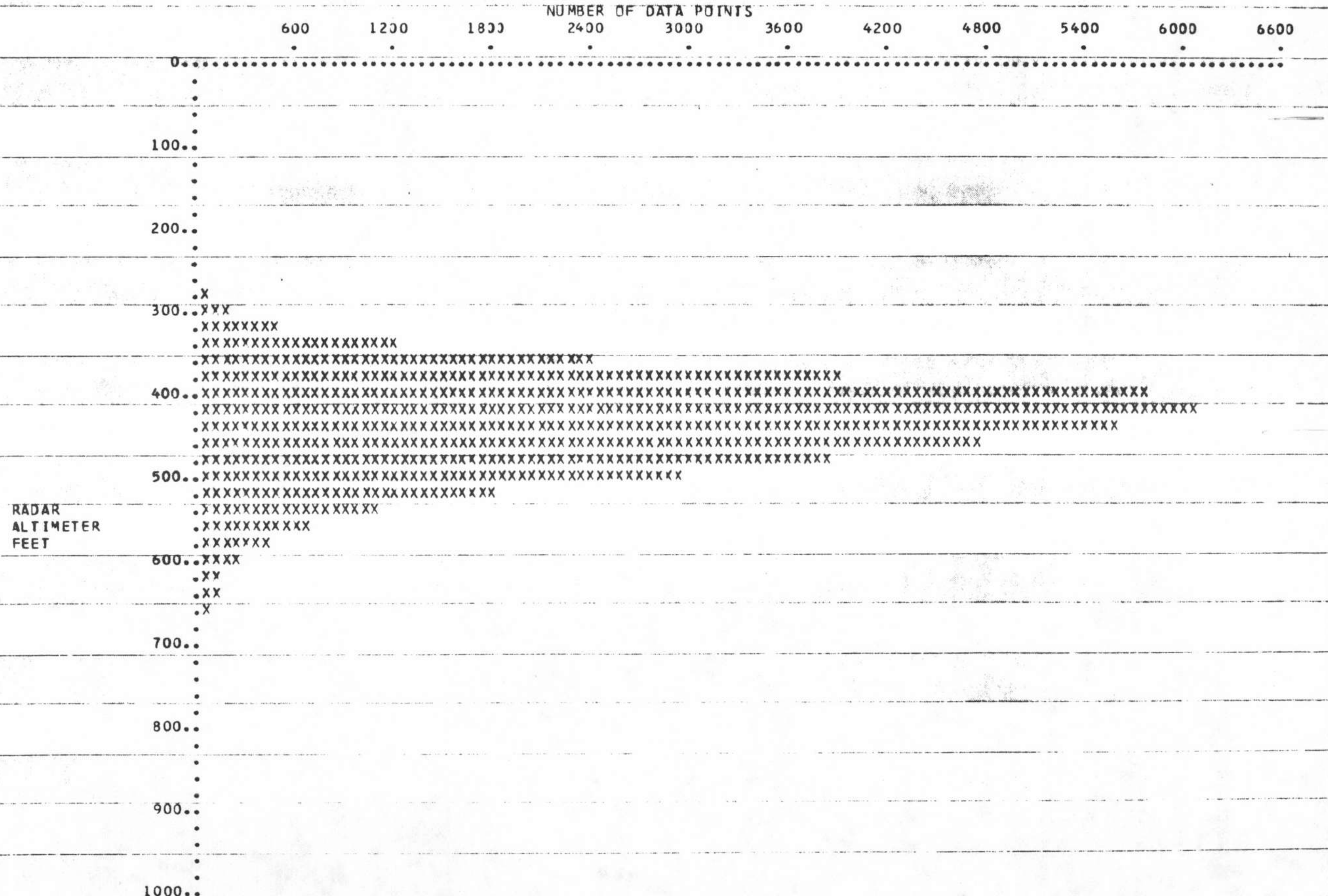
Daily Production Summary
Ophir Quadrangle
cont'd.

| DATE | BASE (S) | ACTIVITY | FLIGHT |
|---|---|---|---|
| 08/21/79 | McGrath, Alaska | Production | 40,41,42 |
| 08/22/79 | McGrath, Alaska | Production | 43,44,45,46 |
| 08/23/79 | McGrath, Alaska | Production | 47,48,49,50 |
| 08/24/79 | McGrath, Alaska | Production | 52,53 |
| 08/25/79 | McGrath, Alaska | Production | 54,55,56 |
| 08/26/79 | McGrath, Alaska | Rain | |
| 08/27/79 | McGrath, Alaska | Rain | |
| 08/28/79 | McGrath, Alaska | Rain | |
| 08/29/79 | McGrath, Alaska | Rain | |
| 08/30/79 | McGrath, Alaska | Rain | |
| 08/31/79 | McGrath, Alaska | Production | 57,58,59 |
| 09/01/79 | McGrath, Alaska | Tail rotor U/S | |
| 09/02/79 | McGrath, Alaska | Tail rotor U/S | |
| 09/03/79 | McGrath, Alaska | Tail rotor U/S | |
| 09/04/79 | McGrath, Alaska | Tail rotor U/S | |
| 09/05/79 | McGrath, Alaska | Tail rotor U/S | |
| 09/06/79 | McGrath, Alaska | Test flight | |
| 09/07/79 | McGrath, Alaska | Production | 60,61 |
| 09/08/79 | McGrath, Alaska | Production | 62,63,64,65 |
| 09/09/79 | McGrath, Alaska | Production | 66,67 |
| 09/10/79 | McGrath, Alaska | Logistics, awaiting fuel supply | |
| 09/11/79 | McGrath, Alaska | Production | 68,69,70,71 |
| 09/12/79 | McGrath, Alaska | Last production Original contract | 72,73 |
| 09/13/79 | McGrath, Alaska | Awaiting instructions | |
| 09/14/79 | McGrath, Alaska | Awaiting instructions, rain | |
| 09/15/79 | McGrath, Alaska | Awaiting instructions, rain | |
| 09/16/79 | McGrath, Alaska | Crew moved to Manley | |
| 09/17/79 | McGrath, Alaska | Awaiting maps | |
| 09/18/79 | McGrath, Alaska | Ferry to Manley | |
| 09/19/79 | Manley, Alaska | Rain | |
| 09/20/79 | Manley, Alaska | Fog, rain | |
| 09/21/79 | Manley, Alaska | Fog, rain | |
| 09/22/79 | Manley, Alaska | Production | 76,77,78 |
| 09/23/79 | Manley, Alaska | Production | 79,80,81 |
| 09/24/79 | Manley, Alaska | Fog, rain | |
| 09/25/79 | Manley, Alaska | Fog, rain | |
| 09/26/79 | Manley, Alaska | Production | 83,84 |
| 09/27/79 | Manley, Alaska | Production, end of project | 85,86 |

takes into account all final samples in the Ophir quadrangle. The mean terrain clearance, as observed, is approximately 420 feet. The ground speed of the aircraft, as determined from the distances between consecutive samples, based on their final X-Y positions, is depicted in graphic form in the histogram of Figure 5, page 13.

AERO SERVICE
QUAD OPHIR

TERRAIN CLEARANCE HISTOGRAM
JOB 9608




6 POINTS GREATER THAN 1000 FEET

FIGURE 4

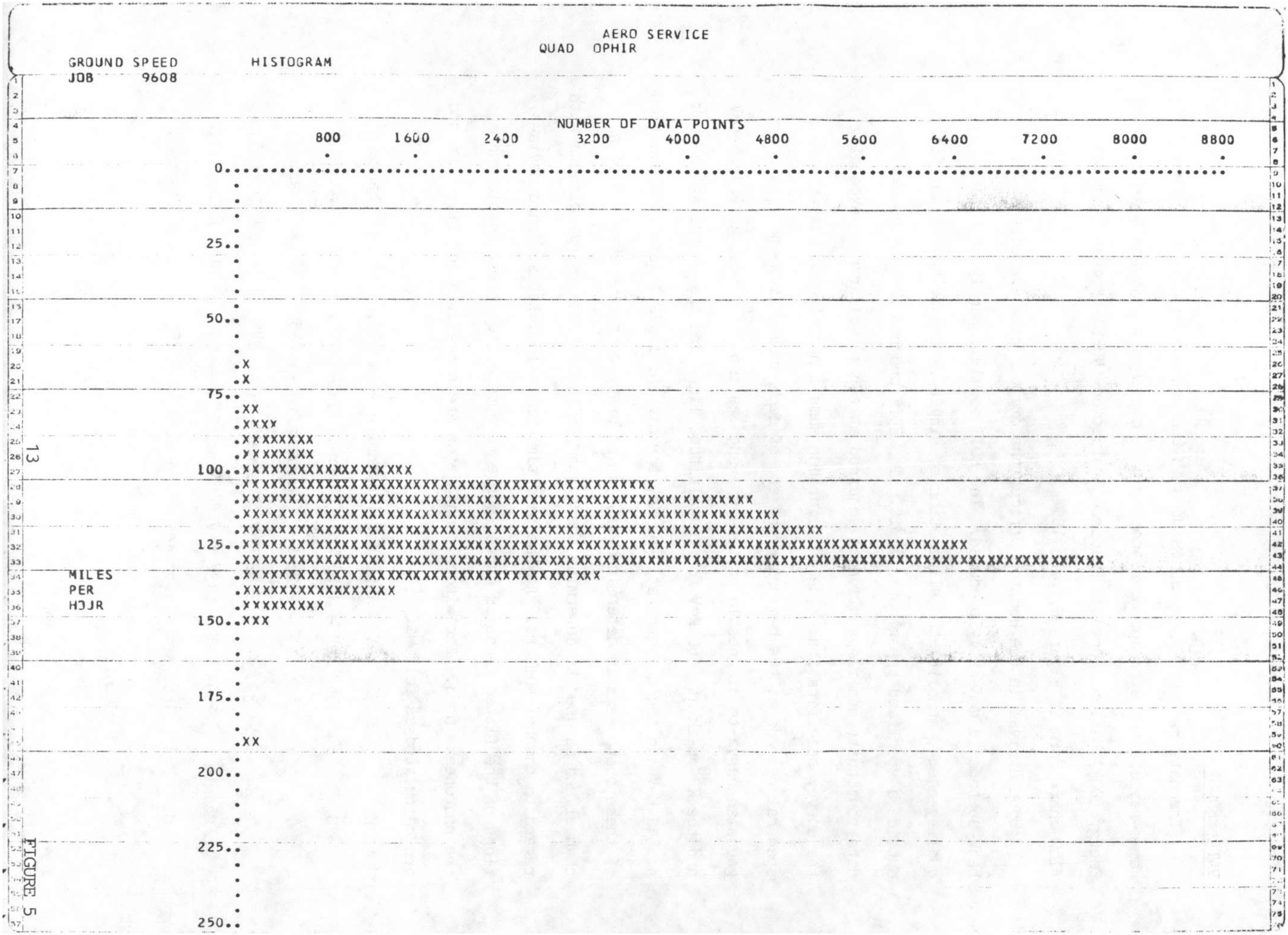

AERO SERVICE
QUAD OPHIR
GROUND SPEED HISTOGRAM
JOB 9608
NUMBER OF DATA POINTS
800 1600 2400 3200 4000 4800 5600 6400 7200 8000 8800
0
25
50
75
100
125
150
175
200
225
250
MILES
PER
HOUR

FIGURE 5

## DATA REDUCTION

The data reduction process as used in the processing of the airborne gamma-ray spectrometer and magnetometer data obtained within the Department of Energy (DOE) National Uranium Resource Evaluation (NURE) program is shown in flow chart form in Figure 6, page 15.

Upon arrival in the Houston Office, the digital data are edited and a back-up tape is generally produced. The EDIT consists partly of a data quality check, enabling the elimination of single record spikes in any field, outside a specified preselected limit. The EDIT program further checks for data continuity and flags all data acquired at terrain clearances exceeding the survey specification. The EDIT further sums a preselected number of spectral records at the beginning and end of each survey line and fits a gaussian curve to diagnostic photopeaks, such as the $Tl^{208}$ peak at 2614.5 KeV and the $K^{40}$ peak at 1460 KeV for low altitude lines and the annihilation peak at 511 KeV and the $K^{40}$ peak at 1460 KeV for high altitude lines. The position of these photopeaks is determined with an accuracy of better than 0.1 of a channel and is used to determine the exact position of the energy windows with regard to channel numbers. At the same time the calculated standard deviations of the fitted gaussian curves serve to obtain the system resolution at the photopeaks used. The window count rates are normalized for live time and are calculated as follows:

| | | |
|---|---|---|
| K | : | 1362 KeV - 1566 KeV (Channel 114 → 130, @ 12 KeV/Channel) |
| U | : | 1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel) |
| T | : | 2406 KeV - 2926 KeV (Channel 201 → 235, @ 12 KeV/Channel) |
| T.C. | : | 390 KeV - 2982 KeV (Channel 33 → 248, @ 12 KeV/Channel) |
| Cosmic | : | 2994 KeV - 6138 KeV (Channel 250 → 512, @ 12 KeV/Channel) |
| $U_{2\pi}$ | : | 1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel) |

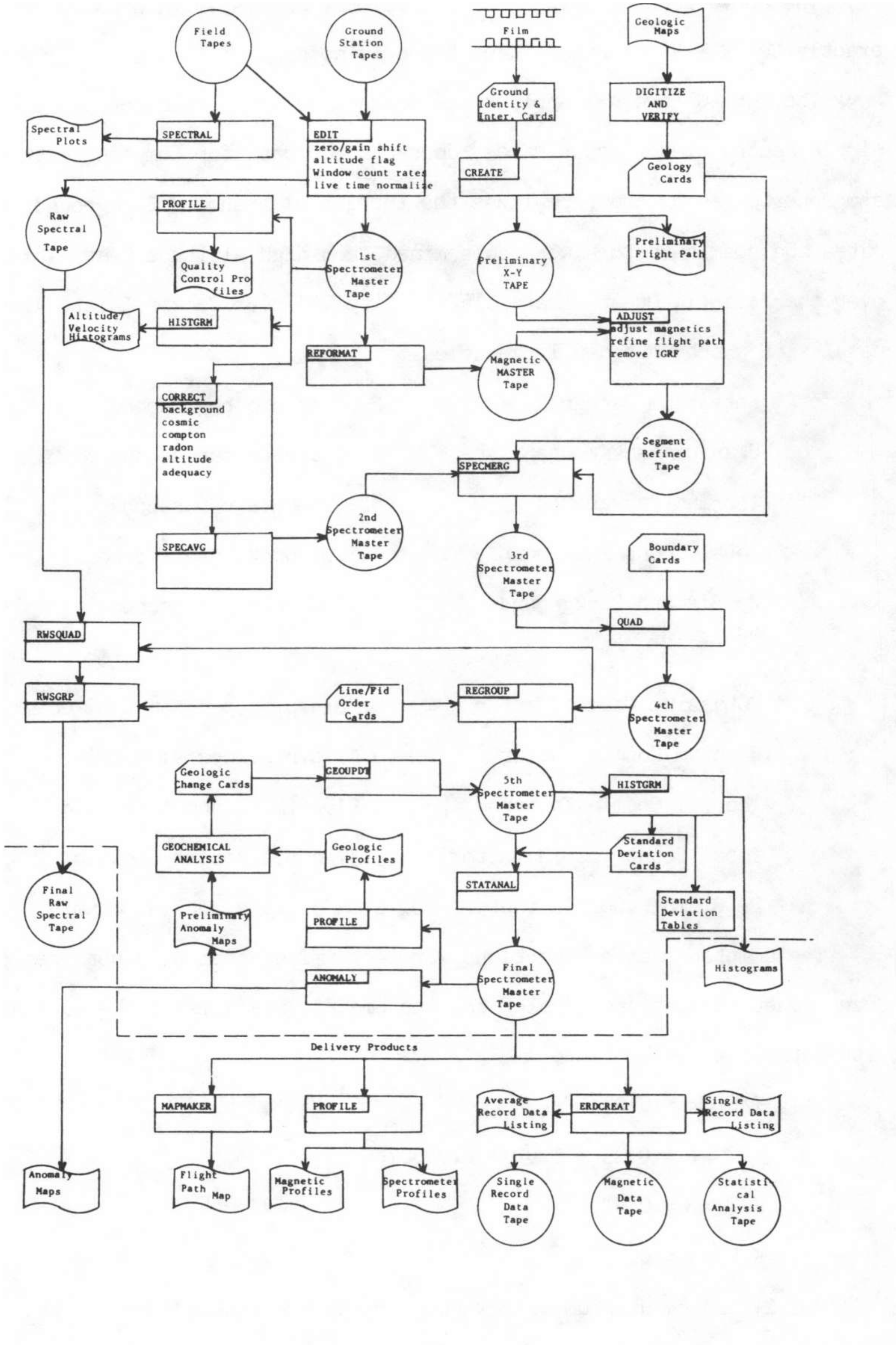

Field Tapes
Ground Station Tapes
Film
Geologic Maps
Ground Identity & Inter. Cards
DIGITIZE AND VERIFY
Spectral Plots
SPECTRAL
EDIT
zero/gain shift
altitude flag
Window count rates
live time normalize
CREATE
Geology Cards
Raw Spectral Tape
PROFILE
Quality Control Profiles
1st Spectrometer Master Tape
Preliminary X-Y TAPE
Preliminary Flight Path
Altitude/Velocity Histograms
HISTGRM
ADJUST
adjust magnetics
refine flight path
remove IGRF
REFORMAT
Magnetic MASTER Tape
CORRECT
background
cosmic
compton
radon
altitude
adequacy
Segment Refined Tape
SPECMERG
2nd Spectrometer Master Tape
SPECAVG
3rd Spectrometer Master Tape
Boundary Cards
QUAD
RWSQUAD
RWSGRP
Line/Fid Order Cards
REGROUP
4th Spectrometer Master Tape
Geologic Change Cards
GEOUPDT
5th Spectrometer Master Tape
HISTGRM
GEOCHEMICAL ANALYSIS
Geologic Profiles
Standard Deviation Cards
Final Raw Spectral Tape
STATANAL
Standard Deviation Tables
Preliminary Anomaly Maps
PROFILE
Histograms
ANOMALY
Final Spectrometer Master Tape
Delivery Products
MAPMAKER
PROFILE
Average Record Data Listing
ERDCREAT
Single Record Data Listing
Anomaly Maps
Flight Path Map
Magnetic Profiles
Spectrometer Profiles
Single Record Data Tape
Magnetic Data Tape
Statistical Analysis Tape



FIGURE 6

The above channel numbers are valid only if system gain corresponds exactly to 12 KeV per channel and there is no zero shift.

The CORRECT program applies the background and cosmic corrections to the single record window count rates, corrects the data for Compton scatter and atmospheric radon, and normalizes the terrain clearance. Background count rates and cosmic factors were determined from high altitude test data acquired over the Atlantic Ocean, near Atlantic City and over Cook's Inlet, Alaska, the results of which were nearly identical:

| | | |
|---|---|---|
| Potassium Background | = | 25.8 counts per second |
| Uranium Background | = | 5.27 counts per second |
| Thorium Background | = | 8.14 counts per second |
| Total Count Background | = | 215.2 counts per second |
| $2\pi$ Bismuth Background | = | 1.43 Counts per second |

| | | |
|---|---|---|
| Potassium Cosmic factor | = | 0.22 c.p.s. per count $4\pi$ cosmic |
| Uranium Cosmic factor | = | 0.17 c.p.s./cps $4\pi$ cosmic |
| Thorium Cosmic factor | = | 0.215 c.p.s./cps $4\pi$ cosmic |
| Total Count Cosmic factor | = | 3.77 c.p.s./cps $4\pi$ cosmic |
| $2\pi$ Bismuth Cosmic factor | = | 0.0375 c.p.s./cps $4\pi$ cosmic |

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

$T/U = \tau = 0.07$

$U/T = \alpha = 0.35 + 0.02 + 0.000076H$

$K/T = \beta = 0.44$

$K/U = \gamma = 0.99$

The $2\pi$ and $4\pi$ uranium window count rates are related through the geometric or equivalency factor. For the present system, installed in the Sikorsky S-58T helicopter, this factor, f, = 5.75. Part of the terrestrial radiation of energy higher than 1662 KeV - the lower threshold of the uranium window - is detected in the uranium window of the upward looking detector, due to imcomplete shielding, skyshine and shine-around. This shine-through/shine-around effect is assumed to be a function of both the intensity of the terrestrial uranium and thorium radiation and of the aircraft terrain clearance. From multi-altitude data acquired over the Lake Mead Dynamic Test Range the shine-through/shine-around effect was determined for each altitude level. The data provided a best fit for an exponential terrain clearance function as follows:

$$\text{shine-through/shine-around} = 0.06\ (U_{4\pi} + 0.35T_{4\pi})e^{-7.0\times10^{-4}H}$$

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

$$U_{2\pi c} = U_{2\pi} - \frac{(U_{4\pi} + 0.35T)\ 0.06 \times e^{-7.0\times10^{-4}H}}{(1-5.75 \times 0.06 \times e^{-7.0 \times 10^{-4}H})}$$

The shine-through/shine-around correction is applied to the $U_{2\pi}$ count rate at each single record. The single record $U_{2\pi}$ count rates are then averaged over 35 records to make them statistically compatible with the data of the primary system. The atmospheric radon correction is applied to both the $U_{4\pi}$ and the Total Count count rates. The equivalency factor for the $U_{4\pi}/U_{2\pi}$ = 5.75, for Total Count/$U_{2\pi}$ it is 80.

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

$\mu_K = 2.71 \times 10^{-3}$ per foot

$\mu_U = 2.55 \times 10^{-3}$ per foot

$\mu_T = 2.10 \times 10^{-3}$ per foot

$\mu_{TC} = 2.12 \times 10^{-3}$ per foot

The formula used for the altitude normalization is:

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

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

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

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

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

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

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

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

Parallel with the radiometric data reduction process, the magnetic data are edited and processed. Using the recovered film intersections and the established ground identities, preliminary flight paths are prepared. The flight path is refined in the magnetic adjustment program until an accurate final flight path has been obtained. The reduced spectrometer data are then merged with the final X-Y position of the data points, the reduced magnetic data and the digitized geology, and a master tape is produced with data that pertain to each 3° x 1° NTMS quadrangle only. The REGROUP program then eliminates all duplicate line segments, orders the remaining line segments and renumbers the fiducials on the flight lines.

