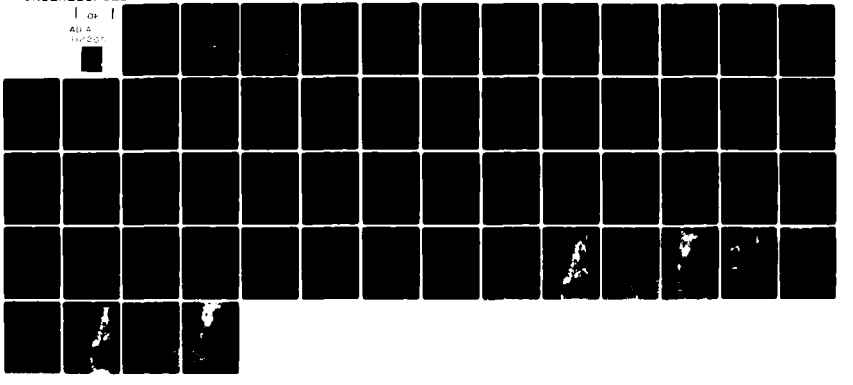
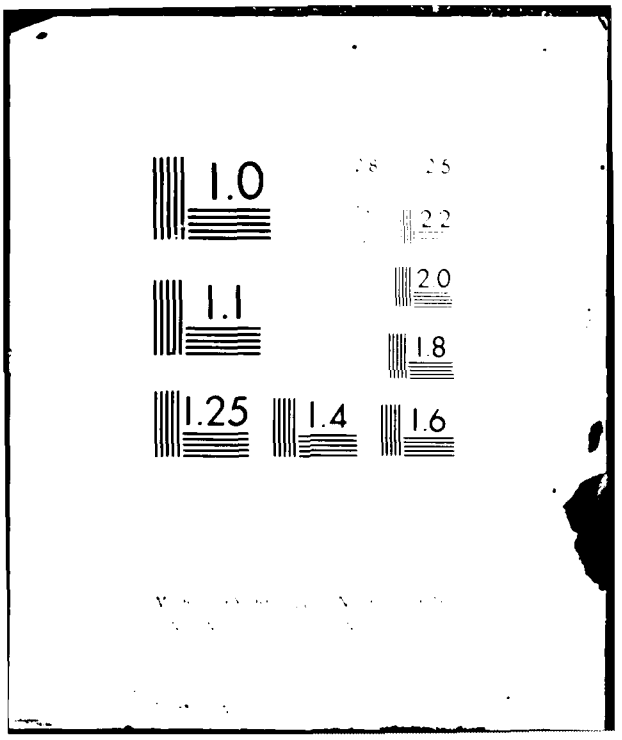
AD-A112 205 ERTEC WESTERN INC LONG BEACH CA F/G 8/7
MX SITING INVESTIGATION, GRAVITY SURVEY - DELAMAR VALLEY, NEVAD--ETC(U)
JUL 81 F04704-80-C-0006
UNCLASSIFIED E-TR-33-DM NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2

PHOTOGRAPH THIS SHEET

AD-A112205

DTIC ACCESSION NUMBER

II

LEVEL

1

INVENTORY

ETR-33-DM

DOCUMENT IDENTIFICATION

This document has been approved for public release and sale; its distribution is unlimited.

DISTRIBUTION STATEMENT

ACCESSION FOR	
NTIS GRA&I	X
DTIC TAB	
UNANNOUNCED	
JUSTIFICATION	
BY	
DISTRIBUTION /	
AVAILABILITY CODES	
DIST	AVAIL AND/OR SPECIAL
A	

DISTRIBUTION STAMP

DTIC COPY INSPECTED

DTIC ELECTE MAR 19 1982 E

DATE ACCESSIONED

89 [illegible] 10

DATE RECEIVED IN DTIC

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDA-2

DTIC FORM OCT 79 70A

DOCUMENT PROCESSING SHEET

Ertec

The Earth Technology Corporation

Ertec

The Earth Technology Corporation

Ertec Western, Inc.

3777 Long Beach Boulevard • Long Beach, California 90807
Telephone: (213) 595-6611

23011 Moulton Parkway, Suite G10 • Laguna Hills, California 92653
Telephone: (714) 951-0926

3116 West Thomas Road, Suite 601 • P.O. Box 14570 • Phoenix, Arizona 85063
Telephone: (602) 269-7501

E-TR-33-DM

MX SITING INVESTIGATION

GRAVITY SURVEY - DELAMAR VALLEY NEVADA

Prepared for:

U.S Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

Ertec Western, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

20 July 1981

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER E-TR-33-DM ~~E-TR-33-DM~~ | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER

4. TITLE *(and Subtitle)*
A Gravity Investigation of Delamar Valley, Nevada

5. TYPE OF REPORT & PERIOD COVERED
Final

6. PERFORMING ORG. REPORT NUMBER
E-TR-33 DM

7. AUTHOR(s)
Ertec

8. CONTRACT OR GRANT NUMBER(s)
F04704-80-C-0006

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Ertec Western Inc. (formerly Fugro National)
P.O. Box 7765
Long Beach CA 90807

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
64312 F

11. CONTROLLING OFFICE NAME AND ADDRESS
U.S. Department of the Air Force
Space and Missile Systems Organization
Norton AFB CA 92409 (SAMSO)

12. REPORT DATE
DEC 1981

13. NUMBER OF PAGES
~~42~~ 37

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*

15. SECURITY CLASS. *(of this report)*
--

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*
Distribution Unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*
Distribution Unlimited

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*
Gravity, ~~Delamar Valley~~ SURVEY, BOUGUER CONTOURS, DEPTH TO ROCK, VALLEY FILL, FAULTS, GRAVITY PROFILE, GRABEN

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Gravity data from Delamar Valley and Pahroc Valley were studied together for the purpose of making a geological interpretation which includes estimates of the overall shape of the structural basin, the thickness of alluvial fill, and the location of concealed faults. The estimates will be useful in modeling the dynamic response of ground motion in the basin and in evaluating groundwater resources. Gravity data and interpretation covering the part of Pahroc Valley referred to as "Eastern Pahroc Valley" (that part east of South Pahroc Range) in our ~~Verification report (Ertec, 1981b) are included in this report.~~

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

FOREWORD

Methodology and Characterization studies during Fiscal Years 1977 and 1978 (FY 77 and 78) included gravity surveys in ten valleys in Arizona (five), Nevada (two), New Mexico (two), and California (one). The gravity data were obtained for the purpose of estimating the gross structure and shape of the basins and the thickness of the valley fill. There was also the possibility of detecting shallow rock in areas between boring locations. Generalized interpretations from these surveys were included in Ertec Western's (formerly Fugro National) Characterization Reports (FN-TR-26a through e).

During the FY 77 surveys, measurements were made to form an approximate 1-mile grid over the study areas, and contour maps showing interpreted depth to bedrock were made. In FY 79, the decision was made to concentrate on verifying and refining suitable area boundaries. This decision resulted in a reduction in the gravity program. Instead of obtaining gravity data on a grid, the reduced program consisted of obtaining gravity measurements along profiles across the valleys where Verification studies were also performed.

The Defense Mapping Agency (DMA), St. Louis, Missouri, was requested to provide gravity data from their library to supplement the gravity profiles. For Big Smoky, Hot Creek, and Big Sand Springs valleys, a sufficient density of library data was available to permit construction of interpreted contour maps instead of just two-dimensional cross sections.

In late summer of FY 79, supplementary funds became available to begin data reduction. At that time, inner zone terrain corrections were begun on the library data and the profiles from Big Smoky Valley, Nevada, and Butler and La Posa valleys, Arizona. The profile data from Whirlwind, Hamlin, Snake East, White River, Garden, and Coal valleys, Nevada, became available from the field in early October 1979.

A continuation of gravity interpretations has been incorporated into the FY 80-81 program, and the results are being summarized in a series of valley reports. Reports covering Nevada-Utah gravity studies are numbered "E-TR-33-" followed by the abbreviation for the subject valley. In addition, more detailed reports of the results of FY 77 surveys in Dry Lake and Ralston valleys, Nevada, were prepared. Verification studies were continued in FY 80 and 81, and gravity studies were included in the program. DMA continued to obtain the field measurements, and there was a return to the grid pattern. The interpretation of the grid data allows the production of contour maps which are valuable in the deep basin structural analysis needed for computer modeling in the water resources program. The

gravity interpretations will also be useful in Nuclear Hardness and Survivability (NH&S) evaluations.

The basic decisions governing the gravity program are made by BMO following consultation with TRW, Inc., Ertec Western, and the DMA. Conduct of the gravity studies is a joint effort between DMA and Ertec Western. The field work, including planning, logistics, surveying, and meter operation is done by the Defense Mapping Agency Hydrographic/Topographic Center (DMAHTC), headquartered in Cheyenne, Wyoming. DMAHTC reduces the data to Simple Bouguer Anomaly (see Section A1.4, Appendix A1.0). The Defense Mapping Agency Aerospace Center (DMAAC), St. Louis, Missouri, calculates outer zone terrain corrections.

Ertec Western provides DMA with schedules showing the valleys with the highest priorities. Ertec Western also recommended locations for the profiles in the FY 79 studies with the provision that they should follow existing roads or trails. Any required inner zone terrain corrections are calculated by Ertec Western prior to making geologic interpretations.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

TABLE OF CONTENTS (cont.)

LIST OF DRAWINGS

1.0 INTRODUCTION

1.1 OBJECTIVE

Gravity data from Delamar Valley and Pahroc Valley were studied together for the purpose of making a geological interpretation which includes estimates of the overall shape of the structural basin, the thickness of alluvial fill, and the location of concealed faults. The estimates will be useful in modeling the dynamic response of ground motion in the basin and in evaluating ground-water resources. Gravity data and interpretation covering the part of Pahroc Valley referred to as "Eastern Pahroc Valley" (that part east of South Pahroc Range) in our Verification report (Ertec, 1981b) are included in this report.

1.2 LOCATION

Delamar Valley is located in the southeastern part of Nevada (Figure 1) in Lincoln County. The town of Caliente, Nevada, is approximately 15 miles (24 km) east on U.S. Highway 93. Access throughout the valley is good due to an extensive network of well-maintained, unpaved roads. The valley is primarily undeveloped desert rangeland.

Delamar Valley is bounded on the east and southeast by the Delamar Mountains and on the west by the South Pahroc Range (Figure 2). U.S. Highway 93 forms the northern boundary and also separates Delamar Valley from Dry Lake Valley.

The area covered by this report lies between North latitudes 37°10' and 37°45' and West longitudes 114°40' and 115°05'. The

E-TR-33-DM

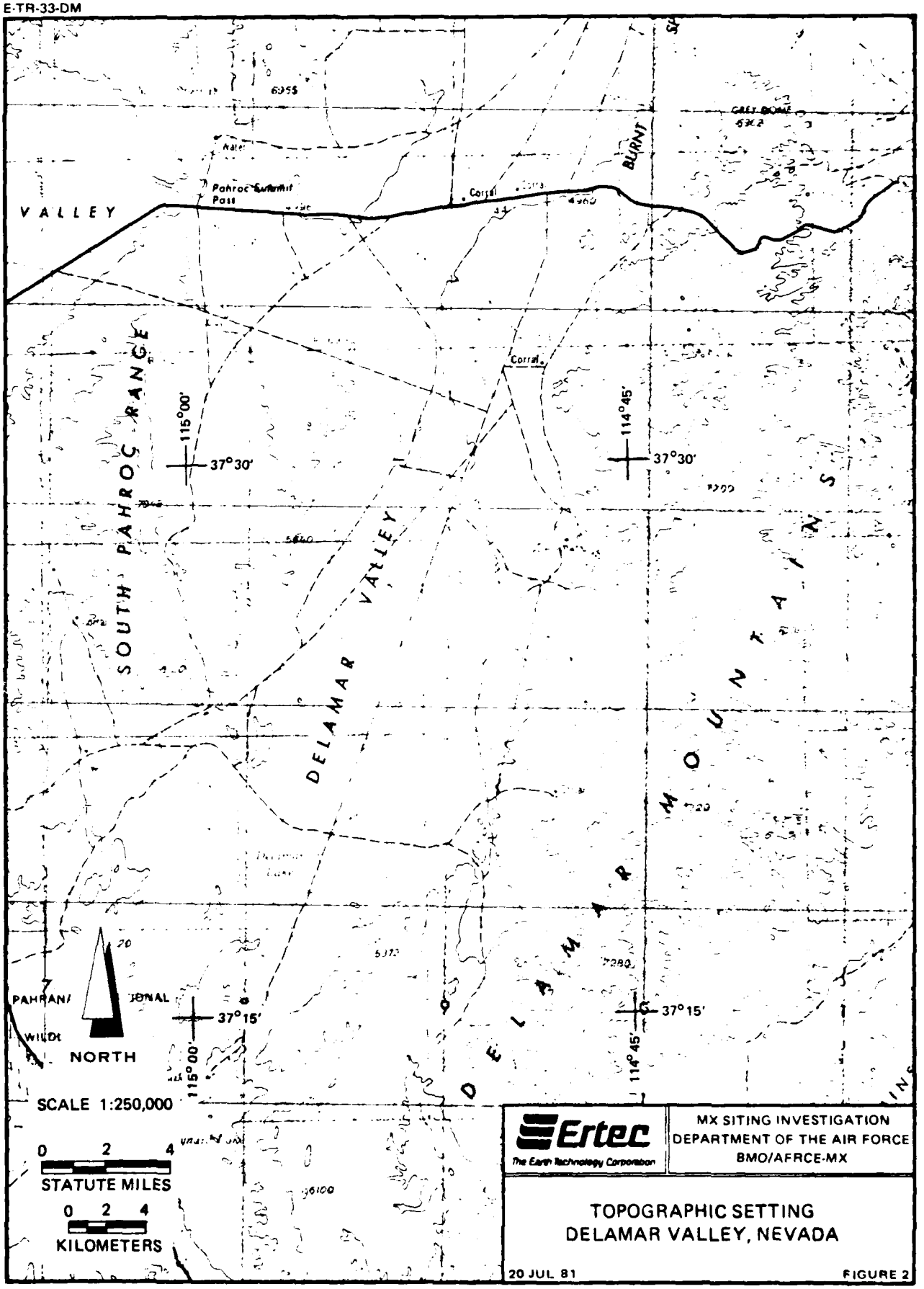
Ertec
The Earth Technology Corporation

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

LOCATION MAP
DELAMAR VALLEY, NEVADA

20 JUL 81

FIGURE 1



Ertec
The Earth Technology Corporation

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

TOPOGRAPHIC SETTING
DELAMAR VALLEY, NEVADA

20 JUL 81

FIGURE 2

valley is approximately 22 miles (35 km) long and the width varies from 8 to 12 miles (13 to 19 km).

1.3 SCOPE OF WORK

Five primary work elements were completed during this study. They are:

1. Computation and merging of terrain corrections;
2. Synthesis of regional and valley-specific geological data;
3. Evaluation of the regional field and residual separation;
4. Inverse modeling to estimate depth to bed rock; and
5. Interpretation of structural relationships.

The gravitational field within Delamar Valley was defined by measurements from 418 stations. The principal facts for these stations are listed in Appendix A2.0, and their distribution is shown in Drawing 1.0. The Defense Mapping Agency Aerospace Center (DMAAC) supplied 246 gravity stations from its library, and 172 new gravity measurements were made by the Defense Mapping Agency Hydrographic Topographic Center/Geodetic Survey Squardon (DMAHTC/GSS).

Delamar Valley and Pahroc Valley were studied together, with the results presented in separate reports. The rectangular region containing both valleys is the area between North latitudes 37° 10' and 37° 45' and West longitudes 114° 40' and 115° 15'. There are 516 gravity stations in the region. All were used to establish a common regional gravity trend for the two valleys.

Following residual separation, the geologic modeling of the two valleys was done independently. This report includes Delamar

Valley and Eastern Pahroc Valley (east of the South Pahroc Range).

2.0 GRAVITY DATA REDUCTION

DMAHTC/GSS obtained the basic observations for the new stations and reduced them to Simple Bouguer Anomalies (SBA) as described in Appendix A1.0. Up to three levels of terrain corrections were applied to the new stations to convert the SBA to the Complete Bouguer Anomaly (CBA). Only the first two levels of terrain corrections described below were applied to the library stations.

First, the DMAAC, St. Louis, Missouri, used its library of digitized terrain data and a computer program to calculate corrections out to 104 miles (167 km) from each station. When the program could not calculate the terrain effects near a station, a ring template was used to estimate the effect of terrain within approximately 3000 feet (914 m) of the station. The third level of terrain corrections was applied to those stations where relief of 10 feet (3 m) or more was observed within 130 feet (40 m). In these cases, the elevation differences were measured in the field at a distance of 130 feet (40 m) along six directions from the stations. These data were used to calculate the effect of the very near relief.

The principal facts and CBA values for the Delamar Valley stations are listed in Appendix A2.0.

3.0 GEOLOGIC SUMMARY

Delamar Valley is located within the Great Basin section of the Basin and Range physiographic province.

The Delamar Mountains, east of the valley, are composed primarily of middle Tertiary lavas (andesite and dacite) overlain by late Tertiary tuffs (Tschanz and Pampeyan, 1970; and Ekren and others, 1977). Some carbonates and siliceous clastic rocks (shales and quartzites) crop out in the central portion of the range near the Delamar mining district. On the west, the South Pahroc Range and the southern end of the North Pahroc Range are composed mainly of late Tertiary volcanic rocks.

Delamar Valley has a typical Basin and Range fault-block structure which is the result of late Tertiary and Quaternary block faulting due to tensional stresses directed in an east-west or northwest-southeast direction. The Pahroc fault is a zone of normal displacement near the foot of the South Pahroc Range. The scarp formed by the Pahroc fault separates the main part of the South Pahroc Range from alluvial flats and low volcanic hills to the east. Numerous small faults and joints trend both northerly and easterly in these low volcanic hills. This is thought to be an area of small fault blocks of varying and differential separation which step down to the east (Ertec, 1981a).

On the east side of Delamar Valley, a range bounding fault is interpreted in alluvial fans at the base of the Delamar Mountains.

This interpretation is based on a surface scarp in the alluvium (Ertec, 1981a). The northeast trending Buckhorn and Maynard Lake Faults bound the south end of Delamar Valley. They are major faults in the Pahranagat Shear Zone which is postulated to have from 10 to 12 miles (16 to 19 km) of pre-Quaternary left-lateral separation (Tschanz and Pampeyan, 1970).

The valley fill is divided into older and younger deposits. The older deposits consist of non-indurated to partly indurated alluvial-fan deposits containing primarily silt, sand, and gravel derived from adjacent highland areas. These deposits possibly include some rocks of volcanic origin. The younger valley fill includes clay, silt, sand, and gravel and is largely restricted to modern intermittent stream channels and playa areas. Depth to ground water ranges from 300 feet (91 m) in the northern part of the valley to more than 1000 feet (305 m) beneath the playa area in the southwestern part of the valley (Eakin, 1963).

4.0 INTERPRETATION

The basis of interpretation is the Complete Bouguer Anomaly (CBA). Contours of the CBA gravity field and the the gravity station locations are shown in Drawing 1.

Mathematical treatment of irregularly spaced data is inefficient. In order to simplify the computer processing, the station CBA and elevation data are reduced to sets of values at uniformly spaced points (nodes) in a geographic array, or grid. The values at each node are calculated from the station data within a circular area around the node. A bell-shaped weighting function assigns greater weight to the nearer data points. The node spacing is chosen to match the average data spacing. A 1.2-mile (2-km) grid spacing was used for this analysis.

4.1 REGIONAL-RESIDUAL SEPARATION

A fundamental part of the gravity interpretation is the separation of regional effects from the local effects of the valley and its fill. The CBA contains long wavelength components from deep and broad geologic structures extending far beyond the valley. These long wavelength components, called the regional gravity, were approximated by upward continuation of the gravity field. Upward continuations were made to successively higher elevations until the negative anomaly over the valley was essentially smoothed out. The final continuation was calculated for an elevation of 170,000 feet (51,816 m). This regional field was subtracted from the CBA and the resulting residual gravity anomaly was adjusted by a constant -2.0 milligals so

that the zero residual would approximately fit the existing rock outcrops.

4.2 DENSITY SELECTION

The construction of a geologic model from the residual anomaly requires selection of density values representative of the alluvial fill and of the underlying rock. Because only very generalized density information is available, the geologic interpretation of the gravity data can be only a coarse approximation. Five borings were drilled approximately 100 feet (30 m) into the alluvium during Verification studies (Ertec, 1981a). The average of the densities measured at the bottom of these borings was 2.0 g/cm^3. To account for compaction with depth (Woollard, 1962; and Grant and West, 1965), a density of 2.3 g/cm^3 was used in the modeling process.

The basement rocks underlying the alluvium of Delamar Valley are assumed to be similar to the rocks comprising the adjacent mountain ranges. These ranges are comprised of late Tertiary volcanic rocks unconformably overlying Paleozoic carbonate rocks. Published values for Paleozoic carbonate and clastic rocks typically range between 2.6 to 2.9 g/cm^3. The carbonate rocks in Nevada and Utah are commonly reported to be relatively high in density, on the order of 2.8 g/cm^3. This value was selected to represent the density of the basement rock. The density of siliceous to intermediate volcanic rocks generally ranges between 2.0 to 2.5 g/cm^3 depending on the degree of welding, compaction, and alteration. The older volcanics in the

Delamar Valley area are probably at the higher end of this density range, being approximately equivalent to dense alluvium or between the density of alluvium and the density of bed rock. The information available regarding the volume and characteristics of subsurface volcanic rocks in Delamar Valley is insufficient to make an estimate of their effect on the geologic model. The density contrast used for modeling was -0.50 g/cm^3.

4.3 *MODELING*

Modeling was done with the aid of a computer program which iteratively calculates a three-dimensional solution of gravity anomaly data (Cordell, 1970). The gravity anomaly is represented by discrete values on a two-dimensional grid. The source of the anomaly (the volume of low-density valley fill) is represented by a set of vertical prism elements. The tops of the prisms lie in a common horizontal plane. The bottoms of the prisms collectively represent the bottom of the valley fill. Each prism has a cross-sectional area equal to one grid square and a uniform density. A grid square of 1.2 miles by 1.2 miles (2 km by 2 km) was selected as representative of the gravity station distribution. Computations were made for three iterations of mutually interactive prism adjustments. The root-mean-square error between the observed residual gravity field and the field calculated for the final model of the entire valley was less than 0.3 milligal.

The calculated thickness of the valley fill depends upon the residual anomaly and the density contrast (i.e., fill density

minus rock density) used. Since neither fill nor rock density is perfectly known, nor even uniform, the calculated thickness should be expected to contain a corresponding degree of uncertainty. A source of error in modeling Delamar Valley as a simple alluvium-basement rock system is the widespread volcanic material throughout the valley.

One seismic refraction line (DM-S-13) and one boring (WR-T1) were used as constraints in the modeling process. Their locations are marked in Drawing 2. The refraction line is located near the mountain flank. It found a 10,000 feet per second (3048 mps) velocity at a depth of 55 feet (17 m) which may represent the basement material. The alluvial fill material in the center of the valley is at least 1195 feet (364 m) thick according to the boring. The calculated thickness of fill, or interpreted depth to rock, is contoured in Drawing 2.