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

## DATA PRESENTATION

### General

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

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

### Radiometric Multiple-Parameter Stacked Profiles

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

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

Magnetic and Ancillary Parameter Stacked Profiles

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

Histograms

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

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

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

Anomaly Maps

The anomaly maps have been prepared at scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. The fiducial numbers along the flight lines match those of the corresponding profiles. Positive signed deviations of the mean are indicated by a plus sign to the north or west of the flight lines, while negative signed deviations are indicated by a minus, plotted to the south or east of the line. The number of pluses or minuses corresponds with the levels of standard deviation from the mean. To avoid crowding standard deviation signs are calculated and plotted for every fifth sample only.

Computer Printer Maps

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

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

# GEOLOGY

## General

The Ophir quadrangle is located in west central Alaska and includes the area between latitudes 63°N and 64°N and between longitudes 156°W and 159°W. The area consists mainly of low lying flatland, marshes, bogs and lakes, with isolated flat topped, rounded hills, generally trending northeast-southwest. The average elevation of the lowland area is approximately 70 feet above sea level.

In sharp contrast, steep mountains are prevalent in the southeastern corner of the mapsheet, near Ophir, where elevations of 3995 and 4234 feet are measured on Twin Mountain and Cloudy Mountain respectively.

The main drainage artery of the quadrangle is the Innoko River with its many contributaries, of which the Mud River, Dishna River and Iditarod River are the most important. The Yukon River is found in the northwest corner of the mapsheet. The watershed between the Yukon and Innoko rivers is formed by the Kaiyuh Mountains.

Vegetation in the area includes both boreal forest and tundra. Permafrost is widespread throughout the area, in particular in the bog areas.

The geology of the area has been compiled by geologists of ESCA-TECH Corporation, Costa Mesa, Ca., especially for the purpose of the present radiometric survey. The compilation was made solely from existing data and from interpretation of satellite imagery. A considerable discrepancy exists between particularly the Unalakleet and Ophir geological maps, but also between Ophir and the adjoining Medfra and Nulato quadrangles.

## Stratigraphy

Bedrock exposed in the Ophir quadrangle ranges in age from possibly Precambrian to Late Tertiary or Quaternary. The oldest rock outcropping in the area consists of regional metamorphic schist, limestone, quartzite and phyllite. These rocks are overlain by chert, limestone and sandstone of lower grade metamorphism, probably of Upper Mississippian or Permian age. The exact stratigraphic position of the metamorphic mafic igneous complex, consisting mainly of mafic extrusive and intrusive rock with minor chert and graywacke, is unknown.

The Cretaceous chert and argillite mapped may be part of the same depositional series as the Upper Paleozoic chert, limestone and argillite. Only one Upper Cretaceous series is mapped, the Kuskokwim group. The Kuskokwim group, mapped in the western part of the map continues in the Unalakleet sheet as metamorphic igneous complex, and would thus be equivalent to MzPzv. However, it is more likely that the Upper Cretaceous sediments mapped in the western part of the map are equivalent to the Lower Cretaceous chert and argillite, Kc, mapped in the southeastern part of the quadrangle.

The sediments of the Kuskokwim group are cut by various intrusives and overlain by numerous extrusives. These include both Late Cretaceous, Early Tertiary and Late Tertiary/Early Quaternary rocks of various composition. A large part of the area is covered by unconsolidated Pleistocene to Recent deposits. Vegetation and soil cover in many parts of the area are thick, and often conceal much of the underlying bedrock. As a result the nature of the bedrock could not be established in large parts of the area. A brief description of the various geologic formations mapped is given below, beginning with the oldest.

Undifferentiated Metamorphic Rock, PpЄ

The oldest rocks exposed in the Ophir quadrangle are a group of undifferentiated metamorphic rocks, which include schist, crystalline limestone, quartzite, slate, phyllite and greenstone. In the Medfra and Ruby quadrangles an older mainly limestone unit and a supposedly younger clastic and volcanoclastic unit have been distinguished. No such distinction is made in the Ophir map sheet. No mention is made, either, of the crystalline limestone and dolomite of Ordovician to Lower Devonian age in the Ophir quadrangle. It is likely that this prominent formation in the Ruby and Medfra quadrangles is included in the metamorphic complex of the Ophir quadrangle.

Igneous Complex of Mafic Extrusive and Intrusive Rock, (MzPzv)

A thick series of basic igneous rocks with intercalated siltstone, slate, graywacke and minor limestone overlays the rocks of the metamorphic complex with no apparent discontinuity. The series obviously corresponds to a eugeosynclinal ophiolite suite and appears to correlate with the Rampart group of the Yukon-Tanana region. Triassic fossils have been collected from similar deposits to the east of the Mt. McKinley quadrangle and Lower Cretaceous fossils are found in similar greenstone of the Gemuk group in the Central Kuskokwim region. The series is indicated on the geologic map as of possible Upper Paleozoic and Mesozoic age and is probably of Permian through Lower Cretaceous age.

Upper Paleozoic Chert (Pc)

A series of chert, minor limestone and sandstone of possible Mississippian age is mapped to overlie the metamorphic complex(Ppe) in the southeastern part of the map sheet. This series apparently takes the place of the metamorphic mafic igneous complex (PzMzv). The description of this series is similar to that of the Permian beds described in the Medfra quadrangle by Patton and others (1977). They probably form the base of the deposits of the Gemuk group of the Central Kuskokwim area, which consists of mainly clastic sediments of Upper Permian, Triassic, Upper Jurassic and Lower Cretaceous age.

Lower Cretaceous Chert and Argillite (Kc)

Only one outcrop of Lower Cretaceous chert, argillite, limy sandstone and limestone is mapped in the Ophir quadrangle. The rock description, and their fossil content, matches those mapped as undifferentiated Mesozoic rocks of the Medfra quadrangle and the deposits of the Upper Gemuk group in the Central Kuskokwim region. It is thus quite possible that the Upper Paleozoic chert (Pc) and the Lower Cretaceous chert and argillite (Kc) form part of the same formation.

Kuskokwim Group (Kk)

A regional unconformity separates the clastic sediments of the Kuskokwim group from the underlying deposits. The deposits of the Kuskokwim group consist mainly of sandstone, graywacke, shale, grit and conglomerate of Middle and Upper Cretaceous and possibly Paleocene age. The Kuskokwim group is presumably deposited by turbidity currents in a deep water environment. Ripple marks and other evidence of shallow water deposition are only found in the upper series of the group. The series resembles closely the Upper Lower and Lower Upper Cretaceous deposits of the Shaktolik group of the Yukon-Koyukuk basin. Sediments of the Kuskokwim group have also been mapped in the western part of the Ophir quadrangle. They continue to the north, into the Nulato quadrangle as Shaktolik group, while to the west, in the Unalakleet quadrangle, the same Kuskokwim group is mapped as metamorphic mafic igneous complex, equivalent to the Gemuk group. To avoid any controversy, the Middle and Upper Cretaceous sediments to the west of the Innoko River, in the Ophir quadrangle, have been digitized as Mesozoic/Cretaceous sediments, MK, while the Upper Cretaceous sediments to the east of the Innoko River have been digitized as Kk, Kuskokwim group.

Quaternary Surficial Deposits (Qal)

Unconsolidated, Recent deposits, consisting of silt, sand and organic material, including fluvial, glacial, lacustrine and eolian deposits make up over 50% of the area exposed in the Ophir quadrangle. In particular in the center of the map, in the lowlands area of the Innoko River, bogs predominate. In the southeast corner of the map area, near Ophir, a number of mine tailings have been mapped, related to gold placer operations in the area, and digitized separately as Qmt.

Intrusive Igneous Rock (Km, TKqd, Tmi)

Intrusive igneous rocks of felsic to mafic composition have been mapped in the Ophir quadrangle. They have been distinguished as monzonite, monzodiorite, tonalite with locally quartz monzonite and granodiorite of Cretaceous age, granite to quartz diorite of Cretaceous/Tertiary age and pyroxenite, gabbro, pyroxene diorite and diabase of Middle to Late Tertiary age. The intermediate igneous rocks cut the Kuskokwim group, and related contact metamorphism has produced hornfels in rocks of the Kuskokwim group and older. The monzonites have also produced hydrothermal cinnabar/stibnite and other base metal deposits in the Nixon Fork, Russian Mountains, Iditarod and other mining areas in the Kuskokwim region. Contact metamorphic alteration is also noted with the intrusives of the more felsic granite to quartz diorite composition of Tertiary/Cretaceous age. The latest intrusives are apparently the mafic to ultramafic rocks mapped as Tmi. Dikes of this unit apparently cut through andesite and basalt flows, considered to be of Tertiary age, in the Medfra quadrangle.

Extrusive Igneous Rocks (Kba, Kb, TKv, QTv)

The oldest extrusive rocks identified in the Ophir quadrangle, outside the metamorphic mafic igneous rock complex, are basalt to andesite flows, with minor gabbro (Kba) and related basaltic agglomerate flow breccias (Kb) of apparently Cretaceous age. It is believed that these flows and breccias are comparable to the Iditarod basalt, found farther to the south, and assumed to be of Late Cretaceous age. The dacite and rhyolite flows and related basalt dikes and sills of map unit TKv have, in contrast to the previously mentioned basalt flows of units Kba and Kb, not been folded. Since the folding is believed to be Pre-Eocene, these mostly extrusive igneous rocks are considered of Cretaceous/Tertiary age. The latest extrusives mapped in the Ophir quadrangle are basalt and andesite flows of Late Tertiary/Quaternary age. They have been mapped only in the southwest corner of the map and continue into the Iditarod quadrangle, where they have been dated.

Structure

Three major structural units are recognized in the Ophir quadrangle: The Kuskokwim Geosyncline, which is found in the southeastern part of the map and exposes mainly Cretaceous rocks; the Ruby Geanticline, which is found in the center of the map and which exposes mainly Precambrian, Paleozoic and Early Mesozoic strata; and the Yukon-Koyukuk Basin, in the northwest of the map, again exposing mostly Upper Cretaceous and perhaps Early Tertiary strata. The Kuskokwim Geosyncline and the Yukon-Koyukuk Basin were both folded and uplifted during probably the Early Eocene. The Ruby Geanticline was probably folded during Jurassic time and repeatedly uplifted and eroded since. A large part of the Innoko River lowland is believed to represent a structural basin, formed by subsidence of the Ruby Geanticline. This basin, named the Innoko Basin, extends to the south and southwest, into the Iditarod quadrangle. Thickness of the Quaternary deposits in the postulated basin is unknown.

A number of faults and lineaments are mapped in the mapsheet. None is considered a major feature, however.

The general strike of the strata in the area is approximately northeast-southwest. The older, consolidated beds are generally tightly folded. Regional metamorphism is widespread in the series of the Ruby Geanticline. Often strong contact metamorphism can be observed in the sedimentary beds intruded by the Cretaceous and Early Tertiary igneous rocks.

Economic Geology

The Ophir area, in the southeastern part of the map, and the Folger area, in the east central part of the survey area, represent well-known placer mining districts. Literature of the area is scarce and no information was obtained regarding active lode mining in the area. Nonetheless, the southeastern portion of the map area, which contained a large number of intrusives of varying composition, appears similar to other mining districts in the Kuskokwim region, containing copper, lead, mercury, antimony mineralization. Certain monzonite intrusives in the Kuskokwim area yield high uranium and thorium values. No known mercury/antimony or uranium/thorium deposits are reported from the present survey area.

## INTERPRETATION

### General

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

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

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

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

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

| Radioelement | Count Rate | Concentration |
|---|---|---|
| Potassium | 95.26 cps | 1%K |
| Uranium | 9.92 cps | 1ppm eU |
| Thorium | 6.26 cps | 1ppm eT |

Geochemical Analysis

A total of fourteen geological formations are distinguished on the geologic map of Ophir. As discussed above, in the chapter on geology, the Upper Cretaceous sediments to the west of the Innoko River were treated as a separate unit, MK, Mesozoic/Cretaceous sediments. The geologic formations of a number of bedrock areas were not identified on the map and these areas were digitized as unsurveyed bedrock areas, U.

A total of sixteen geological formations were thus digitized, plus water. Of these sixteen formations, four have too few samples to yield diagnostic histograms. These are: Qm, the mine tailings; Kc, the Lower Cretaceous chert and argillite; Kb, the Cretaceous basaltic agglomerate flow breccia; and Kba, the Cretaceous basalt and andesite flows. The samples of the formation Qm fit in well with those of the Quaternary surficial deposits, with which they could have been combined. The samples of Kc could have been combined with those of MK, the "Kuskokwim group" west of the Innoko River and also with those of the Mississippian (?) chert, Pc.

The histograms of the Quaternary surficial deposits show a clean distribution with one single peak for each of the six radiometric parameters. The mean values of the potassium, uranium and thorium concentrations are very low. This may be due to the preponderance of marsh deposits in this formation. Other formations with relatively clean radiometric distribution curves include Kk, the Kuskokwim group, east of the Innoko River; MK, the Cretaceous sediments to the west of the Innoko River; Pp€, The Paleozoic and Precambrian (?) metamorphic rocks; MzPzv, the Paleozoic and Mesozoic mafic intrusive and extrusive rock complex; and, surprisingly, U, the unsurveyed bedrock areas.

The potassium histogram of the Mississippian (?) chert (Pc) shows a very complex shape, with at least five (5) distribution peaks. A pseudo anomaly map was prepared, on which the samples below 0.17% potassium were assigned a minus three standard deviation sign, those samples with concentrations between 0.17 and 0.52% a minus one standard deviation sign. Those samples with concentration between 0.52 and 0.69% a plus one deviation sign and those above 0.69% a plus three deviation sign. The samples with the lowest potassium concentration are found over the westernmost outcrop of Pc on traverse 420. The samples with potassium content between 0.52 and 0.69% were observed on traverse 400 and over the eastern outcrop of Pc on traverse 420. The southern part of the Pc outcrop on tie-line 5140, near the intersection with traverse 400 also contains samples with a potassium content of 0.52 to 0.69%. The northern part of the outcrop on tie-line 5140 has the highest K content of more than 0.70%.

No effort was made to unravel the very complex distribution curves of the

Tertiary mafic intrusives, Tmi.

The potassium histogram of the Tertiary granite intrusives, TKqd, was divided in a way similar to the histogram of Pc, in samples with a content below 0.42%, those between 0.42% and 1.05% and those with a potassium content above 1.05%. The samples with the lowest potassium content are observed on traverse 440 and over both outcrops on tie-line 5120. The values between 0.42 and 1.05% are found on traverse 420, near fiducial 6330 and on traverse 400, over the western part of the TKqd outcrop. The highest potassium values are obtained over the eastern part of the TKqd outcrop on traverse 400.

The potassium histogram of the Tertiary/Cretaceous volcanics, TKv, shows two well defined distribution peaks which seem to correspond with similar peaks on the uranium histogram. The thorium distribution curve does not show the two peaks, but the ratio histograms involving thorium show distribution curves consisting of one single main peak, suggesting that the thorium, uranium and potassium distributions in the volcanics are approximately analogous. The samples with potassium concentrations of less than 0.78% are all obtained over the western outcrop and the western part of the eastern outcrop of traverse 460. The high potassium concentrations are encountered over part of the eastern-most outcrop of traverse 460 and on traverse 440.

The samples under the peaks of the potassium, uranium, and thorium histograms of the Cretaceous monzonite, Km, do not seem to correspond, in view of the irregular shape of the histograms of the three radiometric ratios. Only the potassium histogram was further analyzed. The distribution of the potassium appears to be a function of the elevation of the outcrops: the low lying monzonite outcrop on traverse 400 has low potassium content; the outcrops on intermediate levels, on the flanks of the monzonite stock of traverse 480, have concentrations of between 0.5 and 0.83%; the high potassium concentrations are observed over the higher portions of the monzonite outcrop on traverse 480.

Based on the dispersion of the uranium distribution curves, no formation sampled in the Ophir quadrangle is thought to be positively favorable as a possible host of an economic uranium deposit. The most probable formation to contain a possible uranium deosit is Qal, with a normal uranium distribution and a very low mean value of U = 0.7 ± 0.45 ppm. The mafic Tertiary intrusives, Tmi, also with a normal uranium distribution and with a high mean value of U = 4.1 ± 0.95 ppm may be considered a favorable formation on the basis of the high radiometric values rather than the width of the uranium distribution curve.

The formation with the greatest number of uranium anomalies is Qal, the Quaternary surficial deposits, with a total of 12. A total of 27046 samples were recorded over this formation. The formation with the most uranium anomalies per 1000 samples is the Kuskokwim group with 1.24, followed by Pp€, the Paleozoic and Precambrian (?) metamorphic complex, with 0.84.

Anomaly Map Analysis

In addition to the anomaly maps of the six radiometric parameters, pseudo-contourmaps at an approximate scale of 1:500,000 have been prepared of the total magnetic intensity with the I.G.R.F. regional removed and of the six radiometric variables. These maps have been included in this report. The grid spacing of these computer printer maps is 2117 x 1270 meters. As a result only the very broad regional features can be seen on these maps and narrow local events are generally not noticeable on these pseudo-contourmaps.

Broad, strong positive magnetic zones are indicated in the northwestern and southwestern corners of the map area. No geologic correlation can be

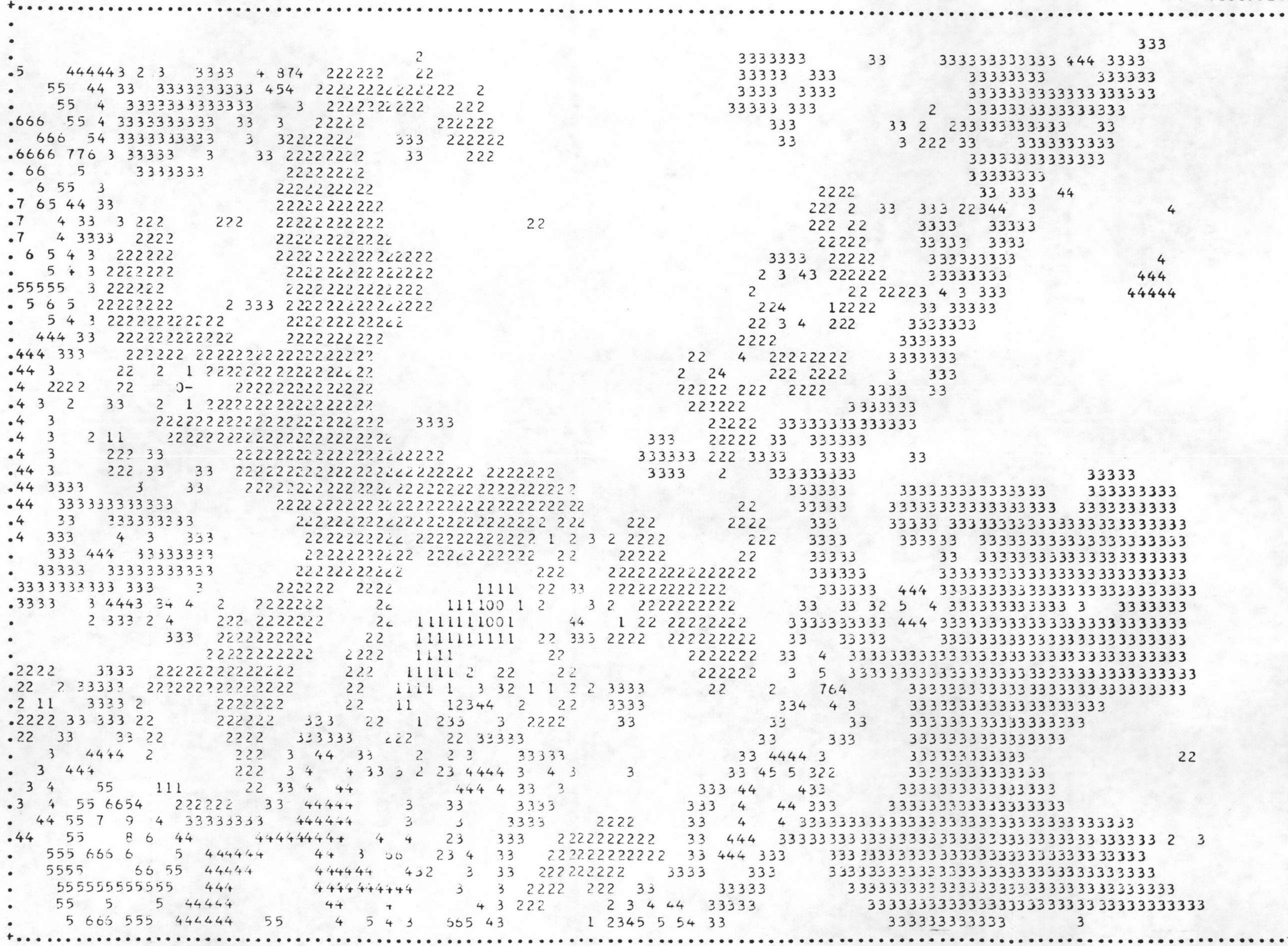
LEGEND TO TOTAL FIELD GAMMAS MAP

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 55000.0 |
| 0 | 55000.0 | 55100.0 |
| 1 | 55100.0 | 55200.0 |
| 2 | 55200.0 | 55300.0 |
| 3 | 55300.0 | 55400.0 |
| 4 | 55400.0 | 55500.0 |
| 5 | 55500.0 | 55600.0 |
| 6 | 55600.0 | 55700.0 |
| 7 | 55700.0 | 55800.0 |
| 8 | 55800.0 | 55900.0 |
| 9 | 55900.0 | 56000.0 |
| + | 56000.0 | |

ALASKA OPHIR TOTAL FIELD GRID FILE PRINT

X4= 500000.0
Y4= 7103552.0

X3= 662560.0
Y3= 7103552.0



X1= 500000.0
Y1= 6985000.0

X2= 662560.0
Y2= 6985000.0

FIGURE 7

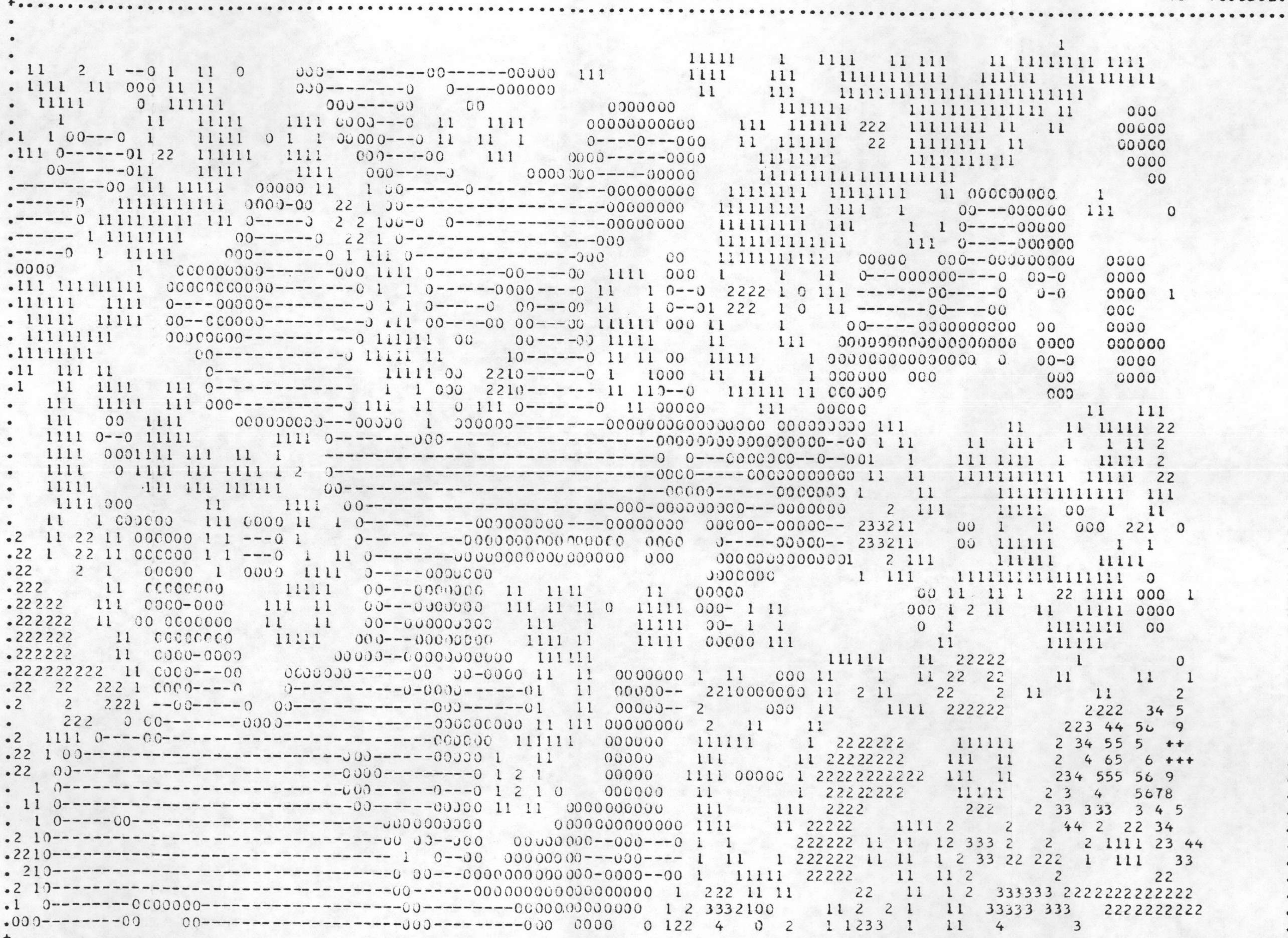
LEGEND TO POT AVGE MAP PPM

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 0.2 |
| 0 | 0.2 | 0.4 |
| 1 | 0.4 | 0.6 |
| 2 | 0.6 | 0.8 |
| 3 | 0.8 | 1.0 |
| 4 | 1.0 | 1.2 |
| 5 | 1.2 | 1.4 |
| 6 | 1.4 | 1.6 |
| 7 | 1.6 | 1.8 |
| 8 | 1.8 | 2.0 |
| 9 | 2.0 | 2.2 |
| + | 2.2 | |

ALASKA OPHIR POTASSIUM AVG GRID FILE PRINT

X4= 500000.0
Y4= 7103552.0

X3= 662560.0
Y3= 7103552.0



X1= 500000.0
Y1= 6985000.0

X2= 662560.0
Y2= 6985000.0

FIGURE 8

LEGEND TO URN AVGE MAP PPM

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 0.4 |
| 0 | 0.4 | 0.8 |
| 1 | 0.8 | 1.2 |
| 2 | 1.2 | 1.5 |
| 3 | 1.5 | 1.9 |
| 4 | 1.9 | 2.3 |
| 5 | 2.3 | 2.7 |
| 6 | 2.7 | 3.1 |
| 7 | 3.1 | 3.5 |
| 8 | 3.5 | 3.9 |
| 9 | 3.9 | 4.3 |
| + | 4.3 | |

ALASKA        OPHIR  - URANIUM  AVG GRID FILE PRINT

```
X4=  500000.0                                                                                                                   X3=  662560.0
Y4= 7103552.0                                                                                                                   Y3= 7103552.0
+...........................................................................................................................................+
.                                                                                                                                            .
.                                                                                                                        3                   .
.                                    0                          1                  222 1 1 2 32  01  22222 1   222 2                        .
.2  222 11     1      2 1 111     00 00---0  0  000011111 2 2222    1        11   1  22  1  2   2 111  22222          2                   .
.2      11   1 2     ? 111111111      0000 111       11111  22222           1  11        2222222  22     2222222  1111111                  .
.222   1111111 22  222           11         111       2222222 2222        111111111  2 33    33  22222   222     1 1111                    .
.2222 11    112  33    2222  22    2  1111111 2  3333333     22     111111          11112 3  3    333 2   2 3 2222 2 1  1  0               .
. 222 1 000 12 3333 2    2   2 333 2 111111   23333      33   22 111111111   2222 111 1   4 3    333 2   2       2 1111111                 .
.     1 00--0 23      22222  2      2  1111111 2 333333     22  111111111     111111 2 3 33     3  2  222   2 1  111111                   .
.1111  0000 12 3333 2222     22   22   1111 00 122222  222     11111111111  1   1    22     22222  222       1     1    1                 .
.0000        11 22   222   11111   222  11   000                           11111111111  2     2         22222 1111  11  1  222 11          .
.000000           2222222  1     1  222 1   0     00000000000000       111 11       2   3 2 11        222     1  11      22  21            .
.0----01 2  11   22    2 1 000   1 222 1 0 1 1 0-----------000        111    1 222 2   3 21 111111 2221 0   1111  1  222  1              .
.0----01222 111        11 000000 1   11   000000-----------000        11111111   2 222   2 11111111    1      11    111       1            .
.00000 1     111       11  0000000 11    1 0---0-------0000  11       111 111              11        11111      111    111  11            .
.11111111          11111111  0000000   1  2 21  0----00           1 2    2 1   1        1    11 1 0000  1   000 111      11    1222        .
.22                1    1111   0    000   1  332  0----0         12 33   21 001 22       1 00    1 ---0  1   000 1111           1 2 1     .
.22 2              1 0   1111 00    0--0 1   332  ----- 111 0    1 2 333 21 001 22222 1 00 111 0000        00  111             1          .
.2222              1     1111   00000000 1 2  21 0000 111      11 2    22 1   1 22   2 1      1  0000          111111             1111     .
.2222              11          00000000 11 22222 1  1111  00    1  22   1111   22   22   111          0        11     11               11   .
.2222        1      111     0000000---0 1 22       111    1 00-000 11     111 222 11 2   2 1        00        11  2   11     111 00   111  .
.  222              111       0000000---01222 1   1     2 21 ------0 1    1       2 2    2 3 2 1  111 000 1 111 2     1     111   0    11  .
.  222 1   22 2    11 1 0    000000---01222 1   1   12 21 ------0 11 11 0 1 2222222 22 111111          1111           1111111          11  .
.  222     222          11      000000-001    1      111     1 0-----00  111       1                111 111111     111111    11111111       .
.222222  1  1 2          111111           000   1111    11   11  000---0000          111111111          11     1   111111111         1111111   .
.2222222  111 222 1        1111111 000               00000          00000-----00  1                    1 22 1   111   1111 1       11 1111   .
.222 2   2 1 12   211     2222 111  1 0000 00---------00      00000-------0 1 1    1       1          1 2 21   111   1111   11 111111111   .
.222 2   2 1 12    11    2222 11    1 0000 00---------00      0000------00                          11   222 11111111111111   111111111   .
. 22222222     22   1    22   11     11  00000-000----00      000000000000                 111111 22   222    11111 111              1111   .
.  222 22 111                1111        11 000000000000             000000                      1   111 333     2  111      11          1 111  .
.    2    2 111111111   2 1    1 22   2   0-----0000         11      00000 111       11        1 221  13   3   3     111 2221          0 1    111  .
.3 22   3 2  11111111 2210001 2 33     0----0000        1111      00000 1    0 1    000      1 221  13   3   3   1111   2 1111    11  1111  .
.3  2   3       11111111 2210001 2    2 100--000         11111     0   11    1  111   00   11    111  333    2   111       1  11111111111  .
.           2 111111111    1    1 2222  1 00000           11111111111111     11111              11111  22 2222       1111     11   11111111111  .
.              2  11111 111111    22   111         111  11    11 2222 11         11         1     0  1   222           1111  11    2111111111 2 .
.                  1          11   222222 1111    0     11            11    3 2 11222       1 00  111 000 1   222 1111     1    22     22 1111111111  .
.           2 1  1          1 22222   1  11 00 11    00 1  1       332 11222      1   0 111 000 1   22    1        111              111 1111111   .
.         33 211            11   2222 11                     11   2    2     22        11      11          1                     1111            .
.3        333 2  11         11        111                0000     11  22222   11             22 11   111111  222                2222222           .
.333        3  2222 11        11     11 00              0000    11 22    2  11 11   1 2 3 2 1111111  2222              222222222222   2222222222   .
.4 3 2      3333 2 11         11     1 0-0      00     000000 11 2      2 11 0 1   112 4    111111  222222              222222   2 22              3333 .
.     222   33   321      000   11111 0--0      00     00000   11 2      2 11 0 1   112 4    111111   222222             22222222222222    333   45 6 .
. 3 2222 2 1   211    000     111   0000          0         000       1   2      2  1     1    1 23 3 2            222222222                  222222 223 44456   9 .
.33 22     1 00 11                000                   0000     11 2222222  111111   22     222222    22222222222                  22222 3 4  44  68 + .
.     2 11 0000      00          0000 0000 1111   00000   1 2     22222   11111   22222222        22222222    2                111 222   3 4       4 8  ++ .
.   2   1 0-00       0-0   11 0000 00000 1    1 000         11 2 3  22222   111111 222222 1 1 222     2222  2                111 2222 3 44444   7 .
.      11 0--0    00--0 11 0000000000 1    1 000         111 2 3 2222     111111    222                  222222222222                     2222   33     4 5   88 .
. 22 11 00      00000            00000000000 111   00     1111 22222         11111  11                       222222222               222222222222            3   5 .
. 22 11   0      0000000000000000000000000          0      11                1111          00   1               1                111 22       22222      2     22   4 .
.   2 11   0000---0000000000000000000------00 1 00    1        11           0000000000  1    1111111   22        22 1    2    33  222222    2 111112            .
.   2 11   000----000000-----00000--------01     100 1       1        000000000---0  11   1    11     22       22 1   122           22222           111 2 33 .
.3 2 11   00----0000000000-00000000----00 11 00   1  11       00000000000    1      111111            22   111    22           22           2222    33 .
. 22 11   00---000000000000000000    000000           0000     11                    11    222    111           22222222   1111     2 333    22 222          333 .
.     11     00     11 11 00-000   111   00   11 00-00               11111      11111 2      2 111      2222 33 22 11   1   333333 2 22       3     333 .
.        11  0 1         22    0--000   1 1 000   1110--00         0 1    1   11      12    33   32             22223    2 1 1    1 23              1                .
+...........................................................................................................................................+
X1=  500000.0                                                                                                                   X2=  662560.0
Y1= 6985000.0                                                                                                                   Y2= 6985000.0
```

FIGURE 9

LEGEND TO THOR AVGEMAPPPM

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 1.0 |
| 0 | 1.0 | 2.0 |
| 1 | 2.0 | 3.0 |
| 2 | 3.0 | 4.0 |
| 3 | 4.0 | 5.0 |
| 4 | 5.0 | 6.0 |
| 5 | 6.0 | 7.0 |
| 6 | 7.0 | 8.0 |
| 7 | 8.0 | 9.0 |
| 8 | 9.0 | 10.0 |
| 9 | 10.0 | 11.0 |
| + | 11.0 | |

ALASKA-      OPHIR  - THORIUM AVG GRID FILE PRINT

```
X4=  500000.0                                                                                                              X3=  662560.0
Y4= 7103552.0                                                                                                              Y3= 7103552.0
+...........................................................................................................................+
.                                                                                                                           .
.                                                                                                                           .
.                                                                 1    1    11111 111   2       2222    11 2 222      22    .
.2 11   22 1 --01   2 1     11 1  0---00---00000--000        11       111    1    11 1    111        2222   11   22222      .
.   1      11 00 1 22   1    1111    00000--0 11 00000       111111111      1111111     111    2222222                111111111 .
.  1111        11 22   11111111111     0000 11 111   11111111111              111    111         22    2222222222   11    11 11 .
.   1          11 2   22       1111 22  1   00000 1           111111   00000000   11       111        22      222222222 11 1 111 11 000 .
.1  1 0----0   2 33 2     2    1    2 1    00--0122 11 22 1   111 000000-00    11     111        22     22222    222 11111111    00 .
.111  0-----    23 3 2      1111 222 11    0000   1 11    11          000000000      111                22    2222            11111111 .
.     00----0   2 33 2    11111          11     00--00 111111           000000000      11111       2222222222222     11111       1111111 .
.-----00000 1  222222     11          11 2222 1 0---00000000----000000              1111     222222222          222  1            111111111 .
.------0 11        2222      1    0000 1        1 0000)0-------------000               11      2222     2222   11 2 2 1  000000000   11    111 .
.------ 1            2         1 0--0-01   33 2100 110--------------00               111   22222    2222   1    1 22 1  0--000000   11111111 .
. ----01 2               111100-----012      1 0000--------------00                   111     2222222     11    11   1    000000000      1111111 .
. 0--0 11               1111   00-----0 1 22   1 0---------------00    111111      1         2222       11                000000 00000 .
.111   11111111111             000-----000 1 22 100---0000000--00  1   2    1 0    1 22    22 11111 00-0000000---00   0000   1    0 .
.                 1111   00000     00---------01 2 21  ---0000000000-0  1 222  10-0    2       22 1 11    ----0000------011 000          0   111 .
. 22     222 1111 00---00    0---------   12 21  ---000      0--000 12222 1 00    2        22 1 111 0---00000----00                      0   111 .
.2222 222   1111   00000000---------0 1222 1                000000 1 222 1     1 22      22 11 1  000000000000000                              1 .
.222222        111     0000000---------0 1   2222   11111   00--00 1      11   11 22     22   11   0000                        00000       00 .
.                11       11   0------------0          2    2 1 22 10-----0 1   2 1      1   222222222 1 0000                   000        000 11 .
.        1      11       1   1 0------------01 22 2221   1 3 10-------01 22 1000    22    222 22 100-00 111   111111          000          0000 .
.      111 22 111 221  0------------01          221   12 210------0  1 2 10-0  1  22222       1   000   11111111111                              0 .
.      111      111      1 00000--------0 1111      1   1        0------0 1111 0000 1111     111      00   1111111111111 .
.222       11       11       111                   0000000      111               0--------0000 000000              00000 11    11111111111             11 .
.222          1 00 1                 11111 1 0--------0000-------------------00   000000000000000000 1      11 11111   11          11              111 .
. 22            00   2 11              11122   0-------------------------------0   0--000000000000000 1 2    111111    11          11            1111 .
.  2             1 0      11          2 11 22 10------------------------------0000-0000000000000     1       111111    11        111           11111 .
.  22           111111             1   2 1 00-----------------------------00000000000000000 1    22     111                              1111 .
.   22222 1 C   11111        11111        11 0--------------------------0000000000000000000       0 12    22 11                        000 1     1 0 .
.   222          1             111   1 000  1 222 1  0---------00000000000--000     0000      0000000        00              1 1    00       11          0001 2 1    0 .
.3 2 2 33 2       0       11 2     ---   1 2   21  0---------000       0000000000      00   1 00-0000       00              1 1 00          1                1      1 .
.3 2 2 33 2       0        1         ---  1 22221  00------000                 000                  00000              12    2 111                11             11111 .
.3   22 3 2 11              1111 000 1    22 11  000000000         11111111      111111                          11       111               11   11   11111    00 .
.      2 222   11       00          111   2   11    000000          1111111     11 11         11 0000 1111                                11111111        22 1111 000    1 .
.      22222   11       0000   11    22222  11    0000000              1   111 22 1 1     2  1 0--    221       0             00 11111111111     1111 0000 .
.3       22222 11         00000 11    2     21   1 00-0000            11 1112 2 1 1      22 1 00-    22       1                    1111111111111111         0 .
.          22222   1        000       11   222 1        000000             1111    222 111             11 000  1111                   11111111111111 .
.3             2222    1    00000    111 111        000000000000          11    222    111111111    11                111111                 11111             11 .
.33       333     22 1    000000 1111    00000000000000     000000 1 2222 11        00 12 2 11    00      11 1111             111111             11          111 .
.33       33 33    21  0000--0 1    1 0--------000000-00000      2   2 11      000-1    3 000000    1        11    0  1111111               11111 .
.33        3       3321000---0 11100------------00-00000-0000     22  2 1    0000--134            000     11    111               111111                   22 3 4 .
.     2       32 1111000-------00       0--------------0000000000 1   22    1     00000 123 2 11        111111111             1111111            2   33 4     8 .
.   2              0--00000-------00000-------------00000000   11             111    0000   11      11            11   11111111 111   1111     22 3      34   9 .
. 221        0------0000-----------00------000000000000000 1 22 111111 0000                           11    11 1111    1111   11           2   44    3 8998 .
.32    000--------000------------00------00000-000000000    2     1   111 0000                 0          1      11 1111111111111            2 3      3457888 .
.221  0-------------0---------------------0000-000000000    2  2 1     11 0000                       11      11111111111111111           222 333 456777 .
.2 1  00--00000----------------------------00000000000    1  2    1               00000                111          111111111               222       2222     34 5 .
.2       000000    0---------------------------00000000000       111111             000000000   111111 111     22    1111      1    22222        2 33              2 3 4 .
. 2      0--000000---------------------------0       0000  1111         000000000-00   11 11       1     2222 11111    1 22     22          2 2 111111     333 .
.3      0----00----------------------------0 11 000  1    1 000000000000---0011 11       1     2222 11111     11 222222     22      111111 2 3 .
.3      0-----------------------------------0       0--0   11   0000000000000000 11      11111      2222   1111    11    2222222                   222 .
.2210------00000----------------------------0000000000000000000000000000     1        11    11                 111111 2222222 2222222       2222 .
.11 00------000000000----------------------000---000000000   0000000       11 22 2     00 1       111 22        11  11 2 2222       222222          22222 .
.00000-----00    1     00------------------00----------000    00000          1    2 3 2 0 1        1 1       2 11     11 2 3 .
+...........................................................................................................................+
X1=   500000.0                                                                                                             X2=   662560.0
Y1=  6985000.0                                                                                                             Y2=  6985000.0
```