4.4 DISCUSSION OF RESULTS

The interpreted geologic structure of Delamar Valley is shown on the depth-to-rock contour map (Drawing 2). The interpretation is based on geologic information from published reports, analysis of aerial photographs, and geologic field reconnaissance as well as gravity data. The analysis of the gravity data included calculation of the second vertical derivative (SVD) of the CBA field. One property of the SVD is that its zero value marks the steepest gradients of the input CBA field. This property was used to guide the placement of faults in the structural interpretation. The interpreted faults represent only the major

fault systems which probably comprise many smaller fault zones. There may be other discrete faults that had a minor role in basin formation but with displacements so small that they were not resolved by the widely spaced gravity data available for this study.

The depth-to-rock contours define an elongate north-south trending basin coincident with the valley physiography. These contours (Drawing 1) define two north-trending subsurface basins. The northern basin is about 2500 feet (762m) deep and the southern basin is about 5000 feet (1524 m) deep.

The subsurface structural configuration of the northern part of Delamar Valley is complex compared to the relatively simple, deeply faulted grabens in the southern part of the valley and in Dry Lake Valley to the north. Structurally, it is a horst between these two grabens. A major fault system is indicated along the base of the Delamar Mountains by the gravity data but the Pahroc fault on the west side of the valley which is so prominent on the surface, is not clearly indicated. The positions of the Pahroc fault on Drawing 2 are based primarily on surface geologic and geomorphic data. The irregular gravity contours between the Pahroc fault and the Delamar Mountains suggest a relatively shallow basement (bed rock) complex of small fault blocks separated by numerous small-displacement, normal faults. These faults are not reflected in the gravity data because their small displacements do not create large density contrasts. This interpretation is consistent with surface

geology which shows numerous normal-faulted bedrock outcrops scattered throughout this part of the valley.

The southern basin contains a graben with a depth of 5000 feet (1524 m). The western side of the graben has a steeper linear gradient separating it from South Pahroc Range than is indicated on the east side along the Delamar Mountains. The eastern margin of the graben appears to be characterized by two major fault systems; one very near the base of the Delamar Range which is probably related to the basin-bounding fault farther to the north, and a shorter basin-ward fault. These north-south bounding faults appear to be terminated against the northeast trending Buckhorn Fault which is part of the Pahranagat Shear Zone.

5.0 CONCLUSIONS

Delamar Valley gravity data indicates the northern half of the valley is a horst buried by about 1500 feet (457 m) of alluvium. A graben about 5000 feet (1524 m) deep forms the southern half of the valley.

The calculated depths to carbonate bed rock are only approximate because little is known about the actual density distribution which has been represented by a simple two-density model. Also, the residual gravity anomaly is necessarily based on an interpreted regional field. An average density contrast of -0.50 g/cm^3 between the alluvium and bed rock was used to calculate the thickness of the valley-fill material. Future studies that acquire better density data or measure actual depths to bed rock in deep parts of the valley can be used to refine the gravity interpretation

REFERENCES

Cordell, Lindreth, 1970, Iterative solution of three-dimensional gravity anomaly data, *Geological Survey Computer Contribution* No. 10: U.S. Geological Survey, Washington, D.C.

Eakin, T. E., 1963, Ground water appraisal of Dry Lake and Delaar valleys, U.S. Geological Survey, Ground Water Resources-Reconnaissance Series, Report 16, 24 p.

Ekren, E. B., Orkild, P. P., Sargent, K. A., and Dixon, G. L., 1977, Geologic map of Tertiary rocks, Lincoln County, Nevada, U.S. Geologic Survey Map I-1041.

Ertec Western, Inc., 1981a, MX Siting Investigation, Geotechnical Evaluation, Verification Study - Delamar Valley, Nevada, E-TR-27-DM.

_____, 1981b, MX Siting Investigation, Geotechnical Evaluation, Verification Study - Pahroc Valley, Nevada, E-TR-27-PA.

Goguel, Jean, 1954, A universal table for the prediction of the lunar-solar correction in gravimetry (tidal gravity correction), Geophysical Prospecting, v. II, Supplement, March.

Grant, F. S., and West, G. F., 1965, Interpretation theory in applied geophysics: McGraw-Hill Book Co., New York.

Howard, E. L., 1978, Geologic map of the Eastern Great Basin, Nevada and Utah: Denver, Colorado, Terra Scan Group Ltd., Scale 1: 250,000.

Tschanz, C. M., and Pampeyan, E. H., 1970, Geology and mineral deposits of Lincoln County, Nevada; Nevada Bureau of Mines Bulletin 73, 175 p.

Woollard, G. P., 1962, The relation of gravity anomalies to surface elevation, crustal structure, and geology: University of Wisconsin, Department of Geology, Geophysical and Polar Research Center, Madison, Wisconsin, Report 62-9.

APPENDIX A1.0

GENERAL PRINCIPLES OF THE GRAVITY EXPLORATION METHOD

A1.0 GENERAL PRINCIPLES OF THE GRAVITY EXPLORATION METHOD

A1.1 GENERAL

A gravity survey involves measurement of differences in the gravitational field between various points on the earth's surface. The gravitational field values being measured are the same as those influencing all objects on the surface of the earth. They are generally associated with the force which causes a 1-gm mass to be accelerated at 980 cm/sec^2. This force is normally referred to as a 1-g force.

Even though in many applications the gravitational field at the earth's surface is assumed to be constant, small but distinguishable differences in gravity occur from point to point. In a gravity survey, the variations are measured in terms of milligals. A milligal is equal to 0.001 cm/sec^2 or 0.00000102 g. The differences in gravity are caused by geometrical effects, such as differences in elevation and latitude, and by lateral variations in density within the earth. The lateral density variations are a result of changes in geologic conditions. For measurements at the surface of the earth, the largest factor influencing the pull of gravity is the density of all materials between the center of the earth and the point of measurement.

To detect changes produced by differing geological conditions, it is necessary to detect differences in the gravitational field as small as a few milligals. To recognize changes due to

geological conditions, the measurements are "corrected" to account for changes due to differences in elevation and latitude.

Given this background, the basic concept of the gravitational exploration method, the anomaly, can be introduced. If, instead of being an oblate spheroid characterized by complex density variations, the earth were made up of concentric, homogeneous shells, the gravitational field would be the same at all points on the surface of the earth. The complexities in the earth's shape and material distribution are the reason that the pull of gravity is not the same from place to place. A difference in gravity between two points which is not caused by the effects of known geometrical differences, such as in elevation, latitude, and surrounding terrain, is referred to as an "anomaly."

An anomaly reflects lateral differences in material densities. The gravitational attraction is smaller at a place underlain by relatively low density material than it is at a place underlain by a relatively high density material. The term "negative gravity anomaly" describes a situation in which the pull of gravity within a prescribed area is small compared to the area surrounding it. Low-density alluvial deposits in basins such as those in the Nevada-Utah region produce negative gravity anomalies in relation to the gravity values in the surrounding mountains which are formed by more dense rocks.

The objective of gravity exploration is to deduce the variations in geologic conditions that produce the gravity anomalies identified during a gravity survey.

A1.2 INSTRUMENTS

The sensing element of a LaCoste and Romberg gravimeter is a mass suspended by a zero-length spring. Deflections of the mass from a null position are proportional to changes in gravitational attraction. These instruments are sealed and compensated for atmospheric pressure changes. They are maintained at a constant temperature by an internal heater element and thermostat. The absolute value of gravity is not measured directly by a gravimeter. It measures relative values of gravity between one point and the next. Gravitational differences as small as 0.01 milligal can be measured.

A1.3 FIELD PROCEDURES

The gravimeter readings were calibrated in terms of absolute gravity by taking readings twice daily at nearby USGS gravity base stations. Gravimeter readings fluctuate because of small time-related deviations due to the effect of earth tides and instrument drift. Field readings were corrected to account for these deviations. The magnitude of the tidal correction was calculated using an equation suggested by Goguel (1954):

$$C = P + N\cos\phi\,(\cos\phi + \sin\phi) + S\cos\phi\,(\cos\phi - \sin\phi)$$

where C is the tidal correction factor, P, N, and S are time-related variables, and ϕ is the latitude of the observation point. Tables giving the values of P, N, and S are published annually by the European Association of Exploration Geophysicists.

The meter drift correction was based on readings taken at a designated base station at the start and end of each day. Any difference between these two readings after they were corrected for tidal effects was considered to have been the result of instrumental drift. It was assumed that this drift occurred at a uniform rate between the two readings. Corrections for drift were typically only a few hundredths of a milligal. Readings corrected for tidal effects and instrumental drift represented the observed gravity at each station. The observed gravity values represent the total gravitational pull of the entire earth at the measurement stations.

A1.4 DATA REDUCTION

Several corrections or reductions are made to the observed gravity to isolate the portion of the gravitational pull which is due to the crustal and near-surface materials. The gravity remaining after these reductions is called the "Bouguer Anomaly." Bouguer Anomaly values are the basis for geologic interpretation. To obtain the Bouguer Anomaly, the observed gravity is adjusted to the value it would have had if it had been measured at the geoid, a theoretically defined surface which approximates the surface of mean sea level. The difference between the "adjusted" observed gravity and the gravity at the geoid calculated for a theoretically homogeneous earth is the Bouguer Anomaly.

Four separate reductions, to account for four geometrical effects, are made to the observed gravity at each station to arrive at its Bouguer Anomaly value.

a. Free-Air Effect: Gravitational attraction varies inversely as the square of the distance from the center of the earth. Thus, corrections must be applied for elevation. Observed gravity levels are corrected for elevation using the normal vertical gradient of:

FA = -0.09406 mg/ft (-0.3086 milligals/meter)

where FA is the free-air effect (the rate of change of gravity with distance from the center of the earth). The free-air correction is positive in sign since the correction is opposite the effect.

b. Bouguer Effect: Like the free-air effect, the Bouguer effect is a function of the elevation of the station, but it considers the influence of a slab of earth materials between the observation point on the surface of the earth and the corresponding point on the geoid (sea level). Normal practice, which is to assume that the density of the slab is 2.67 grams per cubic centimeter was followed in these studies. The Bouguer correction (B_c), which is opposite in sign to the free-air correction, was defined according to the following formula.

$B_c = 0.01276\ (2.67)\ h_f$ (milligals per foot)

$B_c = 0.04185\ (2.67)\ h_m$ (milligals per meter)

where h_f is the height above sea level in feet and h_m is the height in meters.

c. Latitude Effect: Points at different latitudes will have different "gravities" for two reasons. The earth (and the geoid) is spheroidal, or flattened at the poles. Since points at higher latitudes are closer to the center of the earth than points near the equator, the gravity at the higher latitudes is larger. As the earth spins, the centrifugal acceleration causes a slight decrease in the measured gravity. At the higher latitudes where the earth's circles of latitude are smaller, the centrifugal acceleration diminishes. The gravity formula for the Geodetic Reference System, 1967, gives the theoretical value of gravity at the geoid as a function of latitude. It is:

$$g = 978.0381\ (1 + 0.0053204 \sin^2 \phi - 0.0000058 \sin^2 2\phi)\ \text{gals}$$

where g is the theoretical acceleration of gravity and ϕ is the latitude in degrees. The positive term accounts for the spheroidal shape of the earth. The negative term adjusts for the centrifugal acceleration.

The previous two corrections (free air and Bouguer) have adjusted the observed gravity to the value it would have had at the geoid (sea level). The theoretical value at the geoid for the latitude of the station is then subtracted from the adjusted observed gravity. The remainder is called the Simple Bouguer Anomaly (SBA). Most of this gravity represents the effect of material beneath the station, but part of it may be due to irregularities in terrain (upper part of the Bouguer slab) away from the station.

d. *Terrain Effect*: Topographic relief around the station has a negative effect on the gravitational force at the station. A nearby hill has upward gravitational pull and a nearby valley contributes less downward attraction than a nearby material would have. Therefore, the corrections are always positive. Corrections are made to the SBA when the terrain effects were 0.1 milligal or larger. Terrain corrected Bouguer values are called the Complete Bouguer Anomaly (CBA). When the CBA is obtained, the reduction of gravity at individual measurement points (stations) is complete.