FIGURE 10

LEGEND TO URN POT RATIO MAP

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 1.5 |
| 0 | 1.5 | 2.0 |
| 1 | 2.0 | 2.5 |
| 2 | 2.5 | 3.0 |
| 3 | 3.0 | 3.5 |
| 4 | 3.5 | 4.0 |
| 5 | 4.0 | 4.5 |
| 6 | 4.5 | 5.0 |
| 7 | 5.0 | 5.5 |
| 8 | 5.5 | 6.0 |
| 9 | 6.0 | 6.5 |
| + | 6.5 | |

```
                                     ALASKA-       OPHIR URN POT RATIO GRID FILE PRINT
X4=  500000.0                                                                                                      X3=  662560.0
Y4= 7103552.0                                                                                                      Y3= 7103552.0
+..........................................................................................................................+
.                                                                                                                          .
.                                                                                                                3         .
.                                               -                 33     234 3    3  333 21 1    4  0  2 2    2 2 22222    .
.1 443  011  9     3333  223 2      45    22      6  34 3    543 4444  3 2   2 4  2 2    33  2          11 22  2    2222222 .
.2 3  2 1 2 5  54 33333  2 33333  4   4322       444444 5  444    44 3  2   22222    3  22  3333 2222  3   222 22         .
.22 3  2  2345 54  3333333      44   5 6 4   345  5555       666   55 4 32 1      2 3    22  443 22  3333 3 32   233322    .
.222 33  1     4       33  4  4 4 5 55     64334 56 5 67 76 6  887 77 65 4 3222 11      43        222 3334   4    3 22     .
.2 23 4  2  44         33  5543 5 6 5 79+      77 4 78  6 568 986 8   4   3   1 124  5            22 3 34 432  222       3  .
.22 3 4 3 4 54333      33 44  44+ 5555  6 87 5  66555677  556788 7 7765  43    11   4 43 2  44 3  33  4 3211  2  333 3     .
.22 3     444  33   33   +  4444    556 77   6    55 5 66 555 6 7 6666 5  32     22  333           333 4455 3      3   3   .
.222 33 333333   333333333 4 55 4 3  3 4 67  5      4   3   3  444444 3  2     22 33 2  22 2   2   4 56     22  3  443 2   .
.  223     3 2 22  33333333 45 5  2   2345 543      3333       2 3333   3 2           32 11        23 4445       2 2  345 3 2 .
.   23      2 11 2  3333 33 34    21  11 4 5      22 3     10 123 2  3 32 11 2 2 2 3 32 11        23 44 56776 3 33 44 4 3  .
.    3 33222 1  2 3333 33 345  4  111  34 32     2     22 11 22     33 2    2  222     2  22  2  23 44 5 66      333 4   4  .
.11 2 3     22   2  33333333 4555        2 33 2  2222     333333333             22  22      222    3    33  44444 444 5       56 5 .
.    222         3   444      44      333333 3    3       3 4    55 4 33    33   3  11111   112344 3 3   554    444  4443       67 .
.    2      22   4  444 4444  3 55 4 3     44555 +3      3  555   54 33  33344    0  1        3 5 322   66 3    4333    21 1367 4 .
.2   32 1   2 22 5  544 54    3 3 86   2454344455 5        34 5    5   3   33 44  11111            43 3     5     44 3 3   1 23    43 .
.    2      2 3 4  44      44 345 5   3 44 444       3    33     555 4  33333   4    22 11  11   3  333 4          4 333  222 3   3 .
.2     22 22   33 44444       44  4+     4  333   333       333 4  4 3    33      3  111    1  23 4 3222 3 4 5  5    3333   222   33 .
.  2222222   34444 3 4 5   5 4 3 3 365      22 3 3 2 2   2      54 2   2           32 1 222         4  1 2      5 6 53 34 4   2  2 33 .
.   22 22 23      3   3            21 58 63 2      4    1 23   0-   652     1 44    44 2 2 3  11   56  101   2 3   6 53 3   4 2 11 2 3 .
.   2          2     321 33467    2 21 58 63 22      4    1 23320-25         1 44 3 44 3   33 2223     4   11 22 34 554 33   3 2   1 2222 .
.   2        22 333222 345     3 2     5 5  2222 3 3 2 2  2112 4     11       44444       333333      3 2    222   333333333 2   11111 .
.  22 33 3333      2   3 444 3222  444 3       333333       2 2 333 222   33 4    5 4            3 2  1 22      22 3 3 2 1 11110-- .
.    2  34 66   33 22 3   33 2 1   4 4   2   33 444 33   3    3     33 33   3 345 5 4     4 4    44 322              23     1 0    10--- .
.   23444   33 43   123        21 02   53       3 4444   333333 44 3 334 43224 6654 3     54 44 43 2 112         11     321    111 0--- .
.   234 4     3 43   123          1 02   531  2  4    4444 44          333   4 3 3 555    55    55 4444 3 22    2 2   11   2 2   00 111  00- .
.2 2 3 44    4  3 2223333 22 1      443222 2 34 55 4444444       33333      3333 4     555     5   4 33          333  222        1111 11 .
.22   333456654   3       333333     333  2  2    5 4444     4   22   3    33     33 44 5  666     33   33     444  3    111 2222 1   111 .
.2   33  33        4    222   44444 3       2  1      444   44 5 43 2 2 344 3              34  666    6   3  234          4    2   0 112  2 0       4 .
.22 333 2222 3444   2          44 3        2 11 1233   3   4    5432111  4 43 2    222 3 6 7 6   4 3   2344 444        3   111 22222 1 233 .
. 2233 22   2   4 4   2          5 444 3 222   11       4 3   4    4 32   2 344 3          22 2 45    554 33 33 44 44   33 2      22 2      2 3333 .
. 22      22222 3 44 3 2 3 4 444   3 22222   23 44             333            333 33             222 3                   4444 32      2221111111   4 4 .
.  222          33333   4   4 3          3 22     2  33 3   44            222   33    3333        333 33    22    1 2    +444444 5    21 1    222222 1 013565 2 .
.     2    3    33 3   5 4 33       3 2 111    3333 +      222 22 22  3 4 3333 2 3        4   12 1001   4444   45 5   --          22222    013 65 2 .
.       333 2        345   333         1          33 45 3 112      22    3 4 3333 2 3    4   2112 10- 2   4     44   43     0 1                1 23 5  3 .
.     22 3 4 33 33 4 4             2       2 3        33 2222 3       33      33333333   4 4    3  11 1   3        444      1   1        11112   3   4444 .
.22    22    44 3 3     4444       4    3 2 3  4     3   11 23 4   4 33             3   44    444 33333    222222 3       32 11111         1 23 44      4 .
.  2        2   2     5      455 4  4   432 4555                1          7 5    22    2234 5 665 4    334    4    22 22 3 4    211    11222 22 3 4 4 334 .
.3 2 111    223 66 32     7 43    653125 7 444 3   2         8   6 222      2345567 5+4 55 5 5    2   122 4            0  2  222 33        333 44 .
.432 1111  2   5775            8     3     3   5 76 +      33         89 6    222     234 5 7 543 4 4 55    322      2 3 32 1      1 22222    2   33 .
. 3 2      22334566 32     6  6 4 5 543 566 5 44 3333 4567 7 43     22          5 66654    2 2      4    22       22   22               222 1 11 .
.3333            456          345 5            5    6      44 3  3      5555    44        44 55555 443     3      4   2                       1      2222    22 1     1   111111 .
.2          3352 478 32 23     5 5 44 55    6 6    4   333 5 54333     55 4 4555                 444 4         32 11111 2 11   2222        222   11 0 .
.     3 3++3 69+9 2 1 2345 6     4   5    7 6   34 4       5   22      665434 6544 5 32 5     66 6 3 1 1111       11      222         222 1          0 .
.33 3    ++9 79+9          2345     + 34555 67 6   3 45      65   22    66    3+55 4444 33 4444  554 2 111111     1111 222             11      0 .
.   3   63      5 76 2 2       45 4    4  55       54 3 4      6      3   34 5        444         3    33 44    3 2 11111         11111                 1 000 .
.22 34555    2       4 333          3    44444       4   33 345       4 3333       333               2222 3    32  1111   1   2    1111111111       10000         11 .
.            3 22 33    44 3   1  2    4 4 333    22          3          444    3    2          22 2222211 22222 10 11 0    222111111    111        1   111   1111 .
.  1 12    11    333       43 1    12    54          2    233        4 544    33       22         1 12 221       1          0 11 0    22211    2 1   11        111    1111111111 .
. 11                2 333     4 2 11       4 + 33      2222 3 4        4 44      3 2222 22         22 111               2 1    11    1 22                11    111111111111111 .
.  11    33      223 4444 3 222      4       4 3               22 4       4     33333       222222    11 222     2211      2         222    1 00 1111               11 .
.        4 4     2 33 4    66 3222        6 65     2 3332    3+      54 33 44 3        333 2     1 1    5     42 12 33 2     2222     0--011 10                           2222 .
.        3      54333       46 7 31122      7 9753 23           3  6 6    32       54      2 43 2           -146  5 0 12 4   2      222     0---0              - .
+..........................................................................................................................+
X1=  500000.0                                                                                                      X2=  662560.0
Y1= 6985000.0                                                                                                      Y2= 6985000.0
```

FIGURE 11

LEGEND TO URN THOR RATIO MAP

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 0.1 |
| 0 | 0.1 | 0.2 |
| 1 | 0.2 | 0.2 |
| 2 | 0.2 | 0.2 |
| 3 | 0.2 | 0.3 |
| 4 | 0.3 | 0.3 |
| 5 | 0.3 | 0.4 |
| 6 | 0.4 | 0.4 |
| 7 | 0.4 | 0.4 |
| 8 | 0.4 | 0.5 |
| 9 | 0.5 | 0.5 |
| + | 0.5 | |

ALASKA- OPHIR URN THOR RATIO GRID FILE PRINT

X4= 500000.0
Y4= 7103552.0

X3= 662560.0
Y3= 7103552.0

```
+.............................................................................................................................+
.                                                                                                                             .
.                                                                                                     3        2              .
.                                             -                    4443 12 4  2  2  22  1  1  3 1 01  1 2222   2              .
.1 4 432122    4    333 322        3     3         11    3 4 33 3  44432 2 3 211 2     2      2  22   2222222  2222222        .
.2 3 3 2  233 3333333333       333   444 3 222333 22  33        44444 3  1  1111 2 333 22222   22222          2222 2222       .
.            333333333333333333333  44  43211  3  3  444               44 321   11  2 3  33          2222 3333 33 2 22   22   .
. 222   2  2       3333 333    3333 44  5   32234  4 45 66 5 55  55555444 32    1 234  4  22    3   2 334566  32 12222 2      .
.322   32222 3     333     4 54   34555 3786323 77    887655567  56 65 45 4321 1 1257   1123443 2   2 34 43211 22222222       .
.334  4 2 223332  33333  444 333  44 566654  4  44  6  5   5555555 4 443  1111   44  222 333 22  3   32111 2  22222           .
.  3   3 222   22 33  333   33333333 4    4         4444444444444444  33 21  11  2      2222222    3  4432  2     222          .
.   33333   22222         3333  33    33 444 333333333333333  3  333 2 1111  22222 1 222 1 2 3333 4 554322 333  2            .
.   33  333 2    222      333    3 2 11 2    3 222222 2222222        3 2   11 11  2 210- 2 210023 43  457753         2 1      .
.     2222 1  1 2222  222 3  4  2  000 23 32  1    222 100  2  1  2   1  1 2  1 23      222 112    3   5    333  33 2         .
.    22     22     2222 2 22 333  3 211 1 2 3 2     22222 1  2222  2222   11        2222   2222222 33333  44 3   333  3       .
.    22222 22222222222222     3     32    222        222          222222222        1111   2222    2  333 33      5 5   3 44 3 .
.   22222        222222       33     3 2222 1 01     22  3333 33 2222    222  1      1 22 333 2 34 3222 3333  4  123  544     .
.  222      2  3 3  222     222       3  2 3322     222   33 4 4     22    2  21   0 --0  2334432 25 531    2     4   0    7 4 .
. 2 2 11 12 33   43   1 33321    4  44 3 3 4 3 22 23 2   3   6  43322     33   111 00   12 3    3   3    222 33  22        321 .
.22222      2 3333 2222 333    3        33 33   3  222     3   4  4 3           22    2 111   2 33  3          33   3333 222 3 3 2 .
.222222     2 3333      33        33333    3    2222222222 33333333    2  333     2 111111   2 3    322 2222   33 333     22       3 .
. 222222 11 23          3   6 6       3     3   2 111 22222     3 2       2 33333 21 0 1     2 4  4   11    2 3 4 4 3     3221    34 .
.  22222222 34  4  2 2 3     7 532     + 43 2 1 1 222 123 5   2 -00     2 44 33 221  23321124675    -0  1  34      1 3 432 23   3 .
.       222     4431012? 55 64 3211 4 43 2  012 221    56 4321         33 22 33 222    22234        111       3     3   33 33      33 .
.   2  22222 3332 22 3     3   2  2333 22222  33    2 3455543 2 11 1 2   2 33333           33    3 2          22  333333333333       .
.    22   2111        22  3      3  222     2222    3 44     4 5 4 33 22  11 2   3 44 333333333333 33 22 1 22   2   3       33333 3   11 .
.    22   222         2 2 3    332  2 3 2 1 23 4 555   44 444 3  22   1   2 455 4   33 3 33333  3    1   22   12        443   3   3   0 .
.   2 33323  4 3   1   3 3 32   02 43  0 1234 5    5     444   3 222                5 333 4543 334 3      0   2          443 22 33   23 4 .
.1   233443333 4    012221 22  1233    1  3       6 5  444 33 22       222 4555 4 4444444  3333     2 2    2       3 2 1 22       33 .
.  22 333333   3       22     222   2   2 11     5 88     55 44    3 22      22  3 4 444    33 44    33333333333333333333 22      22222 .
.  22    345      3   2222222222222         22 468 8    55 44 3 2 1    2    333        33 33   44     333 33   4444 33     3 222            22 .
.  22 2222 3 4   3 2   222222      222 3 32 1111234     5554   2 11 23333  3333     3   44   43 33 23   55     433      3     2 2111112 34 .
.  2 32 111234 43   1 2 2      3 32 2   432 -- 35 532       54        2344            32 124      5  4 222         55   433  4 3       2      2 3 4 .
.   2  22     2 3    3 2 22 222  33 2  2 3  3 1   2 554 33    4  3 2   2 33 3             22  2       4   33333  4      4 333      33      3 2 22 3 .
.    22222   2 333            222     22222     2   2 333333333        22    33              2 1 2     33       44444      44 3333333           1222 3 4 .
.    222   33 333   3333            22        222       22 33322222                     2                22     234           44 55543 2 3   33 222      2 4   4 4 .
.    22          3   223 4  3 333     2 111 22       3 44           22    2     3 3          2 333 32 11 0-       65 5444566     1        3         2 1          2 .
.1 222 33 21 11    345 3   3 3 21     1      23    5421001222          3        22 211         3332   2      12 4 5           55543 2 333333               4 4 .
.    222          3       3     333333 2      22       3333  11                                 22                  3333 333 22223 4                4 3333333 2 1    3   444 .
.22       22 3    2233 3333333333    222      333333 2     1 2 3     33       2222    33          333 222 33    33 44        555    4        33     222       55 44 55 .
. 22       22    234    433 4    3 333322     444 333     1 1        55     2       222 3    55     333    3        3333     444 55 55    444      3 2    34 67       345 6 .
.3 2 1111       4 65    3455432244 212     6 3 4332         3     7     5     111    1     4 77       3       455 43               44 5 555 4444 43 2 34555 5 444 5 .
.3   1 1    1 2 46         2466 3 255 2 2    753 4       333 3 56        3  2    1112356 6543                34 4    33    444 5555    4444    3          3    4  44      4 .
.33 22222        6 6 3345543    33322 455 4 33333         4 55 4 3    2222       5     5                   4 44    3   444            444           333 2         3         3333 .
.3333 33 2      45 5 44      4 3 222223 444 33      222 3 444444        33333 4     555    43      6 6 4 333 444        44            333333 2    2 33 3 .
.   3   44   3     665 3       5   32111    3     4       22            44      33 4        43334 55     55555 5555              333 4        4 4433  333 3  33333 22 3 32 2 .
.  33 56        6   7 2    6776543    -0    3 55                   24 65          5 6 32367     4 6    5        545 5    3344        44     33 333 3     33333          3 222 .
.      5      75    897 11478 65               233+555 21 2 + 5                 345543 455 444             44444444 333    4444       333                            33   3              22 .
.  3 44    43 2    543                4 3 2222 33 444 3 3455 54   3333 44 33 44              44444               4 3            33                3333                        2      22 .
.        33    211 23    3333333                            3333333   34    54 3333333333     33333    3     3  4443 2222      3     3         3                 22      2 11 2          222 22 .
.222           0012344 32      11           33                               32    2    333333     222222     2       233    22        22    2    0 3     3     2 33       222          22             2222222 2 .
.2 1      11 00            54           000 1 3 33               2 22                    332233332         1 2221--0122 221 2         11          1234 3222 33 2      22        222222  2 .
.2 1       1      0    34 4    111       22 333            33                              3333      22222    2             2222    333 2      2222      33       22            2                     22 222222 .
.22 111111    12      4 33 3333          33 4           4+4 3       1 22 33333       333                                     3 3 3        22     3333333      2222 2    33      2                  222 2 .
. 22 1111111 2 3 4                4 333 43566666         00123    33 4444 33      33333333        334                 22     444 333        22      112344322222             222  2      333 .
.3  2 1    22222 3 4 5 6 6    4 3 3 5     8        88 42 2                3 3455543 4       43           3213 67                 11             543 3 22 1      1                -  .
+.............................................................................................................................+
```

X1= 500000.0
Y1= 6985000.0

X2= 662560.0
Y2= 6985000.0

FIGURE 12

LEGEND TO THOR POT RATIO MAP

| CONTOUR VALUE | LOWER LIMIT | UPPER LIMIT |
|---|---|---|
| - | | 2.9 |
| 0 | 2.9 | 3.6 |
| 1 | 3.6 | 4.3 |
| 2 | 4.3 | 5.0 |
| 3 | 5.0 | 5.7 |
| 4 | 5.7 | 6.4 |
| 5 | 6.4 | 7.1 |
| 6 | 7.1 | 7.8 |
| 7 | 7.8 | 8.5 |
| 8 | 8.5 | 9.2 |
| 9 | 9.2 | 9.9 |
| + | 9.9 | |

ALASKA-      OPHIR THOR POT RATIO GRID FILE PRINT

```
X4=  500000.0                                                                                                              X3=  662560.0
Y4= 7103552.0                                                                                                              Y3= 7103552.0
+.......................................................................................................................................+
.                                                                                                                                       .
.                                                                                                                5     66               .
.                                     4                                          55 5555 66  6666 66   5555   6  5555 4                 .
.  443     22     5 55        55   7  34   9        ++++   7  65    6    3 4 555        55 6666    66  6 555    5 44  5 444             .
.444 3 3 44 33  55555     55  6 66555 7 76  6789  9     7 6 55  6     444 55555      555        66666    555  444444                    .
.    333  44444 55555555555  66 66     66666  7     77  66 55555  55    55 66  55555      55 6666       5 4   4 44 555                  .
.3  3    4   55 66  5555        6 7 6555    6   666 6666  55 44     55 555     55           5 6666       5 44 44444  6                  .
.3 43212 5 5 5 6  6 555      55 67  6 4     5 6 6 5555 66 555433 6 55    5 5      5      44  55  666       5 444        5 5555          .
.33  4 3  3 556 776  55555     5 7   5 5555  5  55    55555  4 4          555     5555       55            55   555  55                 .
.33       33  5 6    6  55555     66 6  555 43 345    4          4444 5          5555           555 5555555555    6   54  4 55  6666    .
.  333   44  55 66666          6    55 6  7665  4 4444        4  55   6          5555 6666   6666 55      5       65555 555 66 66        .
. 222 34 555555  6666 66       66 5  56 7 776 4 3  44433333  4 555 666        5   5 6 7    6     5     4  55   7 76  556555 5  6 66     .
.2 2     3 555555 6 6  6665        ++567 8     3                3455556          6 5   6666 7    6    5    44 555 6  6 5    5555 6666     .
.   2  4 555 55    66   6 65 56      45  7 776   33 44  3   33 4 55   666            6  66      666666 5   4   555 66 55555   55        .
.  333  55  555                555  5    5 6      4          33     44   55          66   6      6  6      55555    44      555    5  4  5  .
.          5555555 55     55              5    6  5 44       44    444 5          6 66555 66   6 5 555    5 5 4    44 55 44444 4 5    5  .
. 5    5   5   4 5   5 4 44   4        44   5   66 6       333 4   5 44445        5 67 6 44   67 6544    544 5   4    3     5 5   4     4 55544 .
. 56 65   554     6     3345  33      3  + 5    6 6655 3 3 44 5 4 4455          5 67 6 4 5  6  6 4 4      4       44444   5555 4    4      4 .
.5   6 55555      5  5 4  4  4          4+  5 566   5554 3   44    444   55555 666655 5  66 5444     55   5555555555    444 444      4   .
.55       5 666 55555   444444 444   555555 66666 55 4444444444    555555 6666 555   55   444   5    66   77 6 5 44444    4 44444       .
.       555   7 65   55   555   334     66665  56 777   5 444   333   4 55   4 55 6 7    66 5   444444 5   666     7 66       433 4 4   444 .
.        55     5 445566             334 56    77 4 5 7 8 7654 44 3     3 4 5 5   4 5 67         655 4 44 3 5     6666   77     43 4   3 3 44 .
.  44   55            6             44 6 667     4 5 7     7654 44 3      33 4 5   3              66 5   4444 4 5     6666     6 5   4 5   33   3333 .
.         55          556666      55   5 66        55 666 555   444 3         3 44 4      5   666     55        4444 555          555 44    4        22 .
.        555          55  666     55     5 66      6     54 3 444     3   22  3          44 5    555555      44        55      5 4444 444 32      22 1 .
.555 5555555          5  6666 5   444 5 7 8 76 54 33    44      3   2    2 3    3333     55 444555  4 44        5          4 3   4432 1 1   2  0- .
. 55 5 6543   4 5 5666 6 5 444 456788   7 54   33            33 2    2      33323          5 4 5 5      444    4455554      3333    2   1   22210- .
. 55 5 55 3   4 5 5666 6 5 4443455788 8      3333    444       322 2 3      3333 4               55   55   4 4 44        4 3333333 22222 222 11 .
. 5555   55       5   666    5 4444 56 7 7 554 333    4444444      3333                4 55555          55      4444444      33     333333333 22 .
.  55          5555          5          5555       5555 4 333 4         4444        44444444444   666 5 6    5         4               33 22 3           3    22 .
.               666 5  5666 5   334              4        55 4   4 55555   5   444 555    4444 56      5 7765  4         33      3 32    2   3    444  32 33 .
.     55 666    4 45 7 65      2   66 66         3 5 65 345 6 5555       4 455    5   44      4566 55 776    444 4       3 4 33    22    33    444   3333 .
.     55 666    4 4      65            6    6      33 + 5   5    5           55 55    5      55   44444 55         66 5 44444 333     33       33            444   33 .
. 5555   566 5      666 5    3 45 6666    4444    555555                 555555555          55   45 66  55555    44444444        33          33 4444 3    4   4 3 .
.55      5555  55        555555 55           555555      55      666      55     555      6                44 5     5 4                  4    4 3 2        3   444 33    55  32 .
.5    444    555   666 5    5   5              55  55 55 4 5 6   66      5       555  666    66654   345    5   333 4 33                2    2 3   44  33    55 4 .
.5 4   4 3 55 6   6         5555 66      5  556     44 45677         55       55    6666      66 4  3334555 4    33  333  444  3 2222      3                4  44 .
.5    444 5555    66 5       555             55    5555 4444  56666      5555555      6666666 5 44    55      44     333333       3 22  22     33333            4444 .
.5    44   5            55      555             5                  444444  5          5555                66 555555         4   333333     2 111112 3     33       33     444 .
.   555555555555    4444 55    666554444        444      4 55                                  56    6655444 55    4 3      33 2 1   0          44      4433 3    4   3 .
.     55555555555 4 33  45 56 66     4 3         4 4         4 5 55            6 566 4     567 6 65 43      5        22 33  21  00000  3455433333    333 .
.        5 55          5   33    45 66666    4 3        4 4         4       555                   56654     56         5 444 5 4 3 222       1           1      444 33              3333 .
.    555     5 44    5 4 3    45 6666 5 4       4      444         4 5555                    554 4 566      4   4        4 3 2                  1       22 33          33      222222 .
.5    444          444 5    4444     6      65 4     44       555 44 4          55555         55 44444     4444       44      4 3 2 1111       11 2 333333333        2                 22 2 .
. 44 33     4          5 5 44455788  65433  455555 6654 4 5            5555             543334443      34       4 5543 22       01       11  233  4 333333 22 11112 22 .
. 4 3           455        665 34      8998   3 2345     556               6      44 55555     6     22         4  2     4     6      3    2       01      11      3     4  333 3      111  11   22222 .
. 4 3     3      6         665                89986  3 23+5      556     65566      + 555555              543 3 4 3     3 44  55543 22 1111              2    3       3333 2 11                22222 .
. 4    33 4    77 66 5 4 5          76     3 3+ 5 55 6     4 5     55555555555555                  333       444444 33     222222                 33333    2            222222222 .
.        4444567   7 6 5    4     5    55     44 44          5      4 4     666     55555 55    44        4 33 44     44 333 333        33 3 22222 3333 2        2222             222 .
.    5    555 7 8    6 5     4         3     55 444444444       55      777       5555        5 4445          32          44443    3 4 33       3 4 32        2 3     3 2 33 22333          222 .
.4     6       55     5 665     32       54         5         3            44445           7 76        5                     45     54 3 444 443       3 4 33             444 3 222 3333 3 4 3      333 .
.45 6       55555         6     3                 3        4      3333       44 5        77 6 5     5555 44 4 55 433                    3333          3333      4     33 2222                3 3333333333 .
.   5        555 66     55 433      3         3   4 3           333      4  5              5   4              44      4444 3333333333 3              33333     444 3     222     222           33                 333 .
.4                4 55        55           4 32     22 33      2 22             3334          54               44 4 33 4     3                 3333                33          3           3 222            2222      3                 3333 .
.   4444444 555              5 4     1112 333211 2    22           456         3 3 3 54               44      2 2222         33       444         22                 3 2 .
+.......................................................................................................................................+
X1=  500000.0                                                                                                              X2=  662560.0
Y1= 6985000.0                                                                                                              Y2= 6985000.0
```