A1.5 INTERPRETATION

To interpret the gravity data, the portion of the CBA that might be caused by the light-weight, basin-fill material must be separated from that caused by the heavier bedrock material which forms the surrounding mountains and presumably the basin floor. The first step is to create a regional field. A regional field is an estimation of the values the CBA would have had if the light-weight sediments (the anomaly) had not been there. Since the valley-fill sediments are absent at the stations read in the mountains, one approach is to use the CBA values at bedrock stations as the basis for constructing a second order polynomial surface to represent a regional field over the valley.

Where there are insufficient bedrock stations to define a satisfactory regional trend, another approach is to estimate the regional by the process of upward continuation of the CBA field.

In Potential Theory, a field normal to a surface, regardless of its actual source, may be considered as originating in an areal distribution of mass on that surface. If the field strength is known the surface density of mass (grams per square centimeter) can be calculated. The observed gravity field at the surface of the earth approximately fulfills the requirements of this theory: thus the observed (Bouguer anomaly) field can be used to compute a surficial distribution of mass which would reproduce the field, and most importantly, account for the gravity field anywhere above the surface of observation. On this basis, the Bouguer anomaly field is readily "continued" to level surfaces above the ground.

An important property of such "upward continuation" is that the resultant field (which can be represented by a contour map), with increasing altitudes of continuation, changes more with respect to shallow sources than it does with respect to deeper sources. The anomalous parts of the field ascribed to shallow density distribution tend to vanish as the continuation is carried upward whereas the field produced by deeper sources changes only slightly, so that upward continuations produce "regional"-type fields.

The difference between the CBA and the regional field is called the "residual" field or residual anomaly. The residual field is the interpreter's estimation of the gravitational effect of the geologic anomaly. The zero value of the residual anomaly is not exactly at the rock outcrop line but at some distance on the

"rock" side of the contact. The reason for this is found in the explanation of the terrain effect. There is a component of gravitational attraction from material which is not directly beneath a point.

If the "regional" is well chosen, the magnitude of the residual anomaly is a function of the thickness of the anomalous (fill) material and the density contrast. The density contrast is the difference in density between the alluvial and bedrock material. If this contrast were known, an accurate calculation of the thickness could be made. In most cases, the densities are not well known and they also vary within the study area. In these cases, it is necessary to use typical densities for materials similar to those in the study area.

If the selected average density contrast is smaller than the actual density contrast, the computed depth to bedrock will be greater than the actual depth and vice-versa. The computed depth is inversely proportional to the density contrast. A ten percent error in density contrast produces a ten percent error in computed depth. An iterative computer program is used to calculate a subsurface model which will yield a gravitational field to match (approximately) the residual gravity anomaly.

The second vertical derivative (SVD) of gravitational field is used to aid the interpreter in evaluating the subsurface mass distribution. Once the CBA field has been projected onto a uniform grid system, its SVD at the grid nodes is readily computed.

In accordance with Laplace's Equation in Free Space, the negative of the second vertical derivative is equal to the sums of the second derivatives in the x-direction and in the y-direction. The second vertical derivative is an indication of the curvature of the Bouguer anomaly field. In particular the zero-value of the SVD indicates the inflection in the field as it changes from "concave-upward" (algebraically negative SVD) to "convex-upward" (algebraically positive SVD). In a general way the zero SVD falls on the tightest contours of the field and where contours are nearly parallel its location can be established by eye. However, where contours diverge, converge, or change direction this is not always so readily done. The zero SVD contour line may be an indicator of a line of faulting, the pinchout of a stratum, truncation of a stratum at an unconformity or merely a marked change in shape or in density of a geologic unit.

APPENDIX A2.0

DELAMAR VALLEY, NEVADA

GRAVITY DATA

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
6746	371071		114414334039T			0	160411697	705031559681920 30			-4040	84510
6741	371113		114461338901T			0	283411758	698361539091920 91			-1580	85433
6747	371163		114440035312T			0	2174118e7	701181553731921 71			-3570	84597
e830	371205		114572260499T			01815411891		681611384041922 25			3070	84275
e745	371214		114401635279T			0	189411966	706841550291922 38			-4020	84139
e837	371292		114506356030T			0	327412073	691321430471923 51			3390	84e27
6831	371325		114538556680T			0	369412124	63e551426941923 99			3600	84e59
e836	371360		114470e50869T			0	369412211	69ee014598619245 0			1370	84409
e939	371419		114413539091T			0	209412341	704991522331925 35			-3520	83349
e835	371585		114513559701T			0	535412611	689401401561927 76			3530	83715
6832	371591		114577550089T			0	338412603	68067145360192 85			-300	82948
e845	371708		114433356831T			0	563412868	701931403e141929 55			1110	82303
e910	371763		114491550639T			0	223412949	693311449331930 35			-410	82523
e909	371768		114564445679T			0	138412935	682541484131930 42			-1650	82908
e908	371907		114574345522T			0	134413188	681021484281932 44			-1990	82624
6913	371963		114513347841T			0	153413312	690011468531933 25			-1460	82373
6638	371998		114553045522T			0	139413364	684131477621933 76			-2780	81829
6911	372067		114472355926T			0	291413518	69e021425831934 76			1710	82941
e912	372086		114499e49800T			0	209413544	691981459511935 04			-700	82529
6907	372109		114577546660T			0	117413561	68047147790193537			-1850	82353
6846	372115		114419172779T			01109413e26		703851308311935 4e			5730	83039
e628	372247		114541045561T			0	134413828	685801467961937 33			-4070	80524
e645	372272		114502548426T			0	146413887	691471460101937 74			-2200	81428
e849	372396		114449505499T			0	e40414135	699241373481939 55			5000	83320
6624	372400		114576948179T			0	143414099	68044146e641939 60			-1770	81943
6623	372478		114595653369T			0	236414238	677651443731940 74			490	82546
6639	372485		114529446e50T			0	137414272	687411463781940 84			-4380	80057
6333	372494		114459060449T			0	318414313	697791403701940 97			3130	82348
e644	372498		114497548442T			0	156414307	e921114634919410 3			-2180	81456
6625	372521		114560546690T			0	121414328	682811478351941 36			-2370	81821
6627	372658		114529746529T			0	135414592	687291466e261943 36			-3930	80335
6640	372e31		114520147110T			0	124414637	68870146532194 69			-3520	80534
6350	372690		114440461250T			0	267414682	700451402611943 82			3490	82587
6643	372696		114437351621T			0	177414676	693531448491943 91			-960	81537
6626	372732		114553846621T			0	128414721	683711477541944 43			-2820	81408
6641	372384		114510346701T			0	126415016	690061460521946 e5			-2790	80726
6642	372925		114472856381T			0	226415105	695571427841947 24			1090	82106
2327	372956		114572052100T			0	151415129	683941450841947 69			-e60	81721
2326	372996		114429069390T			0	429415252	701991342991948 27			-740	81519
1902	373262		114400662740T			0	303415754	70e051386331952 15			2330	253

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG MIN	LONG. DEG MIN +CODE	ELEV.	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
7100	373555	114410562369T		0	218416292	704461409319564			3100	82068
1358	373570	114412062310T		0	218416319	704241402031956			3140	82128
7142	373650	114426059957T		0	194416462	702141428291957			2490	82594
1002	373661	114537149419T		0	99416444	685791471261957			-2180	81069
1001	373670	114549449921T		0	94416457	683971470991958			-1750	81324
1003	373672	114525943809T		0	99416468	687431474141958			-2480	80969
0990	373674	114522548629T		0	100416473	687931474181958			-2650	80870
1360	373680	114521848625T		0	102416484	688031475011956			-2570	80942
7125	373685	114509543133T		0	106416498	689541476451958			-2900	80786
0999	373687	114564049961T		0	95416484	681321470271958			-1810	81245
0991	373692	114503948091T		0	114416511	689921476371958			-2960	80744
0992	373699	114501948461T		0	105416526	690951475551958			-2710	80865
0993	373706	114491849072T		0	107416543	692431472641955			-2430	80937
1361	373713	114537349656T		0	101416524	687381474061958			-1750	81421
0997	373714	114595549711T		0	99416523	677171479501953			-1160	81989
0423	373717	114414758852T		0	194416590	703771433611958			2840	82964
0994	373722	114481449459T		0	116416576	693961473951958			-1960	81286
0424	373724	114404960259T		0	179416607	705211423831958			3170	82809
0995	373726	114469649951T		0	138416587	695591480441956			-660	82248
1004	373729	114527349199T		0	97416573	687201474141958			-2200	81117
7124	373730	114469050089T		0	137416595	695781480681958			-710	80347
0998	373732	114582250899T		0	108416561	679121471961958			-320	81926
0996	373736	114460051191T		0	159416609	697101477751959			20	82729
1359	373747	114456751194T		0	172416631	697581473721959			100	82832
0989	373776	114503648100T		0	100416666	689931480181959			-2690	81000
0299	373793	114431458451T		0	262416725	701281434531959			2440	82772
0301	373802	114407862290T		0	251416750	704751414431960			4030	83041
0300	373808	114413661470T		0	355416757	703161418821960			3690	83085
0298	373818	114443756929T		0	260416767	699461445211960			2040	82690
0936	373819	114455650381T		0	147416764	697711482131960			-420	82547
0938	373819	114472248501T		0	117416758	695271485581960			-1840	81737
0992	373819	114483348041T		0	107416755	693641484601960			-2370	81347
0987	373820	114499647549T		0	103416751	691241487131960			-2580	81303
0988	373820	114515848819T		0	101416745	688951483201960			-1900	81551
0937	373825	114464349272T		0	124416772	696431482471960			-1440	81884
0863	373857	114548952110T		0	120416803	683971477961960			720	83080
0986	373862	114507348041T		0	101416826	690391485771960			-2330	81401
0316	373884	114407765981T		0	570416902	704721387791961			4720	82790
0859	373891	114543952680T		0	121416867	684691478481961			1260	83431
0939	373895	114460948629T		0	122416903	696901487181961			-1670	81962