FIGURE 13

found for the magnetically high zone in the northwest, which in part coincides with the valley of the Yukon River. The high magnetic zone in the southwest corner of the map may, in part, correlate with the Quaternary basalts. The strongest magnetic anomaly, however, falls over the Quaternary surficial deposits. A number of other positive magnetic anomalies can be recognized and appear to indicate a possible northeasterly alignment. A pronounced negative magnetic anomaly is observed on traverse 340, just east of tie-line 5080. The anomaly falls over an area maped as Cretaceous/Mesozoic sediments (MK) with a low radiometric response. The most remarkable feature of the magnetic pseudo-contourmap is probably the absence of any magnetic expression of the mafic Tertiary intrusives in the eastern part of the map, on traverse 440.

The pseudo-contourmaps of potassium, uranium and thorium display much the same picture, of relatively low values over most of the map area, with one noticeable exception: in the eastern part of the map, over the mafic Tertiary intrusive of traverse 440. Exceptionally high radiometric responses corresponding to 2.5% potassium, 4.5 ppm equivalent uranium and 10.5 ppm equivalent thorium are obtained here.

Relatively high thorium values, on the order of 5.0 ppm, are observed over a number of other locations. The most interesting zones appear to be the outcrop of MK (= Kk*, the "Kuskokwim group" west of the Innoko River) on traverse 280, near fiducial 12800; the outcrop of MzPzv on traverse 300, near fiducial 2700; the outcrop of Kk on traverse 380, near fiducial 5550; the outcrop of MK (= Kk*) on traverse 420, near the map edge; the Quaternary deposits on traverse 420 near fiducial 4050; and the outcrop of Kk on traverse 420, near fiducial 5550. These above zones all have "normal" U/K and U/T responses and are thus not indicated on the interpretation map as anomalies. They may, nonetheless, represent possible targets of economic interest.

The ratio maps of U/K and U/T show a number of strong anomalies. These correspond, however, all with zones of very low potassium and thorium content.

Using the criteria outlined in the general section on interpretation, a total of 20 uranium anomalies and one thorium anomaly have been outlined on the interpretation map. Many of the anomalies outlined consist, however, only of anomalous responses on one of the U/T or U/K anomaly maps without support of a strong anomalous response on the uranium anomaly map. They include zones 6, 10, 11, 13 and 19. These zones are considered adequately described in the anomaly listing and are not further discussed in this report.

Uranium anomalies 1,2 and 3 fall on traverse 280, in very similar environment. All three zones have good U, U/K and U/T amplitudes and appear to correlate with the metamorphic complex of mafic volcanic and intrusive rocks, MzPzv, and Quaternary deposits surrounding the bedrock area. Uranium content observed over the zones is on the order of 1.5 ppm, which is relatively high for this mapsheet.

In particular the eastern part of anomaly 4 stands out on the radiometric profile. The zone consists of good responses on all three, U, U/K and U/T, anomaly maps. It is possible, however, that the strong anomalies are caused, in part at least, by too low atmospheric radon corrections.

Anomaly 5 falls in the same environment as zone 4, the Paleozoic and Precambrian (?) undifferentiated metamorphic rock. The zone consists of fair to good uranium and U/K responses with a normal U/T expression.

Zone 7 consists of a narrow, strong U/T anomaly, recognizable on the radiometric profile. The zone is well expressed on the uranium anomaly map, but has normal U/K responses. The anomaly falls in Quaternary deposits over a mapped fault zone.

Anomaly 8 is based on fair to good responses on the uranium, U/K and U/T anomaly maps. The zone is located in sediments of the Kuskokwim group, in an area of widespread granite to quartz diorite intrusives.

Zone 9 is also located in an area mapped as Kuskokwim group. No intrusives are mapped in its vicinity. The zone consists of good U, U/K and U/T responses, to the east of a zone of strong thorium, uranium and potassium values with normal U/T and U/K ratios.

Anomaly 12 falls partly in the Kuskokwim group and partly in alluvial deposits. The zone consists of good uranium, U/T and U/K responses and is easily recognized on the U/T trace of the radiometric profile. The anomaly is located near a zone of strong thorium, uranium and potassium response, with normal U/T and U/K ratios.

The broad zone 14, located in alluvial deposits near an area of unsurveyed bedrock, consists of good U/K and U/T anomalies, accompanied by fair uranium support. The zone is not believed to represent a promising follow-up target, in view of its relatively low uranium content of less than 1.5 ppm.

The uranium response over zone 15, located in an area mapped as Kuskokwim group intruded by Cretaceous/Tertiary granites is normal to slightly anomalous. The zone has good U/T and U/K expression.

Anomaly 16 is believed to be the only zone in the map area that may represent a possibly economic target. The narrow zone is located in what has been mapped as Tertiary mafic igneous rock, which have a very strong radiometric expression but do not show up magnetically. The zone has good uranium, U/K and U/T anomalies, which can be recognized on the radiometric profile.

Anomaly 17, located in the Kuskokwim group, has good U/T and U/K responses, which can be easily recognized on the radiometric profile. The zone has no apparent accompanying uranium anomaly because of generally low radiometric count rate in the area. The zone may deserve further consideration as

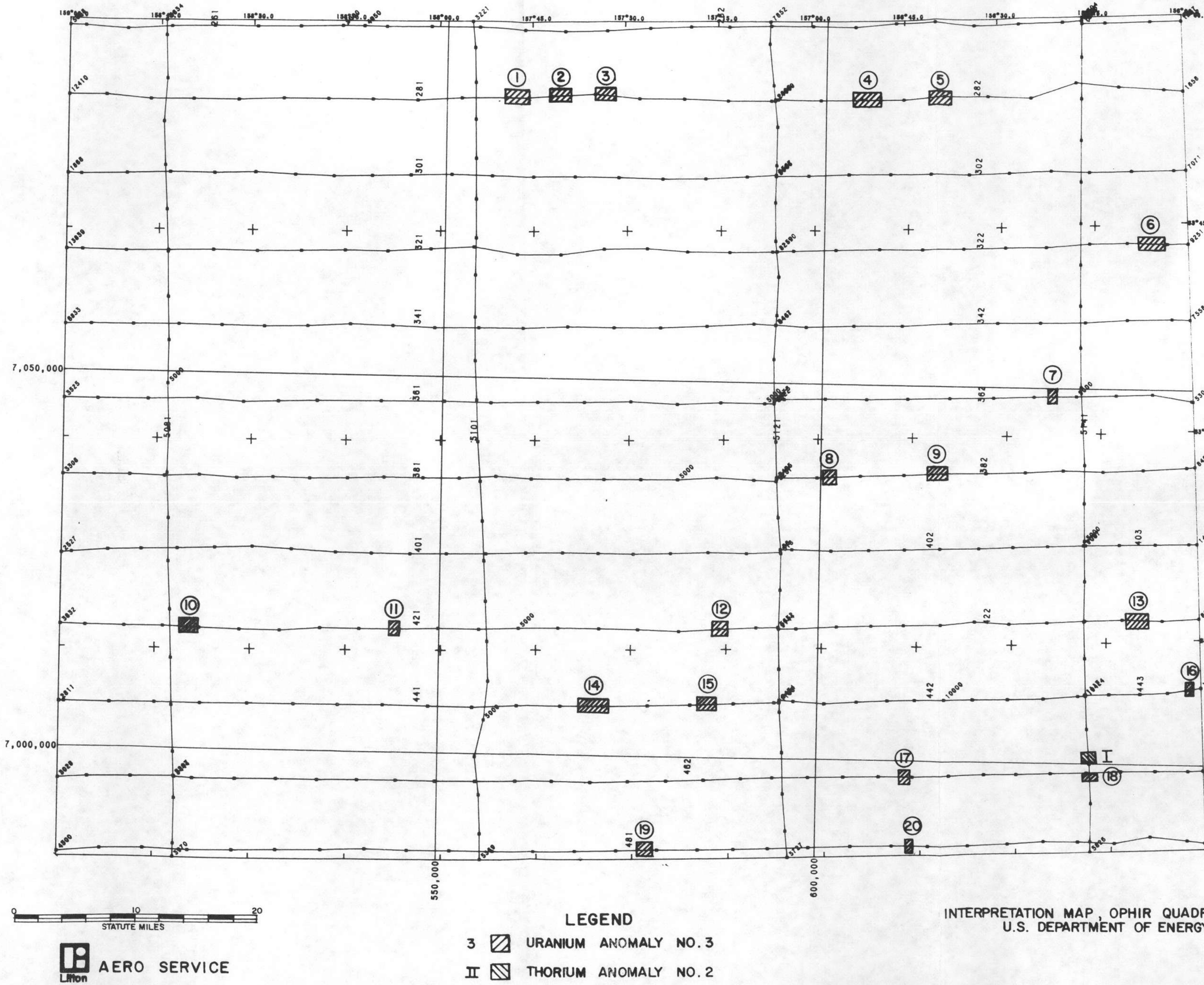



FIGURE 14

INTERPRETATION MAP, OPHIR QUADRANGLE
U.S. DEPARTMENT OF ENERGY

a follow-up target.

Zone 18 consists of narrow, good responses on the uranium, U/K and U/T anomaly maps, which can be seen on the radiometric profile. The anomaly falls in the Kuskokwim group near a thorium anomaly, which is indicative of possible uranium depletion. It is possible that the anomaly is related to unmapped rhyolite/dacite dikes, flows or sills in the area.

Anomaly 20 is another very narrow uranium, U/T and U/K response, recognizable on the radiometric profile. The anomaly falls mainly in the Cretaceous monzonite, which is known to carry high uranium and thorium values.

Only one of the many zones of high thorium content outlined on the thorium anomaly map and the thorium pseudo-contourmap meets the requirements of negative U/T response to be classified as a thorium anomaly. The other zones have been described with the discussion of the pseudo-contourmaps. Anomaly I, located on tie-line 5140, in the Kuskokwim group, has high thorium values and fair to good uranium responses. Tertiary/Cretaceous volcanics, TKv, have been mapped in its vicinity and it is possible that unmapped sills, dikes and flows occur in the neighborhood of the anomaly.

The Ophir area in general displays a rather low radioactive mineral content. Only one area of exceptionally high radiometric response has been outlined by the present survey. It coincides with an area mapped as Tertiary mafic igneous rock, in the eastern part of the map sheet. Uranium anomaly 16 is located in this general area and is believed to represent the only anomaly outlined deserving of further investigation.

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# APPENDIX A

Geologic Legend

# GEOLOGIC LEGEND

| Aero Symbol | Map Symbol | | |
|---|---|---|---|
| QA | = Qal | : | Quaternary surficial deposits |
| QM | = Qmt | : | Mine tailings |
| KK | = Kk | : | Upper Cretaceous Kuskokwim group |
| MK | = kk | : | Upper Cretaceous sediments west of Innoko River |
| KC | = Kc | : | Lower Cretaceous chert and argillite |
| PC | = Pc | : | Upper Paleozoic (Mississippian?) chert |
| PP | = Ppe | : | Lower Paleozoic and Precambrian metamorphic rock |
| QT | = QTv | : | Late Tertiary/Early Quaternary basalt and andesite |
| TM | = Tmi | : | Tertiary mafic intrusive rock |
| TK | = TKqd | : | Cretaceous/Tertiary granite to quartz diorite |
| TV | = TKv | : | Cretaceous/Tertiary volcanics and dikes |
| KB | = Kb | : | Cretaceous basaltic agglomerate flow breccia |
| KA | = Kba | : | Cretaceous basalt and andesite |
| KM | = Km | : | Cretaceous monzonite and related intrusives |
| MP | = MzPzv | : | Upper Paleozoic to Lower Mesozoic metamorphic mafic igneous rock |
| U | = ? | : | Unsurveyed bedrock area |
| W | | : | Water |

# APPENDIX B

List of Geologic Units by Anomaly

## List of Geologic Units by Anomaly

| ANOMALY | FORMATION | LOCATION t-traverse tl-tieline | FID. | BRIEF DESCRIPTION |
|---|---|---|---|---|
| 1 | MzPzv<br>Qal | t-280 | 13425 | Combined good U, U/K, U/T anomaly |
| 2 | MzPzv<br>Qal | t-280 | 13525 | Combined good U, U/K, U/T anomaly |
| 3 | Qal | t-280 | 13625 | Fair U, U/K, U/T anomaly |
| 4 | Ppє<br>MzPzv | t-280 | 14250 | Relatively strong U, U/K, U/T anomaly, in the eastern half easily recognized on radiometric profile |
| 5 | Ppє | t-280 | 14400 | Fair U, U/K anomaly with normal U/T response |
| 6 | Kk<br>Qal | t-320 | 14725 | U, U/K anomaly, in eastern and western thirds with good U/T support |
| 7 | Qal | t-360 | 5690 | Narrow U/T anomaly with fair U expression, recognizable on radiometric profile |
| 8 | Kk | t-380 | 5380 | U/T and U/K anomaly, with fair U support |
| 9 | Kk | t-380 | 5630 | Combined U, U/K and U/T anomaly |
| 10 | MK (Kk*) | t-420 | 4170 | U, U/K anomaly with normal U/T response |
| 11 | Qal | t-420 | 4690 | Combined U, U/K and U/T anomaly in area of generally low K and T response |
| 12 | Kk<br>Qal | t-420 | 5510 | Zone of combined U, U/K and U/T anomalies near zone of strong T, U response |
| 13 | Kk<br>Qal | t-420 | 6625 | Broad zone of U/K anomalies in western half with good U/T support, but normal U response |
| 14 | Qal | t-440 | 2375 | U/K, U/T anomaly with some U support |
| 15 | Qal<br>Kk<br>Tkqd | t-440 | 2650 | U/K, U/T anomaly with some U support |

Kk* Refers to Cretaceous sediments mapped to the west of the Innoko River.

| ANOMALY | FORMATION | LOCATION t-traverse tl-tie line | FID. | BRIEF DESCRIPTION |
|---|---|---|---|---|
| 16 | Tmi | t-440 | 4175 | Narrow, excellent U, U/K, U/T anomaly in area of strong radiometric response; magnetic response is normal |
| 17 | Kk | t-460 | 4220 | Good U/K, U/T anomaly, visible on radiometric profile, with normal U response |
| 18 | Kk | tl-5140 | 3900 | Narrow, good U, U/K, U/T anomaly, visible on radiometric profile |
| 19 | Qal | t-480 | 3040 | U, U/T anomaly with normal U/K response, located on fault |
| 20 | Km<br>Qal | t-480 | 3710 | Very narrow U, U/K and U/T anomaly, easily recognized on radiometric profile |

Thorium Anomalies

| | | | | |
|---|---|---|---|---|
| I | Kk | tl-5140 | 3950 | Zone of strong thorium and good uranium response, with negative U/T anomalies |

# A P P E N D I X   C

List of Anomalies by Geologic Unit

## List of Anomalies by Geologic Formation

| Aero Symbol | Map Symbol | No. of Samples | No. of U Anomalies | No. of T Anomalies |
|---|---|---|---|---|
| QA | Qal | 27,046 | 12 | |
| QM | Qmt | 18 | | |
| KK | Kk | 6,474 | 8 | 1 |
| KC | Kc | 19 | | |
| MK | Kk* | 1,672 | 1 | |
| PC | Pc | 256 | | |
| PP | Ppe | 2,371 | 2 | |
| QT | Qtv | 73 | | |
| TM | Tmi | 179 | 1 | |
| TK | TKqd | 99 | 1 | |
| TV | TKv | 486 | | |
| KB | Kb | 46 | | |
| KA | Kba | 6 | | |
| KM | Kmi | 120 | 1 | |
| MP | MzPzv | 1,670 | 3 | |
| U | | 829 | | |

Kk* Refers to Cretaceous sediments mapped to the west of the Innoko River

# APPENDIX D

Mean Radiometric Values by Geologic Unit

# MEAN VALUE BY GEOLOGIC MAP UNIT

## OPHIR QUAD

### LINE 480

| UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QT | 1.50 | 0.93 | 0.24 | 0.622 | 3.697 | 5.978 |
| QA | 1.64 | 0.91 | 0.28 | 0.514 | 3.252 | 5.474 |
| W | 2.24 | 0.65 | 0.28 | 0.291 | 2.375 | 8.123 |
| KM | 3.55 | 1.75 | 0.78 | 0.532 | 2.463 | 4.633 |

| UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| U | 2.80 | 1.59 | 0.48 | 0.581 | 3.588 | 6.030 |
| PP | 1.49 | 0.86 | 0.27 | 0.636 | 3.134 | 5.227 |
| KK | 3.20 | 1.46 | 0.70 | 0.476 | 2.238 | 4.759 |

### LINE 460

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| TK | 3.78 | 1.54 | 0.63 | 0.414 | 2.462 | 5.983 |
| QA | 1.59 | 0.68 | 0.24 | 0.437 | 2.711 | 6.165 |
| W | 1.25 | 0.39 | 0.19 | 0.145 | 2.385 | 5.472 |
| U | 1.96 | 0.88 | 0.28 | 0.462 | 3.192 | 6.875 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| KK | 2.96 | 1.19 | 0.62 | 0.428 | 2.073 | 4.980 |
| QM | 3.58 | 1.50 | 0.88 | 0.419 | 1.767 | 4.295 |
| KC | 3.39 | 1.35 | 0.64 | 0.418 | 2.165 | 5.280 |
| TV | 3.07 | 1.25 | 0.68 | 0.419 | 1.914 | 4.667 |

### LINE 440

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QA | 1.62 | 0.92 | 0.25 | 0.589 | 3.767 | 6.249 |
| MK | 2.58 | 1.63 | 0.49 | 0.640 | 3.371 | 5.324 |
| W | 1.43 | 0.99 | 0.24 | 0.739 | 4.261 | 5.425 |
| U | 3.30 | 1.16 | 0.52 | 0.368 | 2.304 | 6.331 |
| KK | 2.51 | 1.29 | 0.58 | 0.538 | 2.346 | 4.412 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| TK | 2.30 | 1.52 | 0.34 | 0.667 | 4.511 | 6.753 |
| PC | 1.66 | 1.21 | 0.25 | 0.722 | 5.192 | 6.835 |
| PP | 2.16 | 1.30 | 0.48 | 0.620 | 3.198 | 4.996 |
| TV | 4.80 | 2.19 | 1.25 | 0.476 | 1.811 | 3.879 |
| TM | 9.71 | 4.21 | 2.14 | 0.439 | 1.958 | 4.528 |

### LINE 420

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QA | 1.69 | 0.93 | 0.25 | 0.564 | 3.810 | 6.294 |
| MK | 4.47 | 1.66 | 0.68 | 0.376 | 2.503 | 6.590 |
| KK | 2.52 | 1.33 | 0.49 | 0.582 | 3.050 | 5.376 |
| W | 2.27 | 1.10 | 0.38 | 0.504 | 2.972 | 5.908 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| U | 2.76 | 1.16 | 0.42 | 0.430 | 2.826 | 6.750 |
| PC | 1.88 | 0.94 | 0.30 | 0.502 | 3.549 | 6.616 |
| PP | 2.33 | 1.23 | 0.48 | 0.569 | 2.679 | 4.920 |
| TK | 2.81 | 1.49 | 0.79 | 0.538 | 1.982 | 3.645 |

### LINE 400

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QA | 1.84 | 0.83 | 0.29 | 0.460 | 3.120 | 6.471 |
| MK | 3.59 | 1.38 | 0.58 | 0.400 | 2.496 | 6.299 |
| W | 4.26 | 1.10 | 0.58 | 0.258 | 1.887 | 7.308 |
| U | 2.99 | 1.25 | 0.45 | 0.439 | 2.913 | 6.798 |
| TK | 6.77 | 1.64 | 1.11 | 0.237 | 1.445 | 6.062 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| KK | 2.20 | 0.92 | 0.45 | 0.428 | 2.229 | 5.268 |
| KM | 1.80 | 0.56 | 0.28 | 0.326 | 2.027 | 6.450 |
| KA | 1.31 | 1.02 | 0.29 | 0.784 | 3.514 | 4.501 |
| PP | 1.69 | 1.08 | 0.33 | 0.657 | 3.437 | 5.299 |
| PC | 3.10 | 1.28 | 0.66 | 0.432 | 1.984 | 4.677 |

### LINE 380

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| MK | 4.16 | 1.51 | 0.59 | 0.375 | 2.632 | 7.108 |
| QA | 1.81 | 0.82 | 0.27 | 0.472 | 3.207 | 6.421 |
| U | 2.04 | 1.05 | 0.30 | 0.533 | 3.571 | 6.885 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| KK | 2.50 | 1.24 | 0.49 | 0.541 | 2.943 | 5.377 |
| W | 0.75 | 0.52 | 0.23 | 0.827 | 2.322 | 3.311 |

D1

MEAN VALUE BY GEOLOGIC MAP UNIT

OPHIR QUAD

LINE 360

| UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K | UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QA | 1.74 | 0.81 | 0.26 | 0.481 | 3.149 | 6.189 | W | 0.82 | 0.59 | 0.12 | 0.572 | 5.053 | 7.743 |
| MK | 3.27 | 1.39 | 0.50 | 0.447 | 2.864 | 6.611 | KK | 2.05 | 0.91 | 0.40 | 0.471 | 2.474 | 5.340 |
| KB | 2.12 | 0.77 | 0.76 | 0.393 | 1.064 | 2.753 | | | | | | | |

LINE 340

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MK | 3.15 | 1.08 | 0.45 | 0.356 | 2.480 | 7.110 | PP | 2.95 | 1.11 | 0.39 | 0.397 | 2.960 | 7.479 |
| QA | 2.04 | 0.83 | 0.30 | 0.440 | 2.996 | 6.524 | MP | 3.47 | 1.50 | 0.54 | 0.450 | 2.889 | 6.457 |
| W | 1.73 | 0.70 | 0.26 | 0.350 | 2.223 | 6.154 | KK | 1.80 | 0.89 | 0.30 | 0.502 | 3.218 | 6.304 |
| PC | 1.91 | 0.44 | 0.45 | 0.297 | 0.972 | 4.351 | | | | | | | |

LINE 320

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QA | 1.61 | 0.79 | 0.24 | 0.484 | 3.440 | 6.399 | PP | 3.37 | 1.25 | 0.52 | 0.411 | 2.641 | 6.557 |
| MK | 2.76 | 1.05 | 0.43 | 0.402 | 2.628 | 6.504 | KK | 1.97 | 0.98 | 0.34 | 0.542 | 3.198 | 5.959 |
| MP | 2.91 | 1.63 | 0.41 | 0.589 | 4.437 | 7.609 | PC | 2.15 | 0.88 | 0.37 | 0.447 | 2.652 | 5.977 |

LINE 300

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QA | 1.98 | 0.80 | 0.27 | 0.423 | 3.034 | 6.882 | MP | 4.24 | 1.21 | 0.64 | 0.290 | 1.970 | 6.852 |
| MK | 2.87 | 1.10 | 0.43 | 0.397 | 2.682 | 6.787 | PP | 2.79 | 1.06 | 0.40 | 0.386 | 2.644 | 7.044 |
| U | 2.60 | 1.23 | 0.40 | 0.489 | 3.140 | 6.475 | | | | | | | |

D2

LINE 280

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W | 1.04 | 0.44 | 0.13 | 0.541 | 3.036 | 4.742 | MK | 4.14 | 1.77 | 0.54 | 0.442 | 3.323 | 7.711 |
| QA | 2.02 | 1.11 | 0.31 | 0.578 | 3.857 | 6.378 | MP | 2.66 | 1.31 | 0.38 | 0.527 | 3.626 | 7.134 |
| PP | 3.24 | 1.51 | 0.49 | 0.500 | 3.191 | 6.630 | | | | | | | |

LINE 260

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QA | 2.08 | 0.92 | 0.31 | 0.443 | 3.042 | 6.629 | MK | 3.33 | 1.47 | 0.48 | 0.460 | 3.131 | 6.926 |
| KK | 3.24 | 1.57 | 0.57 | 0.488 | 2.814 | 5.767 | MP | 2.40 | 1.06 | 0.36 | 0.467 | 3.023 | 6.675 |
| W | 2.83 | 0.93 | 0.44 | 0.420 | 2.608 | 5.826 | PP | 3.18 | 1.22 | 0.46 | 0.400 | 2.780 | 7.056 |

LINE 5080

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K | UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QT | 1.97 | 0.97 | 0.26 | 0.503 | 3.888 | 7.693 | W | 2.69 | 0.57 | 0.31 | 0.253 | 1.349 | 5.292 |
| QA | 2.00 | 0.86 | 0.28 | 0.431 | 2.939 | 6.669 | MK | 3.20 | 1.30 | 0.48 | 0.425 | 2.802 | 6.708 |

# MEAN VALJE BY GEOLOGIC MAP UNIT

## OPHIR QUAD

### LINE 5100

| UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QA | 1.49 | 0.64 | 0.21 | 0.444 | 3.100 | 6.409 |
| W | 1.04 | 0.46 | 0.09 | 0.545 | 4.649 | 5.835 |

| UNIT | E THOR | E URN | POT PCT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| PP | 3.81 | 1.29 | 0.51 | 0.361 | 2.602 | 7.626 |
| MP | 2.51 | 0.93 | 0.36 | 0.393 | 2.665 | 6.987 |

### LINE 5120

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| QA | 1.81 | 0.80 | 0.29 | 0.467 | 3.188 | 6.536 |
| KK | 2.14 | 0.93 | 0.37 | 0.447 | 2.534 | 5.901 |
| TK | 1.83 | 0.77 | 0.24 | 0.433 | 3.340 | 7.783 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| U | 3.35 | 1.38 | 0.46 | 0.423 | 3.062 | 7.301 |
| PP | 3.39 | 1.28 | 0.52 | 0.385 | 2.560 | 6.726 |
| MP | 2.63 | 0.95 | 0.40 | 0.376 | 2.454 | 6.650 |

### LINE 5140

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| KK | 2.72 | 1.11 | 0.57 | 0.434 | 2.161 | 5.069 |
| QA | 1.97 | 0.80 | 0.33 | 0.434 | 2.674 | 6.187 |

| UNIT | THOR | URN | POT | U/TH | U/K | TH/K |
|---|---|---|---|---|---|---|
| PC | 4.66 | 1.90 | 0.87 | 0.425 | 2.279 | 5.391 |
| MP | 2.38 | 1.12 | 0.38 | 0.491 | 3.044 | 6.307 |

# A P P E N D I X   E

Standard Deviation Table

CPHIR QUAD

FORMATION QA

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 23021 | 1.11 | LOGNORMAL | 0.24 | 0.39 | 0.66 | 1.85 | 3.10 | 5.20 |
| E URANIUM | 22925 | 0.74 | NORMAL | -0.57 | -0.15 | 0.31 | 1.18 | 1.62 | 2.05 |
| POTASSIUM | 24828 | 0.18 | LOGNORMAL | 0.03 | 0.06 | 0.11 | 0.32 | 0.55 | 0.96 |
| EU/K | 19591 | 2.51 | LOGNORMAL | 0.64 | 1.01 | 1.59 | 3.96 | 6.25 | 9.86 |
| EU/ETH | 17523 | 0.45 | NORMAL | -0.12 | 0.07 | 0.26 | 0.64 | 0.83 | 1.02 |
| ETH/K | 20836 | 6.23 | NORMAL | 1.40 | 3.01 | 4.62 | 7.84 | 9.45 | 11.06 |

FORMATION QM

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 18 | 3.42 | NORMAL | 1.04 | 1.83 | 2.63 | 4.22 | 5.01 | 5.81 |
| E URANIUM | 18 | 1.40 | NORMAL | 0.17 | 0.58 | 0.99 | 1.81 | 2.22 | 2.63 |
| POTASSIUM | 18 | 0.85 | NORMAL | -0.08 | 0.23 | 0.54 | 1.16 | 1.47 | 1.78 |
| EU/K | 18 | 1.61 | NORMAL | 1.06 | 1.24 | 1.43 | 1.79 | 1.98 | 2.16 |
| EU/ETH | 18 | 0.39 | NORMAL | 0.21 | 0.27 | 0.33 | 0.45 | 0.52 | 0.58 |
| ETH/K | 18 | 3.80 | LOGNORMAL | 2.44 | 2.83 | 3.28 | 4.41 | 5.11 | 5.93 |

FORMATION QI

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 73 | 1.09 | LOGNORMAL | 0.36 | 0.52 | 0.75 | 1.59 | 2.30 | 3.34 |
| E URANIUM | 68 | 0.46 | LOGNORMAL | 0.09 | 0.16 | 0.27 | 0.77 | 1.30 | 2.19 |
| POTASSIUM | 73 | 0.22 | NORMAL | -0.00 | 0.07 | 0.15 | 0.29 | 0.37 | 0.44 |
| EU/K | 66 | 3.57 | NORMAL | -1.60 | 0.12 | 1.84 | 5.29 | 7.01 | 8.74 |
| EU/ETH | 54 | 0.50 | LOGNORMAL | 0.19 | 0.26 | 0.36 | 0.69 | 0.95 | 1.31 |
| ETH/K | 71 | 5.90 | NORMAL | 0.89 | 2.56 | 4.23 | 7.57 | 9.24 | 10.91 |

FORMATION KK

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 6474 | 2.40 | NORMAL | -0.28 | 0.61 | 1.50 | 3.29 | 4.18 | 5.08 |
| E URANIUM | 6374 | 1.07 | NORMAL | -0.25 | 0.19 | 0.63 | 1.51 | 1.95 | 2.39 |
| POTASSIUM | 6474 | 0.50 | NORMAL | -0.17 | 0.06 | 0.28 | 0.72 | 0.95 | 1.17 |
| EU/K | 6373 | 1.82 | LOGNORMAL | 0.44 | 0.71 | 1.13 | 2.91 | 4.67 | 7.48 |
| EU/ETH | 6291 | 0.46 | NORMAL | -0.05 | 0.12 | 0.29 | 0.63 | 0.80 | 0.97 |
| ETH/K | 6473 | 4.63 | LOGNORMAL | 1.89 | 2.55 | 3.44 | 6.24 | 8.41 | 11.33 |

FORMATION MK

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 1672 | 3.29 | NORMAL | 0.87 | 1.67 | 2.48 | 4.10 | 4.90 | 5.71 |
| E URANIUM | 1665 | 1.24 | NORMAL | 0.18 | 0.54 | 0.89 | 1.60 | 1.95 | 2.30 |
| POTASSIUM | 1672 | 0.49 | NORMAL | 0.11 | 0.24 | 0.36 | 0.62 | 0.74 | 0.87 |
| EU/K | 1665 | 2.56 | NORMAL | 0.25 | 1.02 | 1.79 | 3.32 | 4.09 | 4.86 |
| EU/ETH | 1661 | 0.38 | NORMAL | 0.02 | 0.14 | 0.26 | 0.50 | 0.62 | 0.74 |
| ETH/K | 1672 | 6.60 | NORMAL | 3.40 | 4.47 | 5.53 | 7.67 | 8.73 | 9.80 |

FORMATION KM

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 120 | 3.02 | NORMAL | -1.25 | 0.18 | 1.60 | 4.45 | 5.87 | 7.30 |
| E URANIUM | 120 | 1.40 | NORMAL | -0.65 | 0.03 | 0.72 | 2.09 | 2.78 | 3.46 |
| POTASSIUM | 120 | 0.65 | NORMAL | -0.42 | -0.06 | 0.29 | 1.01 | 1.36 | 1.72 |
| EU/K | 120 | 2.22 | NORMAL | 0.87 | 1.32 | 1.77 | 2.67 | 3.12 | 3.57 |
| EU/ETH | 120 | 0.46 | NORMAL | 0.08 | 0.21 | 0.34 | 0.59 | 0.71 | 0.84 |
| ETH/K | 120 | 4.86 | NORMAL | 2.07 | 3.00 | 3.93 | 5.79 | 6.72 | 7.65 |

E2

FORMATION KC

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 19 | 3.23 | NORMAL | 0.87 | 1.65 | 2.44 | 4.01 | 4.80 | 5.58 |
| E URANIUM | 19 | 1.25 | NORMAL | 0.82 | 0.96 | 1.11 | 1.39 | 1.53 | 1.67 |
| POTASSIUM | 19 | 0.61 | NORMAL | 0.30 | 0.40 | 0.51 | 0.72 | 0.82 | 0.93 |
| EU/K | 19 | 2.03 | NORMAL | 0.86 | 1.25 | 1.64 | 2.42 | 2.81 | 3.20 |
| EU/ETH | 19 | 0.36 | LOGNORMAL | 0.20 | 0.24 | 0.30 | 0.44 | 0.54 | 0.65 |
| ETH/K | 19 | 5.16 | NORMAL | 3.11 | 3.80 | 4.48 | 5.84 | 6.52 | 7.21 |

FORMATION KA

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 6 | 1.15 | NORMAL | 0.64 | 0.81 | 0.98 | 1.31 | 1.48 | 1.65 |
| E URANIUM | 6 | 0.92 | NORMAL | 0.59 | 0.70 | 0.81 | 1.03 | 1.14 | 1.25 |
| POTASSIUM | 6 | 0.27 | NORMAL | 0.18 | 0.21 | 0.24 | 0.29 | 0.32 | 0.35 |
| EU/K | 6 | 3.33 | NORMAL | 1.86 | 2.35 | 2.84 | 3.82 | 4.31 | 4.80 |
| EU/ETH | 6 | 0.76 | NORMAL | 0.30 | 0.45 | 0.60 | 0.91 | 1.06 | 1.22 |
| ETH/K | 6 | 4.31 | NORMAL | 3.26 | 3.61 | 3.96 | 4.65 | 5.00 | 5.35 |

CPHIR QUAD

FORMATION KB

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 46 | 1.96 | NORMAL | -0.71 | 0.18 | 1.07 | 2.85 | 3.74 | 4.63 |
| E URANIUM | 45 | 0.67 | NORMAL | -0.23 | 0.07 | 0.37 | 0.97 | 1.27 | 1.57 |
| POTASSIUM | 46 | 0.74 | NORMAL | -0.06 | 0.21 | 0.47 | 1.01 | 1.28 | 1.54 |
| EU/K | 45 | 0.93 | NORMAL | -0.42 | 0.03 | 0.48 | 1.38 | 1.84 | 2.29 |
| EU/ETH | 43 | 0.29 | LOGNORMAL | 0.09 | 0.13 | 0.19 | 0.43 | 0.64 | 0.95 |
| ETH/K | 46 | 2.60 | NORMAL | 0.26 | 1.04 | 1.82 | 3.39 | 4.17 | 4.95 |

FORMATION MF

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 1670 | 2.44 | NORMAL | 0.21 | 0.96 | 1.70 | 3.18 | 3.92 | 4.67 |
| E URANIUM | 1639 | 1.04 | NORMAL | -0.17 | 0.23 | 0.64 | 1.44 | 1.84 | 2.24 |
| POTASSIUM | 1667 | 0.36 | NORMAL | 0.05 | 0.15 | 0.26 | 0.46 | 0.57 | 0.67 |
| EU/K | 1634 | 2.95 | NORMAL | -0.11 | 0.91 | 1.93 | 3.97 | 4.99 | 6.01 |
| EU/ETH | 1633 | 0.44 | NORMAL | -0.08 | 0.09 | 0.27 | 0.61 | 0.78 | 0.95 |
| ETH/K | 1660 | 6.68 | NORMAL | 2.69 | 4.02 | 5.35 | 8.01 | 9.34 | 10.67 |

E3

FORMATION PC

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 256 | 2.49 | NORMAL | -0.67 | 0.39 | 1.44 | 3.54 | 4.59 | 5.65 |
| E URANIUM | 249 | 1.13 | NORMAL | 0.15 | 0.47 | 0.80 | 1.45 | 1.78 | 2.10 |
| POTASSIUM | 256 | 0.24 | LOGNORMAL | 0.04 | 0.07 | 0.13 | 0.43 | 0.80 | 1.46 |
| EU/K | 246 | 2.28 | LOGNORMAL | 0.46 | 0.79 | 1.34 | 3.89 | 6.62 | 11.27 |
| EU/ETH | 236 | 0.47 | NORMAL | 0.01 | 0.16 | 0.31 | 0.62 | 0.77 | 0.92 |
| ETH/K | 253 | 5.48 | NORMAL | 2.23 | 3.32 | 4.40 | 6.56 | 7.65 | 8.73 |

FORMATION FP

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 2366 | 2.74 | NORMAL | -0.03 | 0.89 | 1.81 | 3.66 | 4.58 | 5.50 |
| E URANIUM | 2350 | 1.13 | NORMAL | -0.04 | 0.35 | 0.74 | 1.52 | 1.91 | 2.30 |
| POTASSIUM | 2371 | 0.43 | NORMAL | 0.04 | 0.17 | 0.30 | 0.56 | 0.68 | 0.81 |
| EU/K | 2343 | 2.72 | NORMAL | -0.17 | 0.79 | 1.76 | 3.68 | 4.65 | 5.61 |
| EU/ETH | 2323 | 0.44 | NORMAL | -0.12 | 0.07 | 0.25 | 0.62 | 0.81 | 0.99 |
| ETH/K | 2359 | 6.31 | NORMAL | 2.07 | 3.48 | 4.89 | 7.72 | 9.13 | 10.54 |

OPHIR QUAD

E4

FORMATION TK

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 99 | 1.21 | LOGNORMAL | 0.15 | 0.30 | 0.60 | 2.45 | 4.92 | 9.91 |
| E URANIUM | 99 | 1.08 | NORMAL | -0.78 | -0.16 | 0.46 | 1.70 | 2.32 | 2.95 |
| POTASSIUM | 99 | 0.22 | LOGNORMAL | 0.03 | 0.06 | 0.12 | 0.43 | 0.83 | 1.59 |
| EU/K | 99 | 1.84 | LOGNORMAL | 0.51 | 0.78 | 1.20 | 2.83 | 4.36 | 6.70 |
| EU/ETH | 99 | 0.41 | NORMAL | -0.05 | 0.10 | 0.26 | 0.56 | 0.71 | 0.87 |
| ETH/K | 99 | 6.20 | NORMAL | -0.81 | 1.53 | 3.86 | 8.53 | 10.87 | 13.20 |

FORMATION TV

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 486 | 3.68 | NORMAL | -0.29 | 1.04 | 2.36 | 5.01 | 6.33 | 7.65 |
| E URANIUM | 486 | 1.56 | NORMAL | -0.69 | 0.06 | 0.81 | 2.31 | 3.06 | 3.81 |
| POTASSIUM | 486 | 0.87 | NORMAL | -0.40 | 0.02 | 0.45 | 1.29 | 1.71 | 2.13 |
| EU/K | 486 | 1.80 | NORMAL | 0.29 | 0.80 | 1.30 | 2.30 | 2.81 | 3.31 |
| EU/ETH | 486 | 0.41 | NORMAL | 0.06 | 0.18 | 0.29 | 0.53 | 0.65 | 0.77 |
| ETH/K | 486 | 4.06 | LOGNORMAL | 2.07 | 2.60 | 3.25 | 5.08 | 6.36 | 7.96 |

FORMATION JM

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 179 | 9.55 | NORMAL | 2.97 | 5.17 | 7.36 | 11.75 | 13.94 | 16.14 |
| E URANIUM | 179 | 4.11 | NORMAL | 1.27 | 2.22 | 3.16 | 5.06 | 6.01 | 6.95 |
| POTASSIUM | 179 | 2.12 | NORMAL | 1.20 | 1.51 | 1.81 | 2.42 | 2.72 | 3.03 |
| EU/K | 179 | 1.81 | NORMAL | 1.10 | 1.34 | 1.58 | 2.05 | 2.29 | 2.53 |
| EU/ETH | 179 | 0.41 | NORMAL | 0.24 | 0.30 | 0.35 | 0.47 | 0.53 | 0.59 |
| ETH/K | 179 | 4.37 | NORMAL | 2.09 | 2.85 | 3.61 | 5.14 | 5.90 | 6.66 |

FORMATION U

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 829 | 2.69 | NORMAL | 0.42 | 1.16 | 1.93 | 3.45 | 4.20 | 4.96 |
| E URANIUM | 821 | 1.12 | NORMAL | -0.05 | 0.34 | 0.73 | 1.51 | 1.90 | 2.28 |
| POTASSIUM | 829 | 0.40 | NORMAL | 0.05 | 0.17 | 0.29 | 0.52 | 0.64 | 0.76 |
| EU/K | 821 | 2.79 | NORMAL | 0.10 | 1.00 | 1.89 | 3.69 | 4.59 | 5.49 |
| EU/ETH | 820 | 0.42 | NORMAL | -0.02 | 0.13 | 0.27 | 0.56 | 0.71 | 0.85 |
| ETH/K | 829 | 6.50 | NORMAL | 3.18 | 4.30 | 5.43 | 7.68 | 8.81 | 9.94 |