DELAMAR VALLEY GRAVITY DATA

SSTATION IDENT.	LAT. DEG MIN	LONG. DEG MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
0985	373896	11452174990 2T		0	110416884	637961481421961 38		-1050	82040	
0870	373896	11453865162 1T		0	208416862	678121475541961 38		-10	82588	
0940	373907	11445024980 0T		0	162416929	693461490681961 54		-240	82942	
0941	373907	11447244753 9T		0	109416921	695201483791961 54		-2550	81339	
0893	373907	11448344720 1T		0	103416917	693581487301961 54		-3020	80983	
0984	373907	11451624960 0T		0	114416906	688761480181961 54		-1480	81724	
0982	373912	11449494711 9T		0	102416923	691891492071961 62		-2630	81402	
0317	373917	11440156903 9T		0	1030416965	705621365101961 69		5270	82770	
0311	373921	11443595180 1T		0	159416960	700561433461961 75		890	83389	
0860	373936	11456655638 1T		166	279416943	681351443361961 97		1170	82395	
0942	373939	11445384682 1T		0	119416985	697191490301962 31		-1710	81949	
0983	373949	11450604753 9T		0	130416987	690241490371962 16		-2410	81510	
0312	373959	11444085069 9T		0	154417028	699821488771962 30		330	83204	
0857	373960	11455425599 1T		0	195416992	683151465181962 32		1750	82855	
0856	373971	11454185310 0T		0	143417016	684971467971962 48		490	82533	
0313	373982	11443125202 1T		0	159417074	701221481561962 64		820	83249	
0943	373994	11445024892 1T		0	126417090	698431493481962 81		-910	82526	
0944	373994	11446144752 0T		0	112417086	696781491351962 81		-2440	81462	
0945	373995	11447244679 1T		0	105417084	695161489771962 83		-3290	8085	
0894	373996	11448334668 0T		0	101417082	693531488651962 84		-3510	8067	
0976	374001	11449434680 1T		0	100417087	691941490721962 91		-3190	80950	
0960	374017	11451404923 9T		0	125417110	689041483271963 15		-1670	81665	
0977	374037	11450454763 1T		0	104417150	690421490771963 44		-2460	81404	
0874	374043	11455776018 0T		0	332417144	682601424231963 53		2870	82492	
0326	374059	11442465277 9T		0	171417219	702161477831963 76		1050	83231	
7139	374060	11442505287 4T		0	168417221	702101478151963 77		1160	83318	
0946	374081	11445184772 0T		0	114417250	698151497821964 08		-1730	82104	
0947	374082	11446254668 0T		0	1054172 48	696581492901964 09		-3210	80975	
0948	374083	11447234633 9T		0	99417247	695141490401964 11		-3780	80519	
0895	374083	11448344639 1T		0	95417243	693511489961964 11		-3810	80465	
0975	374087	11449364671 9T		0	1004172 47	692011489991964 17		-3470	80700	
0850	374090	11454315503 9T		0	1064172 36	683731459981964 21		1340	82746	
0334	374114	11442535221 1T		0	150417321	703031481701964 56		820	83170	
0974	374113	11450414772 0T		0	97417300	690451491141964 62		-2460	81367	
0344	374154	11441615386 1T		0	168417398	703371471551965 14		1320	83118	
0911	374167	11445174734 9T		0	110417409	698131498231965 33		-2170	81790	
0912	374169	11445484680 1T		0	103417412	697671499391965 36		-2570	81573	
0917	374169	11446964607 0T		0	97417407	695501491211965 36		-4060	80307	
0913	374170	11445764646 0T		0	106417413	697261499081965 39		-2920	81336	
0914	374170	11446024629 9T		0	103417412	696881496991965 38		-3280	81023	

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
0915	374170		114631461527		0	101417411	6964514943019653		-3640		80721	
0916	374170		114665460997		0	99417410	6959514922319653		-3950		80429	
7128	374170		114503547566		0	97417397	6905114935119653		-2440		81437	
0918	374171		114472346070		0	95417409	6951014907919653		-4120		80265	
0919	374171		114475346079		0	94417408	6946614906819653		-4120		80254	
0920	374171		114478046089		0	94417407	6942614910619653		-4080		80294	
0921	374171		114480746119		0	95417406	6938614912219653		-4030		80335	
0923	374171		114490246440		0	93417403	6924714914219653		-3710		80543	
0931	374171		114511048301		0	104417396	6894114911319653		-1990		81644	
0922	374172		114437646280		0	94417406	6928514914519654		-3360		80454	
0926	374172		114498347021		0	95417402	6912814929519654		-3010		81045	
0927	374172		114501047290		0	96417401	6908814933719654		-2720		81246	
0933	374172		114516248901		0	103417396	6886514887619654		-1660		81768	
0924	374173		114492846601		0	95417406	6920914915319654		-3550		80645	
0929	374173		114505747779		0	99417402	6901914925319654		-2340		81459	
0925	374174		114495746821		0	93417407	6916614920919654		-3290		80833	
0930	374174		114508347979		0	100417403	6898114922019654		-2190		81550	
7143	374175		114532050738		0	144417396	6836214833019654		-480		82354	
0937	374176		114471747999		0	121417427	6938014990419654		-1490		82261	
0932	374176		114513448540		0	104417405	6890614904319654		-1840		81704	
0934	374177		114520449491		0	111417404	6880314903019654		-1360		81671	
0935	374177		114523149839		0	116417403	6876314885519654		-1110		82009	
0343	374181		114427851381		0	138417444	7016314883019655		570		83198	
0345	374202		114412855509		0	178417488	7038314620519658		1830		83098	
1919	374203		114503747520		0	97417458	6904714938719659		-2500		81397	
7137	374210		114456046394		0	107417437	6974815020719659		-2740		81547	
0949	374211		114453346749		0	107417490	6973715022019659		-2400		81757	
0973	374218		114522749491		0	123417479	6876714877119660		-1280		81963	
0873	374221		114534353041		0	147417481	6859714701119661		290		82347	
0950	374232		114463745860		0	99417525	6963414942819662		-4060		80399	
0355	374251		114406360010		0	233417581	7047614286219665		2650		82423	
0350	374256		114443243022		0	134417577	6993415025219666		-1240		82514	
0951	374259		114472145840		0	94417572	6953914917919666		-4370		80094	
0971	374262		114492646499		0	95417571	6920314929119667		-3640		80595	
0354	374265		114413662979		0	735417604	7036814081119667		3370		82635	
0952	374278		114456145981		0	104417613	6974515029419669		-3140		81274	
0901	374289		114432845928		0	92417624	6935114927919671		-4220		80202	
0970	374289		114502547119		0	99417617	6906114977219671		-2610		81419	
0881	374310		114527850121		0	150417648	6868814903119674		-560		82500	
7144	374310		114567557854		0	234417635	6810514429019674		1960		82524	

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
0392	374313		114537653081T		20	156417650	685441472121967	46		390	82476	
0371	374323		114416861099T		0	673417710	703191422841967	61		2990	82833	
0372	374324		114426752080T		0	149417708	701731484381967	62		660	83059	
0374	374345		114439947710T		0	141417743	699931503791967	93		-1030	82841	
0376	374345		114449746089T		0	111417739	698341503649196793			-2790	81601	
0954	374346		114460745801T		0	97417737	696731494631967	94		-4240	80227	
0955	374346		114471745801T		0	91417733	695111492051967	94		-4500	79971	
0966	374348		114494046381T		0	96417729	691831495471967	97		-3620	80656	
0968	374348		114510547759T		0	110417724	689411498551967	97		-2010	81810	
0969	374348		114516148350T		0	117417722	688591496561967	97		-1660	81967	
0967	374363		114501546890T		0	100417754	690731499041968	19		-2800	81300	
0375	374381		114437148159T		0	140417810	700181503511968	45		-690	83030	
0370	374401		114417052192T		0	150417854	703121486061968	75		620	83180	
0391	374401		114425950249T		0	167417851	701811496881968	75		80	83117	
7130	374405		114500046765T		1	95417833	690931500661968	60		-2820	81326	
0957	374430		114452145951T		0	101417895	697951501471969	17		-3540	80891	
0387	374430		114533051319T		0	152417868	686071485321969	17		-110	82542	
0958	374432		114473145801T		0	89417892	694871492331969	20		-4600	79869	
0964	374432		114506247310T		0	105417830	693011502721969	20		-2140	81825	
0389	374432		114551456142T		0	197417865	683371461181969	20		2000	83057	
0386	374434		114527250341T		0	131417877	686921490681969	23		-500	82461	
7115	374435		114433743576T		0	140417911	700651506091969	24		-610	82960	
0379	374437		114434143550T		0	128417915	700591505571969	27		-700	82868	
0365	374442		114409954370T		0	131417933	704151471711969	34		1370	82971	
7151	374450		114409654281T		0	129417948	704191471551969	46		1260	82899	
0962	374457		114500346699T		0	99417929	690861501581969	56		-2870	81309	
0378	374459		114444346499T		0	108417952	699011503961969	59		-2250	81998	
0390	374465		114537952021T		0	164417931	685341481631969	68		120	82554	
0380	374480		114425550300T		0	285417997	701841464521969	90		1190	82725	
0369	374491		114413159659T		0	521418022	703651431791970	06		2280	82471	
0960	374495		114458845869T		0	93418013	696941496091970	12		-4250	80193	
0959	374495		114478545801T		0	88418006	694051492971970	12		-4630	79838	
0961	374499		114521249121T		0	123417999	687771497521970	18		-1060	82313	
2227	371020		115 7029990T		0	285411538	676531587621919	56		-4970	85088	
7	371210		115 42032011T		0	165411879	671281561241922	32		-5990	83255	
6925	371216		115 40632011T		0	164411890	671491561371922	41		-5990	83264	
1369	371225		115 27331450T		0	201411911	673451569201922	54		-5740	83741	
6819	371340		115 4139619T		0	200412131	676841524551924	21		-2690	84000	
2226	371340		115 47031969T		0	174412117	670491560621924	21		-6280	82994	
6818	371580		115 19045522T		0	294412570	674541486061927	59		-1330	83434	

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
6904	371755		115	4533667	0T	0	157412885	670591543241930	23		-4200	83457
6817	371853		115	1214636	0T	0	256413077	675461473271931	65		-1750	82526
6905	371908		115	3813903	9T	0	118413170	671591526631932	45		-3850	82948
6906	372058		115	2924188	0T	0	114413451	672651510741934	63		-2980	82844
6621	372201		115	3764359	9T	0	160413712	671561505231936	71		-2130	83160
6622	372239		115	164580	1T	0	125413794	676861486191937	26		-2010	82485
6619	372308		115	2524719	2T	0	176413914	673351492341938	27		-190	83396
6618	372579		115	3975003	0T	0	248414411	671101469711942	21		-130	83008
2319	372804		115	705952	1T	0	408414837	675841411901945	48		2620	82748
2318	373158		115	505534	1T	0	301415492	676001436011950	63		590	82031
2317	373335		115	505292	0T	0	220415820	675931453451953	21		-190	81990
1362	373615		115	2554639	8T	0	189416331	672801495491957	29		-2520	81839
2307	373734		115	504856	2T	0	110416557	675771486201959	02		-1310	82130
1874	374067		115	1505473	0T	0	235417170	674171455741963	86		700	82275
2315	374444		115	1905075	1T	0	114417866	673431492461969	37		40	82864
0928	374172		1145037		0	0	276417400	690491493281965	41		-2490	81290
DMV001	373567		115	69	5754S	252	466416248	675561421891956	59		685	81778
DMV002	373314		115	129	6483C	671	696415778	674771369251952	90		2654	81909
DMV004	373117		115	156	7668S	1085	1910415412	674011232001950	04		5376	82217
PRV013	373936		115	492	4615S	1	102416917	669191502081961	97		-2556	81806
PRV077	372802		115	392	6284S	227	599414823	671091389611945	45		3561	82954
PRV080	372552		115	58	6570S	758	1240414371	676111350801941	32		3265	82855
DMV066	372576		1144690		6226Y	286	568414461	696281388751942	16		3258	82877
DMV071	372761		1144750		5447Y	42	227414801	695321438141944	86		593	82284
DMV102	372296		1145499		4561Y	0	114413916	684461471751938	09		-3711	80847
DMV104	372501		1145480		4593S	0	114414295	684661473111941	07		-3571	80877
DMV105	372595		1145500		4625Y	1	114414469	684331475181942	44		-3201	81140
DMV120	372370		1145877		5041Y	38	175414040	678961454361939	17		-989	82031
DMV121	372255		1145746		5547S	183	578413832	690841415491937	50		6	81849
DMV131	372229		1145624		5016S	598	259413788	682651448381937	12		-1667	82082
DMV135	371678		1145687		4600C	2	154412767	681941481201929	11		-1501	82966
DMV146	372063		1145356		4600C	0	126413489	686671473251934	71		-2855	81581
DMV147	371937		1145393		4624V	0	128413255	686181479401932	39		-1831	82526
DMV169	372135		1144570		6517S	379	603413742	698221362761936	45		3968	82723
DMV171	371990		1144826		6436S	368	1038413372	694531365411933	65		3754	83209
DMV400	373393		1144563		6418S	408	382415976	697791378381954	05		2889	81789
PRV024	374043		1145986		6652S	634	1229417131	676591371331963	53		3391	82566
PRV204	372661		115	177	6486C	15	776414569	674321374461943	40		4154	82823
PRV203	373033		115	453	6282C	145	547415249	670111390231948	81		3269	82534
PRV202	373258		115	410	5742C	9	357415666	670651426041952	09		1437	82219