OPHIR QUAD

FORMATION W

| DATA | SAMPLES | MEAN | | -3 | -2 | -1 | +1 | +2 | +3 |
|---|---|---|---|---|---|---|---|---|---|
| E THORIUM | 221 | 1.71 | NORMAL | -2.59 | -1.16 | 0.27 | 3.14 | 4.57 | 6.00 |
| E URANIUM | 248 | 0.66 | NORMAL | -0.71 | -0.26 | 0.20 | 1.12 | 1.56 | 2.03 |
| POTASSIUM | 262 | 0.09 | LOGNORMAL | 0.01 | 0.02 | 0.04 | 0.19 | 0.41 | 0.87 |
| EU/K | 175 | 1.92 | LOGNORMAL | 0.43 | 0.71 | 1.16 | 3.16 | 5.22 | 8.60 |
| EU/ETH | 146 | 0.40 | NORMAL | -0.10 | 0.07 | 0.23 | 0.57 | 0.73 | 0.90 |
| ETH/K | 181 | 5.74 | NORMAL | 1.05 | 2.61 | 4.18 | 7.31 | 8.88 | 10.44 |

E5

# A P P E N D I X   F

Single Record Data Listing

| REC NO. | LAT | LONG | RESID MAG GAMMA | TERR CL FEET | FLG | GEOL UNIT | COSM CPS | ATM U CPS | TOTAL COUNT CPS | FLG | ETH PPM | FLG | EU PPM | FLG | K PCT | FLG | EU/ETH | EU/K | ETH/K | TEMP CELCIUS | BARO PRES MMHG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5079 | 64.0086 | 160.9199 | 55305 | 763 | MAR | W | 31 | 1 | -12 | NAD | -1.1 | NAD | -0.5 | NAD | 0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 746.8 |
| 5080 | 64.0087 | 160.9189 | 55305 | 751 | MAR | W | 28 | 1 | 36 | MAR | 0.0 | NAD | 0.1 | NAD | 0.1 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 747.1 |
| 5081 | 64.0087 | 160.9176 | 55305 | 741 | MAR | W | 26 | 1 | 4 | NAD | 0.2 | NAD | 0.1 | NAD | -0.1 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 747.4 |
| 5082 | 64.0088 | 160.9166 | 55305 | 730 | MAR | W | 35 | 1 | -60 | NAD | 0.0 | NAD | 0.3 | NAD | -0.1 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 747.7 |
| 5083 | 64.0088 | 160.9154 | 55305 | 722 | MAR | W | 26 | 1 | -4 | NAD | -2.7 | NAD | 2.3 | | -0.4 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 748.0 |
| 5084 | 64.0089 | 160.9144 | 55305 | 712 | MAR | W | 28 | 1 | -12 | NAD | 0.5 | NAD | -1.7 | NAD | 0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 748.1 |
| 5085 | 64.0089 | 160.9131 | 55305 | 702 | MAR | W | 23 | 1 | 37 | MAR | 0.0 | NAD | 0.4 | NAD | -0.3 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 748.5 |
| 5086 | 64.0090 | 160.9121 | 55305 | 691 | | W | 22 | 1 | 50 | | 0.3 | NAD | -0.1 | NAD | 0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 748.8 |
| 5087 | 64.0091 | 160.9109 | 55305 | 680 | | W | 23 | 1 | 46 | | 0.3 | NAD | 0.0 | NAD | -0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.7 | 749.1 |
| 5088 | 64.0092 | 160.9099 | 55305 | 673 | | W | 17 | 1 | 72 | | 0.6 | MAR | 0.3 | NAD | -0.3 | NAD | 0.0 | 0.0 | 0.0 | 12.8 | 749.3 |
| 5089 | 64.0092 | 160.9087 | 55305 | 668 | | W | 20 | 1 | 156 | | -1.6 | NAD | 0.7 | MAR | -0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.8 | 749.4 |
| 5090 | 64.0093 | 160.9075 | 55304 | 666 | | W | 32 | 1 | 113 | | 0.0 | NAD | 0.6 | MAR | 0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.8 | 749.4 |
| 5091 | 64.0093 | 160.9064 | 55304 | 667 | | W | 30 | 1 | 247 | | -0.2 | NAD | 0.6 | MAR | 0.1 | NAD | 0.0 | 0.0 | 0.0 | 12.8 | 749.3 |
| 5092 | 64.0094 | 160.9052 | 55304 | 671 | | W | 29 | 1 | 343 | | 0.2 | NAD | 1.1 | | 0.3 | | 0.0 | 4.0 | 0.0 | 12.8 | 749.2 |
| 5093 | 64.0094 | 160.9042 | 55304 | 679 | | W | 23 | 1 | 659 | | 2.9 | | -0.8 | NAD | 0.8 | | 0.0 | 0.0 | 3.5 | 12.8 | 748.9 |
| 5094 | 64.0095 | 160.9030 | 55304 | 663 | | W | 34 | 0 | 965 | | 3.2 | | 1.4 | | 0.8 | | 0.5 | 1.9 | 4.1 | 12.9 | 748.5 |
| 5095 | 64.0096 | 160.9017 | 55305 | 647 | | KS | 24 | 0 | 1208 | | 8.6 | | 0.0 | NAD | 0.5 | | 0.0 | 0.0 | 18.3 | 12.9 | 748.1 |
| 5096 | 64.0096 | 160.9007 | 55305 | 463 | | KS | 12 | 0 | 945 | | 2.5 | | 1.7 | | 0.5 | | 0.7 | 3.5 | 5.2 | 12.9 | 747.8 |
| 5097 | 64.0098 | 160.8995 | 55305 | 455 | | KS | 20 | 0 | 831 | | 3.0 | | 1.5 | | 0.6 | | 0.5 | 2.8 | 5.5 | 12.9 | 747.6 |
| 5098 | 64.0098 | 160.8985 | 55305 | 457 | | KS | 22 | 0 | 759 | | 2.2 | | 1.4 | | 0.3 | | 0.6 | 5.1 | 8.1 | 12.9 | 747.1 |
| 5099 | 64.0099 | 160.8973 | 55305 | 465 | | KS | 29 | 0 | 699 | | 1.7 | | 2.0 | | 0.5 | | 1.1 | 4.4 | 4.1 | 12.9 | 746.5 |
| 5100 | 64.0100 | 160.8962 | 55305 | 479 | | KS | 28 | 0 | 610 | | 0.5 | NAD | 1.3 | | 0.4 | | 0.0 | 3.7 | 0.0 | 12.9 | 746.1 |
| 5101 | 64.0100 | 160.8950 | 55305 | 497 | | KS | 26 | 0 | 581 | | 2.2 | | 0.5 | MAR | 0.3 | | 0.2 | 1.6 | 7.0 | 12.9 | 746.0 |
| 5102 | 64.0101 | 160.8940 | 55304 | 518 | | KS | 35 | 0 | 512 | | 1.3 | | -0.2 | NAD | 0.3 | | 0.0 | 0.0 | 4.2 | 12.9 | 745.7 |
| 5103 | 64.0101 | 160.8928 | 55303 | 540 | | KS | 20 | 0 | 677 | | 2.1 | | 1.0 | | 0.2 | | 0.5 | 5.6 | 11.2 | 12.8 | 745.5 |
| 5104 | 64.0102 | 160.8918 | 55303 | 569 | | KS | 26 | 0 | 579 | | 1.7 | | 1.2 | | 0.1 | MAR | 0.7 | 12.6 | 17.6 | 12.8 | 745.5 |
| 5105 | 64.0103 | 160.8905 | 55304 | 608 | | KS | 21 | -1 | 611 | | 3.2 | | 3.1 | | 0.0 | NAD | 1.0 | 0.0 | 0.0 | 12.8 | 745.6 |
| 5106 | 64.0103 | 160.8895 | 55303 | 514 | | KS | 16 | -1 | 551 | | 3.7 | | 0.2 | NAD | 0.3 | | 0.0 | 0.0 | 11.1 | 12.8 | 745.5 |
| 5107 | 64.0104 | 160.8883 | 55304 | 595 | | KS | 37 | -1 | 488 | | 1.6 | | 2.4 | | 0.1 | MAR | 1.5 | 18.6 | 12.5 | 12.8 | 745.4 |
| 5108 | 64.0105 | 160.8873 | 55302 | 575 | | KS | 22 | -1 | 510 | | 0.2 | NAD | 1.3 | | 0.3 | | 0.0 | 5.1 | 0.0 | 12.8 | 745.3 |
| 5109 | 64.0106 | 160.8860 | 55304 | 552 | | KS | 28 | -1 | 437 | | 0.0 | NAD | 1.0 | | 0.1 | MAR | 0.0 | 9.0 | 0.0 | 12.8 | 745.2 |
| 5110 | 64.0107 | 160.8848 | 55305 | 532 | | KS | 25 | -1 | 405 | | 0.5 | NAD | 1.1 | | 0.3 | | 0.0 | 4.0 | 0.0 | 12.8 | 745.1 |
| 5111 | 64.0107 | 160.8838 | 55305 | 514 | | KS | 25 | -1 | 379 | | 1.0 | MAR | -0.1 | NAD | 0.3 | | 0.0 | 0.0 | 3.0 | 12.8 | 744.7 |
| 5112 | 64.0108 | 160.8826 | 55305 | 501 | | KS | 35 | -1 | 375 | | 0.5 | MAR | 1.4 | | 0.1 | MAR | 2.5 | 13.6 | 5.5 | 12.8 | 744.5 |
| 5113 | 64.0108 | 160.8816 | 55305 | 490 | | KS | 20 | -1 | 411 | | 0.0 | NAD | 1.1 | | 0.0 | NAD | 0.0 | 0.0 | 0.0 | 12.8 | 744.3 |
| 5114 | 64.0109 | 160.8803 | 55305 | 481 | | KS | 22 | -1 | 417 | | 1.0 | | 1.0 | | 0.1 | MAR | 1.0 | 12.7 | 12.9 | 12.8 | 744.3 |
| 5115 | 64.0110 | 160.8791 | 55305 | 477 | | KS | 28 | -1 | 517 | | 0.8 | MAR | 1.1 | | 0.3 | | 1.3 | 4.0 | 3.1 | 12.8 | 744.1 |
| 5116 | 64.0110 | 160.8781 | 55304 | 479 | | KS | 17 | 0 | 616 | | 1.4 | | 0.7 | | 0.5 | | 0.5 | 1.4 | 2.8 | 12.8 | 744.0 |
| 5117 | 64.0111 | 160.8769 | 55304 | 436 | | KS | 23 | 0 | 623 | | 4.3 | | 0.8 | | 0.6 | | 0.2 | 1.4 | 7.0 | 12.8 | 743.9 |
| 5118 | 64.0111 | 160.8759 | 55303 | 473 | | KS | 22 | 0 | 607 | | 2.5 | | 1.5 | | 0.1 | | 0.6 | 10.2 | 17.5 | 12.8 | 744.0 |
| 5119 | 64.0112 | 160.8746 | 55303 | 500 | | KS | 21 | 0 | 693 | | 3.5 | | 0.5 | MAR | 0.5 | | 0.2 | 1.1 | 7.4 | 12.8 | 744.2 |
| 5120 | 64.0113 | 160.8734 | 55303 | 509 | | KS | 22 | -1 | 633 | | 2.2 | | 2.6 | | 0.3 | | 1.2 | 8.6 | 7.2 | 12.8 | 744.2 |
| 5121 | 64.0113 | 160.8724 | 55302 | 516 | | KS | 30 | -1 | 636 | | 3.7 | | 0.2 | NAD | 0.3 | | 0.0 | 0.0 | 10.9 | 12.8 | 744.5 |
| 5122 | 64.0113 | 160.8712 | 55302 | 519 | | KS | 25 | -2 | 777 | | 5.1 | | 1.5 | | 0.3 | | 0.3 | 5.9 | 20.2 | 12.8 | 744.9 |
| 5123 | 64.0113 | 160.8701 | 55302 | 518 | | KS | 26 | -2 | 658 | | 3.8 | | 0.9 | | 0.4 | | 0.2 | 2.2 | 9.0 | 12.8 | 745.1 |
| 5124 | 64.0113 | 160.8689 | 55302 | 517 | | KS | 32 | -2 | 718 | | 0.8 | MAR | 1.9 | | 0.7 | | 2.1 | 2.8 | 1.3 | 12.8 | 745.6 |
| 5125 | 64.0113 | 160.8677 | 55302 | 523 | | KS | 32 | -2 | 763 | | 2.7 | | 2.2 | | 0.2 | | 0.8 | 13.0 | 16.0 | 12.8 | 746.1 |
| 5126 | 64.0114 | 160.8667 | 55302 | 541 | | KS | 25 | -1 | 781 | | 3.2 | | 1.3 | | 0.6 | | 0.4 | 2.4 | 5.9 | 12.8 | 746.4 |
| 5127 | 64.0114 | 160.8654 | 55301 | 559 | | KS | 26 | -1 | 736 | | 1.1 | MAR | 2.6 | | 0.3 | | 2.2 | 8.2 | 3.8 | 12.9 | 746.8 |
| 5128 | 64.0114 | 160.8644 | 55300 | 574 | | KS | 23 | -1 | 668 | | 3.2 | | 0.2 | NAD | 0.4 | | 0.0 | 0.0 | 7.4 | 12.9 | 747.1 |
| 5129 | 64.0114 | 160.8632 | 55300 | 592 | | KS | 21 | 0 | 640 | | 2.4 | | 3.5 | | -0.0 | NAD | 1.4 | 0.0 | 0.0 | 12.9 | 747.3 |
| 5130 | 64.0113 | 160.8620 | 55300 | 506 | | KS | 14 | 0 | 696 | | 1.9 | | 1.9 | | 0.3 | | 1.0 | 7.1 | 6.9 | 12.9 | 747.3 |
| 5131 | 64.0113 | 160.8609 | 55302 | 517 | | KS | 27 | 0 | 595 | | 1.4 | | 0.7 | MAR | 0.3 | | 0.5 | 2.4 | 4.4 | 13.0 | 747.7 |

# APPENDIX G

Average Record Data Listing

| RECORD NUMBER | LATITUDE | LONGITUDE | RESID TOTAL FIELD GAMMA | GEOL UNIT | COSM CPS | ATM. URAN CPS | TOTAL COUNT CPS | ETH PPM | FLG | STD DEV | EU PPM | FLG | STD DEV | POT PCT | FLG | STD DEV | EU ETH RATIO | STD DEV | EU POTA RATIO | STD DEV | ETH POTA RATIO | STD DEV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5185 | 64.0087 | -160.8023 | 55293 | KS | 29 | 0 | 912 | 3.5 | | 0 | 1.6 | | 0 | 0.6 | | 0 | 0.5 | 1 | 2.8 | 0 | 6.0 | 0 |
| 5186 | 64.0086 | -160.8012 | 55292 | KS | 23 | 0 | 986 | 3.3 | | 0 | 1.6 | | 0 | 0.6 | | 0 | 0.5 | 1 | 2.6 | 0 | 5.6 | 0 |
| 5187 | 64.0085 | -160.8002 | 55291 | KS | 39 | 0 | 947 | 3.8 | | 0 | 1.5 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.4 | 0 | 6.1 | 0 |
| 5188 | 64.0085 | -160.7992 | 55290 | KS | 32 | 0 | 1017 | 3.5 | | 0 | 1.6 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.5 | 0 | 5.6 | 0 |
| 5189 | 64.0084 | -160.7982 | 55291 | KS | 32 | 0 | 956 | 3.3 | | 0 | 1.6 | | 0 | 0.6 | | 0 | 0.5 | 1 | 2.6 | 0 | 5.1 | 0 |
| 5190 | 64.0085 | -160.7971 | 55291 | W | 21 | 0 | 974 | 3.5 | | 1 | 1.4 | | 1 | 0.6 | | 1 | 0.4 | 0 | 2.2 | 0 | 5.3 | 0 |
| 5191 | 64.0085 | -160.7961 | 55291 | KS | 27 | 0 | 918 | 3.2 | | 0 | 1.3 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.1 | 0 | 4.9 | 0 |
| 5192 | 64.0085 | -160.7949 | 55290 | KS | 29 | -1 | 886 | 3.3 | | 0 | 1.3 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.3 | 0 | 5.7 | 0 |
| 5193 | 64.0085 | -160.7939 | 55290 | KS | 32 | -1 | 804 | 3.0 | | 0 | 1.3 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.4 | 0 | 5.3 | 0 |
| 5194 | 64.0084 | -160.7928 | 55290 | KS | 29 | -1 | 789 | 3.0 | | 0 | 1.2 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.2 | 0 | 5.5 | 0 |
| 5195 | 64.0084 | -160.7918 | 55289 | KS | 31 | -2 | 757 | 3.0 | | 0 | 1.3 | | 0 | 0.5 | | 0 | 0.4 | 0 | 2.5 | 0 | 5.7 | 0 |
| 5196 | 64.0084 | -160.7908 | 55289 | KS | 20 | -2 | 809 | 2.7 | | -1 | 1.2 | | 0 | 0.5 | | -1 | 0.4 | 0 | 2.4 | 0 | 5.6 | 0 |
| 5197 | 64.0085 | -160.7896 | 55292 | KS | 24 | -3 | 771 | 2.7 | | -1 | 1.3 | | 0 | 0.5 | | -1 | 0.5 | 1 | 2.9 | 1 | 6.0 | 0 |
| 5198 | 64.0085 | -160.7885 | 55292 | KS | 20 | -3 | 813 | 2.9 | | -1 | 1.3 | | 0 | 0.4 | | -1 | 0.5 | 1 | 3.1 | 1 | 6.4 | 0 |
| 5199 | 64.0085 | -160.7875 | 55292 | KS | 21 | -3 | 772 | 2.5 | | -1 | 1.4 | | 0 | 0.4 | | -1 | 0.5 | 1 | 3.3 | 1 | 6.1 | 0 |
| 5200 | 64.0085 | -160.7865 | 55292 | KS | 28 | -3 | 764 | 2.7 | | -1 | 1.4 | | 0 | 0.4 | | -1 | 0.5 | 1 | 3.4 | 1 | 6.7 | 0 |
| 5201 | 64.0085 | -160.7855 | 55291 | KS | 29 | -3 | 814 | 2.4 | | -1 | 1.5 | | 0 | 0.4 | | -1 | 0.6 | 2 | 3.9 | 2 | 6.1 | 0 |
| 5202 | 64.0086 | -160.7843 | 55291 | KS | 27 | -3 | 789 | 2.4 | | -1 | 1.4 | | 0 | 0.4 | | -1 | 0.6 | 2 | 3.8 | 2 | 6.2 | 0 |
| 5203 | 64.0086 | -160.7832 | 55290 | KS | 27 | -3 | 770 | 2.1 | | -1 | 1.5 | | 0 | 0.4 | | -1 | 0.7 | 3 | 4.0 | 2 | 5.7 | 0 |
| 5204 | 64.0086 | -160.7822 | 55292 | KS | 18 | -4 | 695 | 1.9 | | -1 | 1.4 | | 0 | 0.4 | | -1 | 0.7 | 3 | 4.0 | 2 | 5.5 | 0 |
| 5205 | 64.0087 | -160.7812 | 55292 | KS | 33 | -4 | 633 | 1.7 | | -1 | 1.5 | | 0 | 0.3 | | -1 | 0.9 | 3 | 4.5 | 3 | 5.3 | 0 |
| 5206 | 64.0087 | -160.7802 | 55291 | KS | 33 | -5 | 618 | 2.1 | | -1 | 1.4 | | 0 | 0.3 | | -1 | 0.7 | 3 | 4.1 | 2 | 5.9 | 0 |
| 5207 | 64.0088 | -160.7789 | 55290 | KS | 32 | -5 | 595 | 2.1 | | -1 | 1.1 | | 0 | 0.3 | | -1 | 0.6 | 2 | 3.5 | 1 | 6.1 | 0 |
| 5208 | 64.0088 | -160.7779 | 55290 | KS | 24 | -6 | 605 | 2.1 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.2 | 1 | 6.3 | 0 |
| 5209 | 64.0088 | -160.7769 | 55291 | KS | 20 | -6 | 525 | 1.9 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.4 | 1 | 6.4 | 0 |
| 5210 | 64.0088 | -160.7759 | 55291 | KS | 29 | -6 | 645 | 1.9 | | -1 | 0.8 | | -1 | 0.3 | | -1 | 0.4 | 0 | 2.6 | 0 | 6.0 | 0 |
| 5211 | 64.0089 | -160.7747 | 55291 | KS | 29 | -7 | 547 | 2.1 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.3 | 1 | 6.7 | 0 |
| 5212 | 64.0089 | -160.7736 | 55290 | KS | 35 | -7 | 530 | 2.1 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.8 | 2 | 7.3 | 0 |
| 5213 | 64.0089 | -160.7726 | 55289 | KS | 36 | -8 | 502 | 1.9 | | -1 | 0.9 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.4 | 1 | 6.9 | 0 |
| 5214 | 64.0090 | -160.7714 | 55289 | KS | 33 | -8 | 551 | 2.2 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.4 | 1 | 7.4 | 0 |
| 5215 | 64.0090 | -160.7704 | 55289 | KS | 25 | -7 | 593 | 2.1 | | -1 | 1.0 | | -1 | 0.3 | | -1 | 0.5 | 1 | 3.1 | 1 | 6.5 | 0 |
| 5216 | 64.0091 | -160.7693 | 55289 | KS | 23 | -7 | 669 | 2.1 | | -1 | 1.1 | | 0 | 0.3 | | -1 | 0.5 | 1 | 3.4 | 1 | 6.3 | 0 |
| 5217 | 64.0091 | -160.7683 | 55290 | KS | 23 | -7 | 617 | 2.2 | | -1 | 1.1 | | 0 | 0.4 | | -1 | 0.5 | 1 | 3.0 | 1 | 6.1 | 0 |
| 5218 | 64.0092 | -160.7671 | 55289 | KS | 20 | -7 | 684 | 2.5 | | -1 | 1.0 | | -1 | 0.4 | | -1 | 0.4 | 0 | 2.5 | 0 | 6.3 | 0 |
| 5219 | 64.0092 | -160.7661 | 55289 | KS | 30 | -7 | 608 | 2.7 | | -1 | 1.1 | | 0 | 0.5 | | -1 | 0.4 | 0 | 2.4 | 0 | 6.1 | 0 |
| 5220 | 64.0092 | -160.7651 | 55288 | KS | 29 | -8 | 637 | 3.0 | | 0 | 1.0 | | -1 | 0.5 | | -1 | 0.3 | 0 | 2.0 | 0 | 5.8 | 0 |
| 5221 | 64.0092 | -160.7638 | 55287 | KS | 33 | -8 | 852 | 3.0 | | 0 | 1.0 | | -1 | 0.6 | | 0 | 0.3 | 0 | 1.7 | 0 | 5.1 | 0 |
| 5222 | 64.0093 | -160.7628 | 55287 | KS | 31 | -9 | 817 | 3.0 | | 0 | 1.3 | | 0 | 0.6 | | 0 | 0.4 | 0 | 2.2 | 0 | 5.2 | 0 |
| 5223 | 64.0093 | -160.7618 | 55287 | KS | 26 | -9 | 908 | 3.0 | | 0 | 1.2 | | 0 | 0.6 | | 0 | 0.4 | 0 | 1.9 | 0 | 4.8 | 0 |
| 5224 | 64.0094 | -160.7606 | 55288 | KS | 35 | -9 | 991 | 3.5 | | 0 | 1.3 | | 0 | 0.7 | | 0 | 0.4 | 0 | 1.9 | 0 | 5.2 | 0 |
| 5225 | 64.0094 | -160.7596 | 55288 | KS | 38 | -9 | 972 | 3.7 | | 0 | 1.2 | | 0 | 0.7 | | 0 | 0.3 | 0 | 1.7 | 0 | 5.1 | 0 |
| 5226 | 64.0094 | -160.7585 | 55288 | KS | 25 | -9 | 1046 | 3.7 | | 0 | 1.4 | | 0 | 0.7 | | 0 | 0.4 | 0 | 2.0 | 0 | 5.0 | 0 |
| 5227 | 64.0095 | -160.7575 | 55287 | KS | 24 | -8 | 1050 | 3.3 | | 0 | 1.4 | | 0 | 0.7 | | 0 | 0.4 | 0 | 2.0 | 0 | 4.7 | 0 |
| 5228 | 64.0095 | -160.7563 | 55287 | KS | 24 | -8 | 1016 | 3.5 | | 0 | 1.3 | | 0 | 0.7 | | 0 | 0.4 | 0 | 1.8 | 0 | 4.9 | 0 |
| 5229 | 64.0095 | -160.7553 | 55288 | KS | 35 | -8 | 1066 | 3.8 | | 0 | 1.2 | | 0 | 0.8 | | 0 | 0.3 | 0 | 1.6 | 0 | 4.9 | 0 |
| 5230 | 64.0095 | -160.7542 | 55287 | KS | 27 | -7 | 1065 | 4.0 | | 0 | 1.1 | | 0 | 0.8 | | 0 | 0.3 | 0 | 1.5 | -1 | 5.1 | 0 |
| 5231 | 64.0095 | -160.7530 | 55287 | KS | 41 | -7 | 984 | 4.1 | | 0 | 0.9 | | -1 | 0.8 | | 0 | 0.2 | -1 | 1.1 | -1 | 5.1 | 0 |
| 5232 | 64.0096 | -160.7520 | 55286 | KS | 30 | -6 | 1114 | 4.3 | | 0 | 0.9 | | -1 | 0.8 | | 0 | 0.2 | -1 | 1.1 | -1 | 5.2 | 0 |
| 5233 | 64.0096 | -160.7510 | 55285 | KS | 34 | -6 | 1082 | 4.1 | | 0 | 1.0 | | -1 | 0.8 | | 0 | 0.2 | -1 | 1.2 | -1 | 5.3 | 0 |
| 5234 | 64.0097 | -160.7497 | 55285 | KS | 32 | -6 | 1041 | 4.1 | | 0 | 1.2 | | 0 | 0.8 | | 0 | 0.3 | 0 | 1.5 | -1 | 5.2 | 0 |
| 5235 | 64.0097 | -160.7487 | 55285 | KS | 30 | -6 | 1071 | 3.8 | | 0 | 1.2 | | 0 | 0.8 | | 0 | 0.3 | 0 | 1.6 | 0 | 5.0 | 0 |
| 5236 | 64.0097 | -160.7477 | 55287 | KS | 40 | -6 | 996 | 4.0 | | 0 | 1.4 | | 0 | 0.7 | | 0 | 0.4 | 0 | 1.9 | 0 | 5.3 | 0 |
| 5237 | 64.0098 | -160.7467 | 55287 | KS | 26 | -6 | 1029 | 3.8 | | 0 | 1.7 | | 0 | 0.7 | | 0 | 0.4 | 0 | 2.3 | 0 | 5.3 | 0 |