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
PRV078	372901		115	178	7950V		482460415013	674211263591946e9			6505	81898
PRV043	373195		115	438	5592C	30	368415547	669531434991951l7			1012	82337
PRV035	373361		115	379	5423C	12	261415857	671071450351953S9			715	82491
PRV021	374221		115	55	5792S	6	293417458	675501440171966l2			1918	82462
PRV020	374134		115	201	5650S	20	343417385	673371443361965S8			1003	82096
PRV015	374073		115	313	5636S	21	518417176	671701441791963ge			827	82143
PRV023	373732		115	103	5086S	15	128416645	674971473421959l2			-765	82031
PRV022	373952		115	131	5128S	6	141416958	674491483231962220			364	83021
DMV153	371845		1145152		5109S	12	220413093	689771454091931S4			338	83145
DMV151	371537		1145131		5965S	19	669412524	690211404091927O7			3844	84187
DMV140	371537		1145492		4698S	3	170413160	684731476061932l5			-1396	82753
DMV126	371592		1145774		5009S	17	350412605	680691453631927S6			-282	83001
DMV119	372604		1145888		5542Y	1	404414473	67360142654194257			556	82059
DMV117	372956		1145724		5210Y	2	152415129	690881446421947l9			-1094	81290
DMV113	372403		1145591		4739Y	5	169414111	683061467351939e5			-2160	81680
DMV063	373046		1144537		6704S	8	517415335	693331360281949O0			4228	81887
DMV065	372793		1144575		7095Y	301088414866		697881331791945S2			5430	82348
DMV026	373139		1145495		5258U	15	203415475	684181439971950S6			-1554	80731
DMV005	373151		115	7	5581C	33	339415481	676631429941950S3			467	81804
DMV027	373261		1145488		5013Y	9	93415701	684231458611952l3			-2174	80830
DMV032	373181		1145332		4929U	5	97415558	686561461331950g7			-2526	80764
DMV040	373290		1145193		5131Y	3	134415764	683561457e1195256			-1205	81431
DMV058	373596		1144642		6215S	45	656416349	696541402421957O1			3036	82540
DMV061	373156		1144716		6577S	38	754415532	695651368701950G0			3715	82074
DMV067	372347		1144544		6339Y	6	402414042	698541387001938B3			4480	83268
DMV109	372397		1145587		5346Y	22	331415024	682921435991946B3			-752	81360
DMV111	372621		1145650		4884Y	27	187414312	683101468121942B2			-1506	82050
DMV118	372979		1145891		5494Y	9	223415166	678411431521948O3			56	81550
DMV124	372084		1145892		5071S	14	340413511	678751449211935O1			-855	82203
DMV125	371841		1145910		5182S	24	466413061	678581441441931483			-234	82582
DMV130	372215		1145760		5421S	14	696413757	680641426901936g2			18	82239
DMV132	372095		1145641		4942S	28	348413539	682451450071935l7			-1400	82120
DMV136	371540		1145583		5342S	7	415412515	683531438751927l1			1441	83643
DMV150	371656		1145392		6372V	81376412736		686311367301928B9			3526	83476
DMV172	371860		1144751		5822S	5	360413134	695691406391931l6			2259	82766
DMV173	371646		1144611		7357V	372247412744		697351290721928O5			5458	82649
DMV401	371609		1144844		6356S	28	752412667	694431360111928l1			3324	82425
DMV003	373255		115	81	5438C	0	303415671	675501441251952O5			571	82156
PRV012	373819		115	484	4547S	0	102416701	689351501761960O6			-3059	81534
PRV016	373980		115	355	4801V	0	108417003	671191493221952O1			-1757	81977

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
PRV017	373859		115	359	4666V	0	102416779	671181499591960B4			-2214	81973
PRV018	373798		115	226	4762V	0	101416670	673161496261959995			-1554	82305
PRV025	373691		115	93	4919V	0	133416477	675151483501952400			-1196	82160
PRV027	373470		115	191	5233V	0	208416065	673801460681955180			-203	82160
PRV028	373569		115	208	5015V	0	124416247	673511475041956620			-961	82059
PRV029	373677		115	243479	00T	0	102416446	672951490061958190			-1734	82031
PRV030	373736		115	374	4621V	0	103416551	671001494201959050			-2997	81345
PRV031	373620		115	360	4714V	0	105416337	671251491611957360			-2211	81816
PRV032	373508		115	331	4950C	0	135416131	671721478031955730			-1135	82067
PRV036	373436		115	444	4829C	0	162415994	670091483091954680			-1113	82573
PRV037	373538		115	484	4631C	0	116416182	669461493421956170			-2692	81629
PRV038	373651		115	486	4533C	0	106416391	669391502541957310			-2867	81778
PRV076	372960		115	491	6055S	0	623415113	669571406781947750			2920	82881
DMV006	373049		1145920		5317Y	0	184415295	677951445761949050			-283	81761
DMV007	373302		1145932		5143Y	0	139415762	677661456681952730			-1156	81425
DMV008	373409		1145945		5061Y	0	125415960	677441463851954290			-1413	81450
DMV009	373551		1145952		4963Y	0	105416222	677281473571956360			-1571	81606
DMV010	373644		1145822		4927Y	0	99416398	679161473431957710			-2060	81235
DMV011	373469		1145822		4943Y	0	101416075	679231468491955160			-2000	81225
DMV012	373356		1145802		5016Y	0	104415870	679571462411953550			-1907	81039
DMV013	373217		1145849		5150Y	0	131415908	673931454501951490			-1231	81335
DMV014	373130		1145848		5206Y	0	146415447	675981450951950230			-942	81448
DMV015	373045		1145764		5137Y	0	138415292	680251453441948990			-1208	81409
DMV016	373134		1145723		5080Y	0	118415458	680821455801950280			-1639	81153
DMV017	373273		1145723		5018Y	0	103415715	680771459931952310			-2012	80976
DMV018	373407		1145684		4930Y	0	102415964	681291466631954260			-2366	80921
DMV019	373555		1145712		4888Y	0	103416237	680811473381956410			-2301	81130
DMV020	373598		1145603		4918Y	0	95416320	682401472911957040			-2129	81192
DMV021	373468		1145600		4877Y	0	102416080	682501472531955150			-2363	81105
DMV022	373293		1145601		4939Y	0	98415756	682551463511952600			-2427	80826
DMV023	373183		1145649		4993Y	0	103415551	681391460821951000			-2041	81015
DMV024	373050		1145649		5025U	0	112415305	681951460131949060			-1501	81372
DMV025	373017		1145535		4937Y	0	111415248	683641462761948580			-2119	81153
DMV028	373380		1145490		4865Y	0	110415921	684151466971953870			-2904	80613
DMV029	373555		1145491		4914Y	0	95416244	684071471871956410			-2208	81127
DMV030	373470		1145381		4850Y	0	109416091	685721471401955180			-2734	80633
DMV031	373293		1145380		4830Y	0	112415763	685511469871952600			-2817	80521
DMV033	373059		1145377		4820Y	0	105415331	685951467801949190			-2778	80597
DMV034	373376		1145298		4825U	0	118415920	686991470901953810			-2832	80779
DMV035	373454		1145257		4839Y	0	116416065	687531470671954940			-2587	80725

DELAMAR VALLEY GRAVITY DATA

STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
DMV036	373555		1145271		4854Y	0	102416251	687301472041956 41			-2756	80790
DMV037	373586		1145086		4897S	0	102416315	690011469411956 87			-2659	80740
DMV038	373469		1145131		4937V	0	107416097	689401465441955 16			-2510	80759
DMV039	373380		1145160		4946V	0	105415932	689011463811953 87			-2458	80778
DMV041	373184		1145180		4887S	0	113415568	686801463591951 01			-2750	80695
DMV042	373086		1145228		4809S	0	109415386	688131467121949 58			-2939	80718
DMV043	373086		1145114		4919S	0	118415389	689911459831949 58			-2682	80659
DMV044	373217		1145091		5016S	0	117415632	690101456791951 49			-2264	80745
DMV045	373356		1145013		5159V	0	124415892	691191448371953 52			-1962	80566
DMV046	373483		1144987		5092S	0	117416128	691511455221955 37			-2092	80655
DMV047	373577		1144894		5103V	0	120416305	692841456821956 73			-1966	80749
DMV048	373474		1144813	53232T		0	153416117	694081446001955 23			-826	81172
DMV049	373362		1144868		5399S	0	150415908	693321436681953 60			-880	80856
DMV050	373243		1144927		5314S	0	152415636	692501440471951 87			-1123	80900
DMV051	373133		1144979	51119T		0	142415481	691781450601950 27			-1357	80850
DMV052	373029		1144956		5127S	0	148415239	692161450571946 76			-1566	81095
DMV053	373035		1144844		5364S	0	181415304	693811436491948 84			-752	81133
DMV054	373144		1144835		5377V	0	203415506	693901441211950 43			-316	81547
DMV055	373611		1144748		5211S	0	150416373	694981460961957 23			-585	81792
DMV056	373255		1144795		5613S	0	200415713	694441432511952 05			374	81929
DMV057	373409		1144711		5622V	0	189416001	695611435301954 29			1013	82027
DMV059	373483		1144605		5681S	0	190416141	697141436241955 37			1555	82368
DMV060	373293		1144654		5935S	0	257415738	696501416181952 60			2217	82231
DMV064	372934		1144667		5970Y	0	307415124	696461420961947 37			3548	83493
DMV068	372309		1144731		5352V	0	245413966	695791444451938 28			987	82978
DMV069	372429		1144795		5143V	0	253414185	694601456741940 03			74	82786
DMV070	372570		1144836		5105Y	0	206414445	694131456011942 08			-562	82233
DMV072	372847		1144684		5681Y	0	278414962	696251426051946 11			1462	82364
DMV073	372927		1144795		5472Y	0	197415106	694581431521947 27			-76	81458
DMV074	372823		1144858		5261V	0	179414912	693701437491945 76			-1313	80922
DMV075	372695		1144871		5162Y	0	177414675	693561443401943 90			-963	81603
DMV076	372497		1144975		4844Y	0	153414305	692111463411941 02			-2173	81463
DMV077	372405		1144957		4838Y	0	161414135	692421463561939 68			-2081	81579
DMV078	372311		1144910		4973Y	0	176413963	693151455581938 31			-1471	81743
DMV079	372272		1145026		4843Y	0	149413837	691451460351937 74			-2191	81440
DMV080	372355		1145105		4702V	0	141414038	690251463371936 95			-3308	80796
DMV081	372400		1145130		4680V	0	137414231	689841462771940 48			-3727	80448
DMV082	372626		1145030		4873Y	0	140414542	691251460721942 89			-2356	81163
DMV083	372721		1145046		4882V	0	139414717	690971461321944 27			-2300	81196
DMV084	372732		1144981		5021Y	0	153414832	691901454421945 16			-1820	81208

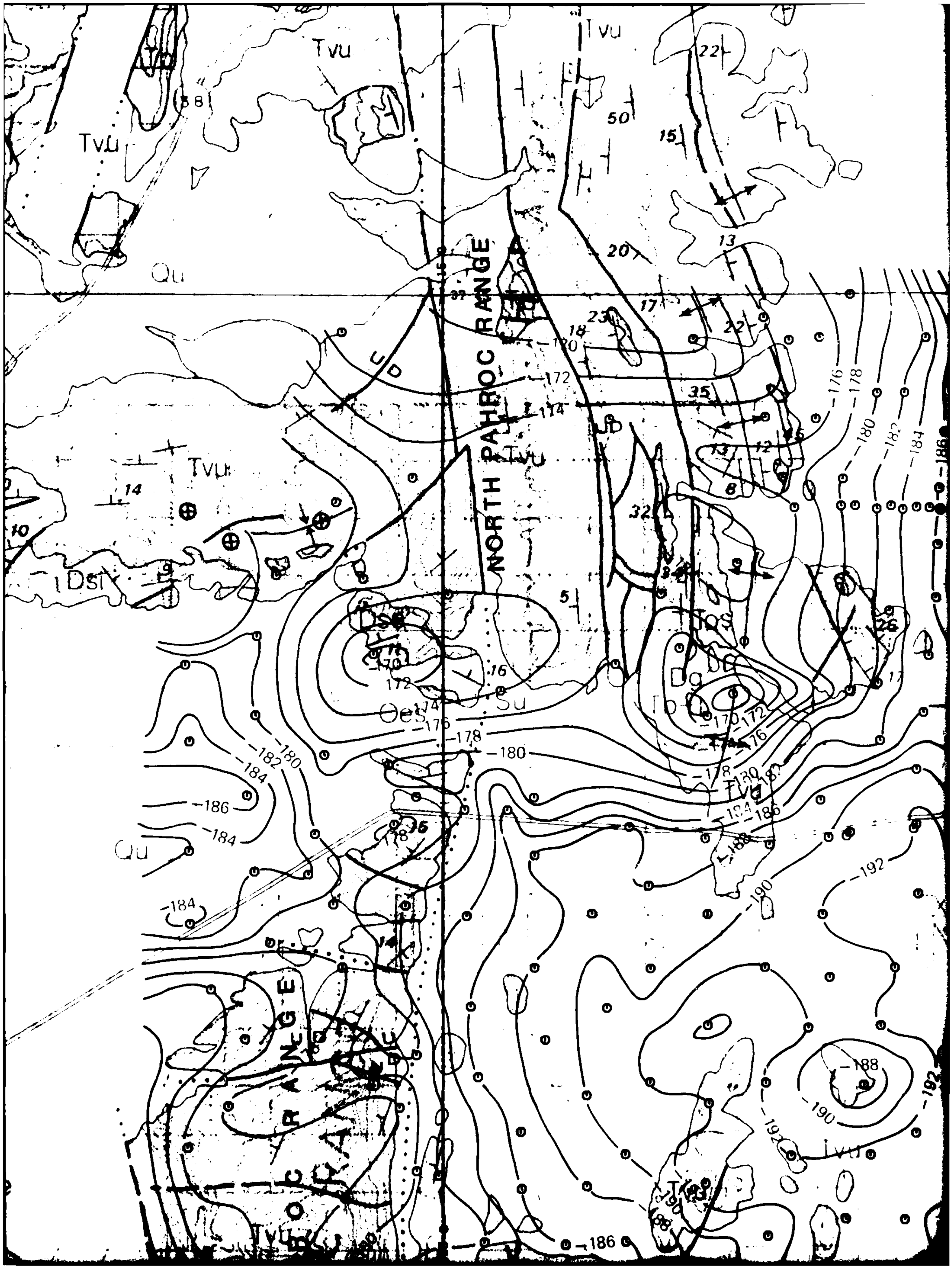
DELAMAR VALLEY GRAVITY DATA

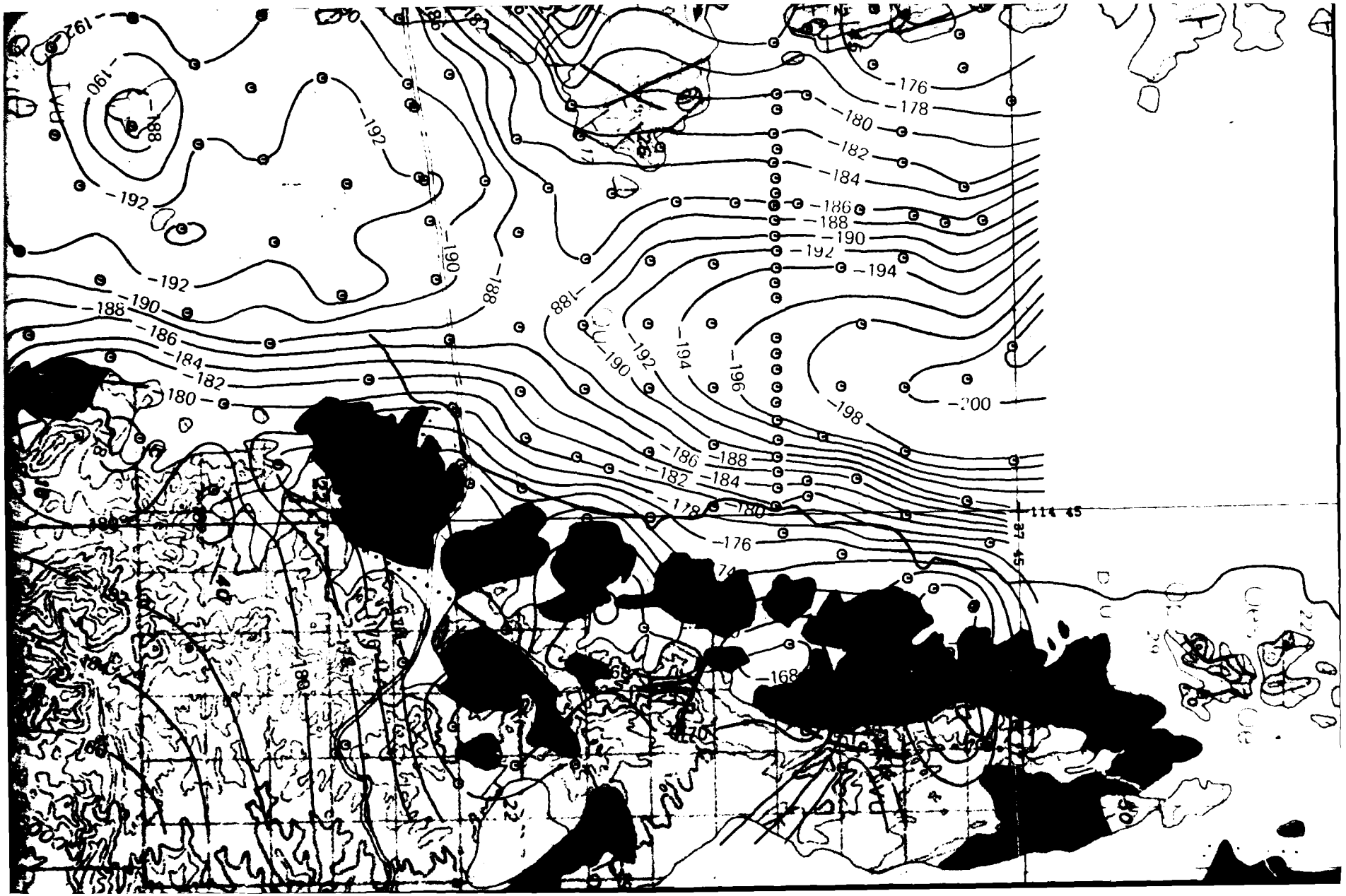
STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
DMV085	372902		1144943		5140Y	0	159415055	692411446022194691			-1714	80914
DMV086	372966		114506149560T			0	131415169	690641455591947B4			-2583	80645
DMV087	372884		114510348711T			0	127415016	690061460571946B5			-2766	80747
DMV088	372811		114513648081T			0	124414680	689601464711945S8			-2838	80887
DMV089	372730		114517647500T			0	130414729	689051466012194440			-3126	80803
DMV090	372574		1145180		4696V	0	143414440	689061462881942l4			-3731	80395
DMV091	3722e0		1145196		4655V	0	133413859	688951465221937S7			-3427	80830
DMV092	372368		1145240		4603V	0	144414057	688261464361939l4			-4159	80285
DMV093	372686		1145233		4743V	0	116415016	688141468121946B7			-3219	80720
DMV094	372956		1145196		4797Y	0	114415146	688661464371947B9			-3187	80565
DMV095	372952		1145332		4764V	0	109415134	68666146B0819476S3			-3121	80739
DMV096	372782		1145310		4689V	0	133414821	687051470131945l6			-3375	80766
DMV097	372658		1145298		4653Y	0	138414592	687231466271943S6			-3919	80349
DMV098	372554		1145359		4618S	0	145414397	686421466681941B4			-4056	80338
DMV099	372486		114529446050T			0	139414274	6374114637919403B			-4369	80064
DMV100	372406		114533345850T			0	131414125	686871464501939B9			-4370	80122
DMV101	372327		114537245669T			0	144413977	686331465771936S4			-4298	80270
DMV103	372409		1145467		4582S	0	123414126	684891471041939l4			-3749	80746
DMV106	372693		1145418		4655S	0	128414662	685491470911943B4			-3494	80757
DMV107	372850		1145419		4747V	0	114414943	685421469611940l5			-2980	80943
DMV110	372735		1145554		4673Y	0	132414726	683471478251944A3			-2645	81549
DMV112	372501		1145628		4690Y	0	134414291	682481478751941D7			-2094	82043
DMV114	372400		1145770		4318Y	0	143414099	680421465419396e0			-1763	81947
DMV115	372535		1145759		4863V	0	202414349	680531469091941S7			-1481	82135
DMV116	372704		1145724		4962V	0	164414663	680981467991944D3			-905	82335
DMV122	372238		114591446900T			0	122413795	678361479381937Z5			-1649	82476
DMV123	372173		114584547500T			0	120413677	679411474041936D			-1523	82396
DMV127	371793		1145761		4538S	0	133412977	680801485481930Z8			-1823	82832
DMV128	371971		1145810		4540C	0	109413305	680001485621933Z7			-2049	82575
DMV129	372109		114577546660T			0	114413561	680471477381935Z7			-1837	82362
DMV133	372012		114565245430T			0	117413386	682321485071933D7			-2136	82486
DMV134	371902		1145682		4538C	0	136413181	681921483981932Z7			-2132	82527
DMV137	371635		1145548		4887S	0	307412692	6340114718319284B			327	83966
DMV138	371773		1145505		4972S	0	247412948	6345914603819304D			-218	83071
DMV139	371831		1145613		4543Y	0	136413052	682971484371933l3			-1942	82699
DMV141	371998		114553145522T			0	141413364	684111477561933T6			-2782	81834
DMV142	372078		114549245499T			0	127413513	684661475081934D2			-3164	81444
DMV143	372171		114544945499T			0	126413686	685251471651936Z8			-3642	80965
DMV144	372247		114541045561T			0	136413828	685901467941937B8			-4067	80529
DMV145	372180		1145280		4600C	0	135413708	687741469281936e1			-3422	81024