# APPENDIX H

DOE Single Record Reduced Data Tape

## DOE SINGLE RECORD REDUCED DATA TAPE

```
Line            Character Number
Number   12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

         02 0978   (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

         SINGLE RECORD REDUCED DATA TAPE

         FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

         ITEM      FORMAT      DESCRIPTION
         1         A40         QUADRANGLE NAME AS PROJECT IDENTIFICATION
         2         A20         NAME OF SUBCONTRACTOR
         3         I4          APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
         4         I1          NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR
                               THIS QUADRANGLE
         4         I1          AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
         6         A20         AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR
                               FIRST SYSTEM
         7         F6.1        NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
                               TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
                               IN CPS PER PERCENT K FOR FIRST SYSTEM
         8         F6.1        NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
                               TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE
                               IN CPS PER PPM EQUIVALENT U
         9         F6.1        NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
                               TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
                               IN CPS PER PPM EQUIVALENT TH
         10        I6          BLANK FIELD (999999)
         11        F6.3        4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
                               PLACES IN SECONDS FOR FIRST SYSTEM
         12        F6.3        2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
                               PLACES IN SECONDS FOR FIRST SYSTEM
         13        I3          NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST
                               AERIAL SYSTEM
         14        I3          NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST
                               AERIAL SYSTEM
         15-24     (SAME)      REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
          *         *                             *
          *         *                             *
          *         *                             *
         85-94     (SAME)      REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
         95        I3          NUMBER OF FLIGHT LINES ON THIS TAPE
         96        I4          FIRST FLIGHT LINE NUMBER ON THIS TAPE
         97        I6          FIRST RECORD NUMBER OF FIRST FLIGHT LINE
         98        I3          JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS
                               COLLECTED
         99-101    I4,I6,I3    REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS
                               TAPE
          *         *                             *
          *         *                             *
          *         *                             *
         390-392   I4,I6,I3    REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS
                               TAPE
```

Character Number

```
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

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
6         F8.4       LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7         F6.1       TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8         F7.1       RESIDUAL  (IGRF REMOVED) MAGNETIC FIELD INTENSITY
                     TO ONE DECIMAL PLACE IN GAMMAS
9         A8         SURFACE GEOLOGIC MAP UNIT CODE
10        I4         QUALITY FLAG CODES
11        F6.1       APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM
                     (K-40) TO ONE DECIMAL PLACE IN PERCENT K
12        F4.1       UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL
                     PLACE IN PERCENT K
13        F6.1       APPARENT CONCENTRATION OF TERRESTRIAL URANIUM
                     (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
14        F4.1       UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL
                     PLACE IN PPM EQUIVALENT U
15        F6.1       APPARENT CONCENTRATION OF TERRESTRIAL THORIUM
                     (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
16        F4.1       UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL
                     PLACE IN PPM EQUIVALENT TH
17        F6.1       URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN
                     PPM EQUIVALENT U PER PPM EQUIVALENT TH
18        F6.1       URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN
                     PPM EQUIVALENT U PER PERCENT K
19        F6.1       THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN
                     PPM EQUIVALENT TH PER PERCENT K
20        F8.1       GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL
                     PLACE IN COUNTS PER SECOND
21        F6.1       UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL
                     PLACE IN COUNTS PER SECOND
22        F5.1       ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL
                     PLACE IN PPM EQUIVALENT U
23        F4.1       UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION
                     TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
24        F4.1       OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN
                     DEGREES CELSIUS
25        F5.1       OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
```

# A P P E N D I X  I

DOE Raw Spectral Data Tape

DOE RAW SPECTRAL DATA TAPE

```
Character Number
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

01 0978   (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

RAW SPECTRAL DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK ON TAPE)

ITEM       FORMAT     DESCRIPTION
1          A40        QUADRANGLE NAME AS PROJECT IDENTIFICATION
2          A20        NAME OF SUBCONTRACTOR
3          I4         APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4          I1         AERIAL SYSTEM IDENTIFICATION CODE
5          A20        AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
6          I3         BFEC CALIBRATION REPORT NUMBER
7          F6.3       4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
                      PLACES IN SECONDS
8          F6.3       2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
                      PLACES IN SECONDS
9          I3         NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
10         I3         NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
11         I3         NUMBER OF FLIGHT LINES ON THIS TAPE
12         I4         FIRST FLIGHT LINE NUMBER ON THIS TAPE
13         I6         FIRST RECORD NUMBER OF FIRST FLIGHT LINE
14         I3         JULIAN DATA (DAY OF YEAR) FIRST FLIGHT LINE WAS
                      COLLECTED
15-17      I4,I6,I3   REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS
                      TAPE
 *          *                          *
 *          *                          *
 *          *                          *
306-308    I4,I6,I3   REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS
                      TAPE

FORMAT FOR RAW SPECTRAL DATA RECORD (THIRD THRU LAST BLOCK ON TAPE)

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
6          F8.4       LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7          F6.1       TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8          F7.1       TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE
                      IN GAMMAS
9          A8         SURFACE GEOLOGIC MAP UNIT CODE
10         I4         QUALITY FLAG CODES
11         F4.1       OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN
                      DEGREES CELSIUS
12         F5.1       OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
13         F5.3       LIVE TIME COUNTING PERIOD TO THREE DECIMAL PLACES IN
                      SECONDS
14         I4         SUMMED RAW OUTPUT FROM COSMIC CHANNELS (3-6 MEV) IN
                      COUNTS
```

| Line Number | Character Number 123456789012345678901234567890123456789012345678901234567890123456789012 | | |
|---|---|---|---|
| 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 |

# A P P E N D I X  K

DOE Statistical Analysis Data Tape

## DOE STATISTICAL ANALYSIS DATA TAPE

| Line Number | Character Number 12345678901234567890123456789012345678901234567890123456789012345678901 2 | | |
|---|---|---|---|
| 1 | 03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES) | | |
| 2 | | | |
| 3 | STATISTICAL ANALYSIS DATA TAPE | | |
| 4 | | | |
| 5 | FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK) | | |
| 6 | | | |
| 7 | ITEM | FORMAT | DESCRIPTION |
| 8 | 1 | A40 | QUADRANGLE NAME AS PROJECT IDENTIFICATION |
| 9 | 2 | A20 | NAME OF SUBCONTRACTOR |
| 10 | 3 | I4 | APPROXIMATE DATE OF SURVEY (MONTH, YEAR) |
| 11 | 4 | I1 | NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR |
| 12 | | | THIS QUADRANGLE |
| 13 | 5 | I1 | AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM |
| 14 | 6 | A20 | AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR |
| 15 | | | FIRST SYSTEM |
| 16 | 7 | F6.1 | NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO |
| 17 | | | TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE |
| 18 | | | IN CPS PER PERCENT K |
| 19 | 8 | F6.1 | NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO |
| 20 | | | TERRESTRIAL URANIUM (B1-214) TO ONE DECIMAL PLACE |
| 21 | | | IN CPS PER PPM EQUIVALENT U |
| 22 | 9 | F6.1 | NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO |
| 23 | | | TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE |
| 24 | | | IN CPS PER PPM EQUIVALENT TH |
| 25 | 10 | I6 | BLANK FIELD (999999) |
| 26 | 11 | F6.3 | 4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL |
| 27 | | | PLACES IN SECONDS FOR FIRST SYSTEM |
| 28 | 12 | F6.3 | 2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL |
| 29 | | | PLACES IN SECONDS FOR FIRST SYSTEM |
| 30 | 13 | I3 | NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST |
| 31 | | | AERIAL SYSTEM |
| 32 | 14 | I3 | NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST |
| 33 | | | AERIAL SYSTEM |
| 34 | 15-24 | (SAME) | REPEAT OF ITEMS 5-14 FOR AERIAL SYSTEM |
| 35 | * | * | * |
| 36 | * | * | * |
| 37 | * | * | * |
| 38 | 85-94 | (SAME) | REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM |
| 39 | 95 | I3 | NUMBER OF FLIGHT LINES ON THIS TAPE |
| 40 | 96 | I4 | FIRST FLIGHT LINE NUMBER ON THIS TAPE |
| 41 | 97 | I6 | FIRST RECORD NUMBER OF FIRST FLIGHT LINE |
| 42 | 98 | I3 | JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS |
| 43 | | | COLLECTED |
| 44 | 99-101 | I4,I6,I3 | REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS |
| 45 | | | TAPE |
| 46 | * | * | * |
| 47 | * | * | * |
| 48 | * | * | * |
| 49 | 390-392 | I4,I6,I3 | REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS |
| 50 | | | TAPE |
| 51 | | | |

Line Number | Character Number 12345678901234567890123456789013456789012345678901234567890123456789012

FORMAT FOR STATISTICAL ANALYSIS 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 |
| 6 | F8.4 | LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES |
| 7 | F6.1 | TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS |
| 8 | F7.1 | RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS |
| 9 | A8 | SURFACE GEOLOGIC MAP UNIT CODE |
| 10 | I5 | QUALITY FLAG CODES |
| 11 | F6.1 | AVERAGED CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K |
| 12 | F4.1 | UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K |
| 13 | F5.1 | POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |
| 14 | F6.1 | AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 15 | F4.1 | UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 16 | F5.1 | URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |
| 17 | F6.1 | AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH |
| 18 | F4.1 | UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH |
| 19 | F5.1 | THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |
| 20 | F8.1 | GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND |
| 21 | F6.1 | UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND |
| 22 | F5.1 | ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 23 | F4.1 | UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 24 | F6.1 | AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH |
| 25 | F5.1 | URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |
| 26 | F6.1 | AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K |
| 27 | F5.1 | URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |
| 28 | F6.1 | AVERAGED THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K |
| 29 | F5.1 | THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED |

# APPENDIX L

DOE Statistical Analysis Summary Data Tape

DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE

Character Number
1234567890123456789012345678901234567890123456789012345678901234567890l2

05 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)

STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

| ITEM | FORMAT | DESCRIPTION |
|---|---|---|
| 1 | A40 | QUADRANGLE NAME AS PROJECT IDENTIFICATION |
| 2 | A20 | NAME OF SUBCONTRACTOR |
| 3 | I4 | APPROXIMATE DATE OF SURVEY (MONTH, YEAR) |
| 4 | I6 | NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS QUADRANGLE |

FORMAT FOR STATISTICAL ANALYSIS SUMMARY DAT RECORD (THIRD THRU LAST BLOCK)

| ITEM | FORMAT | DESCRIPTION |
|---|---|---|
| 1 | A8 | SURFACE GEOLOGIC MAP UNIT IDENTIFYING CODE |
| 2 | I6 | TOTAL RECORDS FOR GEOLOGIC MAP UNIT |
| 3 | I6 | NUMBER OF POTASSIUM RECORDS COMPUTED FOR GEOLOGIC UNIT |
| 4 | F6.1 | POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PERCENT K |
| 5 | F6.1 | POTASSIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PERCENT K |
| 6 | A3 | POTASSIUM CONCENTRATION DISTRIBUTION CODE |
| 7 | I6 | NUMBER OF URANIUM RECORDS COMPUTED FOR GEOLOGIC UNIT |
| 8 | F6.1 | URANIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 9 | F6.1 | URANIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U |
| 10 | A3 | URANIUM CONCENTRATION DISTRIBUTION CODE |
| 11 | I6 | NUMBER OF THORIUM RECORDS COMPUTED FOR GEOLOGIC UNIT |
| 12 | F6.1 | THORIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH |
| 13 | F6.1 | THORIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH |
| 14 | A3 | THORIUM CONCENTRATION DISTRIBUTION CODE |
| 15 | I6 | NUMBER OF URANIUM-TO-THORIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT |
| 16 | F6.1 | URANIUM-TO-THORIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH |
| 17 | F6.1 | URANIUM-TO-THORIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH |
| 18 | A3 | URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE |
| 19 | I6 | NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT |
| 20 | F6.1 | URANIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K |
| 21 | F6.1 | URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K |
| 22 | A3 | URANIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE |

| Line Number | Character Number<br>123456789012345678901234567890123456789012345678901234567890123456789012 | | |
|---|---|---|---|
| 54 | 23 | I6 | NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS |
| 55 | | | COMPUTED FOR GEOLOGIC UNIT |
| 56 | 24 | F6.1 | THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE |
| 57 | | | IN PPM EQUIVALENT TH PER PERCENT K |
| 58 | 25 | F6.1 | THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE |
| 59 | | | DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K |
| 60 | 26 | A3 | THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE |

# A P P E N D I X   M

DOE Magnetic Data Tape

# DOE MAGNETIC DATA TAPE FORMAT

Line Number — Character Number

12345678901234567890123456789012345678901234567890123456789012345678901 2

04 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

MAGNETIC DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

| ITEM | FORMAT | DESCRIPTION |
|---|---|---|
| 1 | A40 | QUADRANGLE NAME AS PROJECT IDENTIFICATION |
| 2 | A20 | NAME OF SUBCONTRACTOR |
| 3 | I4 | APPROXIMATE DATA OF SURVEY (MONTH, YEAR) |
| 4 | I3 | NUMBER OF FLIGHT LINES ON THIS TAPE |
| 5 | I4 | FIRST FLIGHT LINE ON THIS TAPE |
| 6 | I6 | FIRST RECORD NUMBER OF FIRST FLIGHT LINE |
| 7 | I3 | JULIAN DATA (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS COLLECTED |
| 8 | F8.4 | LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE |
| 9 | F8.4 | LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE |
| 10-14 | (SAME) | REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS TAPE |
| * | * | * |
| * | * | * |
| * | * | * |
| 495-499 | (SAME) | REPEAT OF ITEMS 5-9 FOR 99TH FLIGHT LINE ON THIS TAPE |

FORMAT FOR MAGNETIC 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 |
| 6 | F8.4 | LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES |
| 7 | F6.1 | TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS |
| 8 | F5.1 | OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG |
| 9 | A8 | SURFACE GEOLOGIC MAP UNIT CODE |
| 10 | F7.1 | TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS |
| 11 | F7.1 | RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS |
| 12 | F7.1 | DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL PLACE IN GAMMAS |
| 13 | F7.1 | MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE IN METERS (IF REQUIRED) |

# APPENDIX N

Reduced Calibration and Test Line Data

## REDUCED CALIBRATION AND TEST LINE DATA

| DATE | FLIGHT | RES. THOR. .583 | RES. THOR. 2615 | LOW PRE ALT. | LOW PRE T.C. | LOW PRE 2 π | LOW POST ALT. | LOW POST T.C. | LOW POST 2 π |
|---|---|---|---|---|---|---|---|---|---|
| 07/27/79 | 17 | 10.3 | 6.2 | 320 | 2600 | 21 | 440 | 2200 | 17 |
| 07/28/79 | 18 | 10.5 | 5.7 | 320 | 2500 | 23 | 500 | 2050 | 28 |
| 08/02/79 | 20 | 9.4 | 5.6 | 380 | 2400 | 12 | | | |
| 08/03/79 | 25 | 10.0 | 5.7 | 325 | 2600 | 10 | 380 | 2600 | 25 |
| 08/11/79 | 30 | 10.4 | 5.6 | 325 | 2500 | 20 | 390 | 2500 | 14 |
| 08/12/79 | 31 | 11.7 | 5.7 | 350 | 1500 | 25 | | | |
| 08/12/79 | 32 | 11.7 | 5.7 | 350 | 1500 | 25 | | | |
| 08/13/79 | 34 | 10.1 | 5.9 | 400 | 1350 | 22 | 400 | 1350 | 20 |
| 08/21/79 | 41 | 10.2 | 6.1 | 400 | 1350 | 25 | 420 | 1250 | 17 |
| 08/21/79 | 42 | 10.2 | 6.1 | 400 | 1350 | 25 | 420 | 1250 | 17 |
| 08/22/79 | 44 | 10.4 | 6.2 | 400 | 1200 | 25 | 420 | 1350 | 23 |
| 08/22/79 | 45 | 10.4 | 6.2 | 400 | 1200 | 25 | 420 | 1350 | 23 |
| 08/23/79 | 47 | 9.3 | 6.0 | 350 | 2600 | 25 | | | |
| 08/23/79 | 50 | 9.3 | 6.0 | 350 | 2600 | 25 | | | |
| 08/24/79 | 53 | 10.0 | 5.8 | 360 | 2600 | 25 | 380 | 2550 | 20 |
| 08/25/79 | 55 | 10.2 | 5.9 | 360 | 2500 | 18 | 340 | 2600 | 28 |
| 08/31/79 | 57 | 10.1 | 5.9 | 380 | 1350 | 22 | 420 | 1300 | 20 |