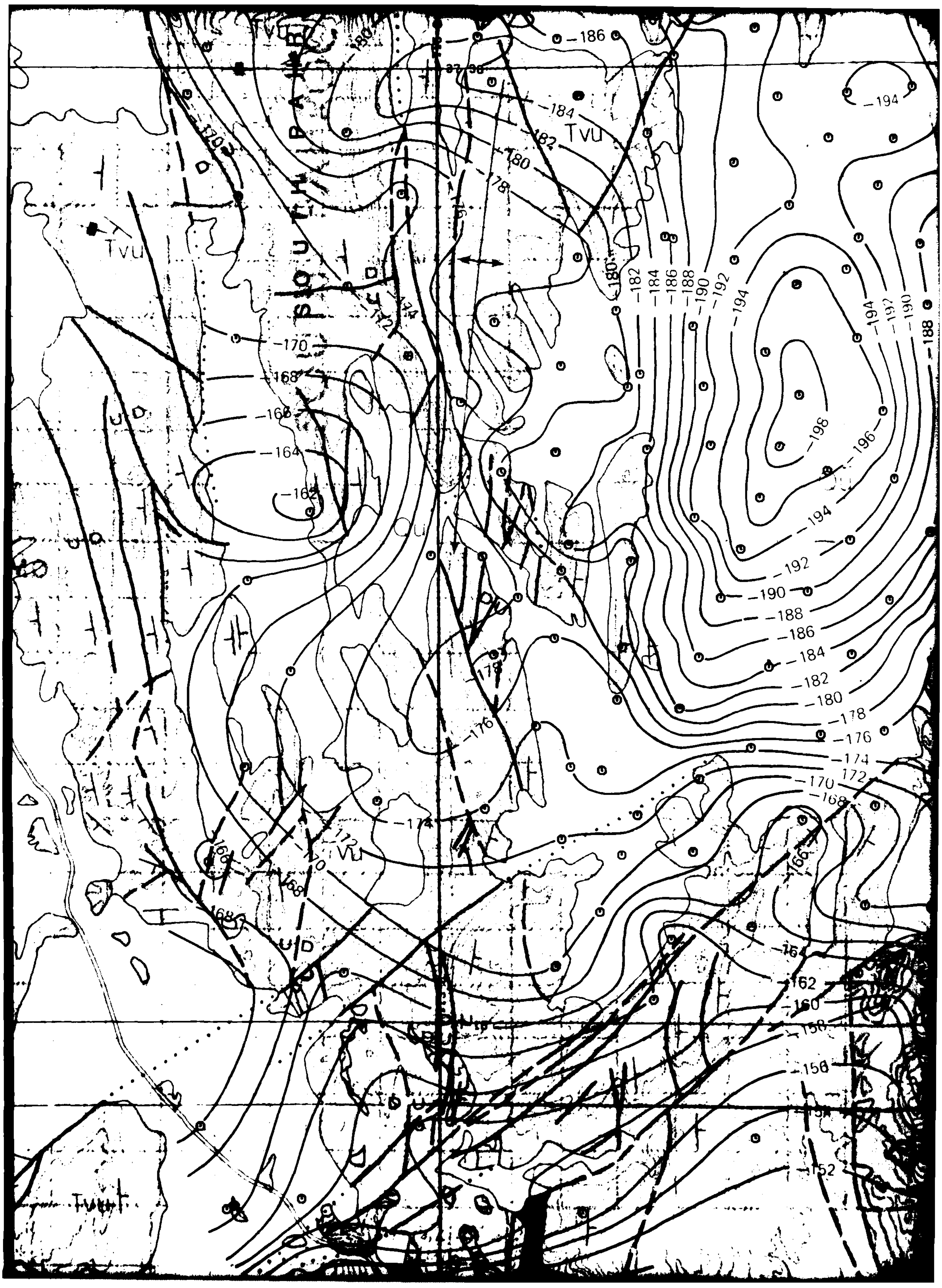
DELAMAR VALLEY GRAVITY DATA

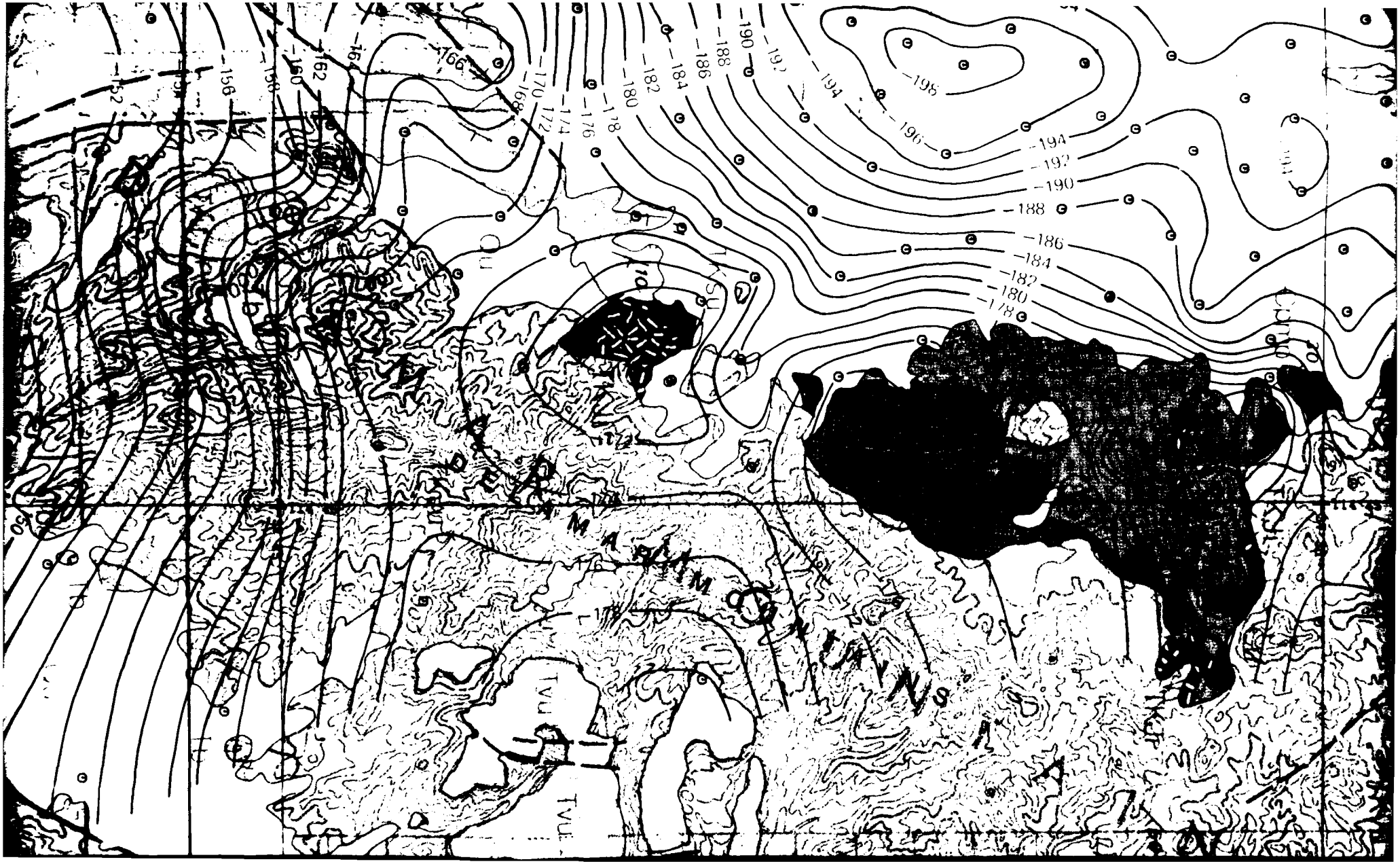
STATION IDENT.	LAT. DEG	MIN	LONG. DEG	MIN	ELEV. +CODE	TER-COR. IN/OUT	NORTH UTM	EAST UTM	OBSV GRAV	THEO GRAV	FAA	CBA +1000
DMV148	371957		1145257		4696S	0	141413297	688181472501933 17			-1872	82252
DMV149	371823		1145294		4898S	0	188413048	687691470231931 22			2	83480
DMV152	371690		1145172		5656S	0	456412806	689541415101929 29			1814	82979
DMV154	371963		1145133		4784S	0	154413312	690011468531933 25			-1450	82387
DMV155	372082		1145195		4692V	0	136413530	689041468901934 98			-2452	81681
DMV156	372166		1145119		4755V	0	153413698	690131464291936 20			-2442	81493
DMV157	372136		1145005		4958C	0	165413636	691321458931935 77			-1023	82232
DMV158	372021		1145017		5128S	0	209413423	691691449091934 10			-239	82480
DMV159	371826		1145018		4929S	0	191413062	691761461591931 26			-579	82801
DMV160	371686		1145028		5052V	0	206412803	691671453821929 23			5	82980
DMV161	371534		1144994		5593S	0	373412616	692221420951927 75			1959	83256
DMV163	371671		1144861		5776C	0	404412781	694151403961929 01			1857	82561
DMV164	371763		1144915		5069S	0	228412949	693311449331930 35			-396	82543
DMV165	371905		1144956		5025V	0	205413211	692641454661932 41			-483	82583
DMV166	372113		1144866		5228V	0	220413598	693581449791935 43			633	83027
DMV167	372190		1144903		5076V	0	184413739	693231456291936 55			-255	82616
DMV168	372170		1144762		5352S	0	233413707	695391436781936 26			422	82401
DMV170	372071		1144725		5593S	0	281413526	695981425681934 32			1725	82930

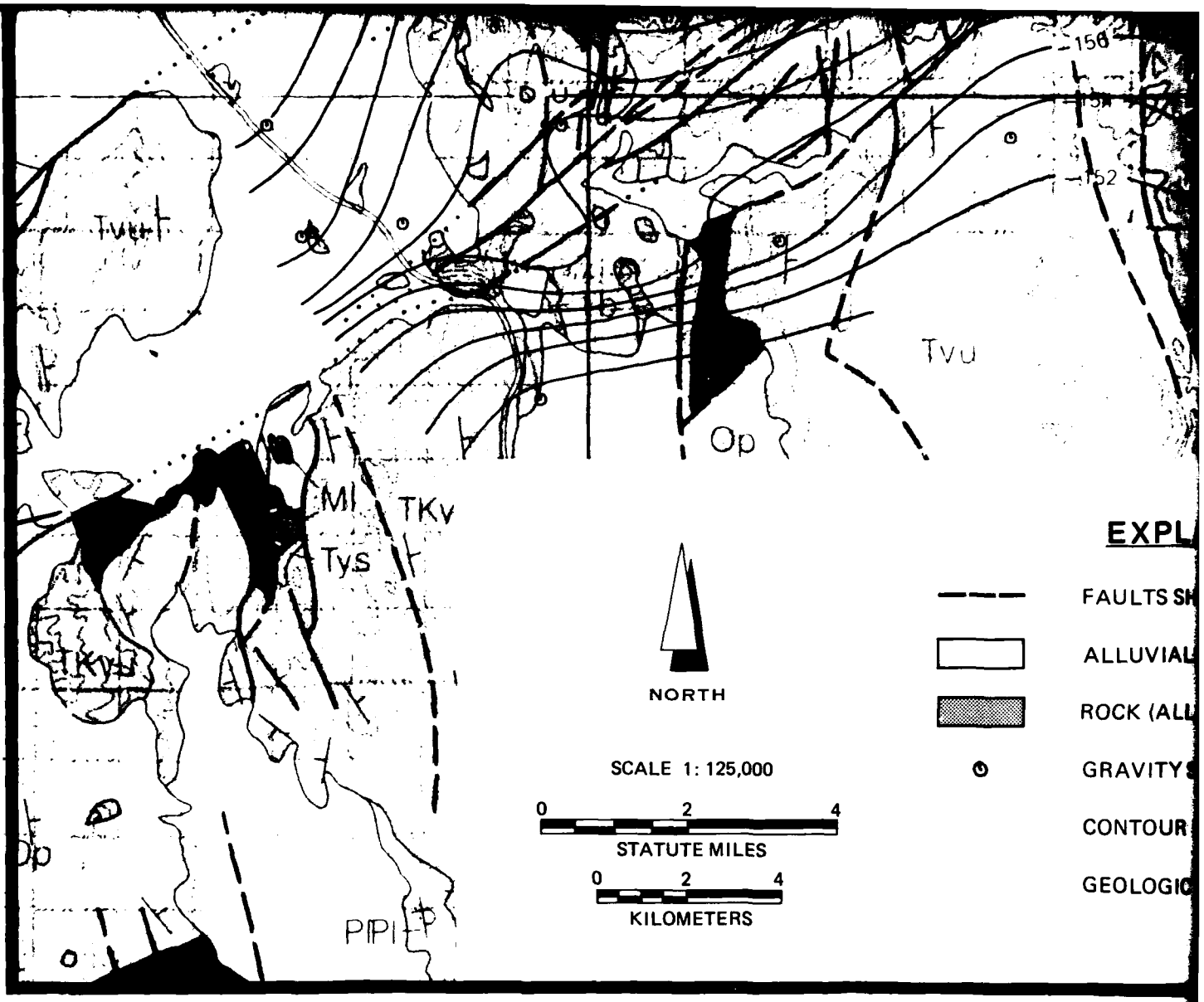
END OF LIST


NORTH PAHROC RANGE
Tvu
Qu
Dsr
Tvu
Oes
Su
Dg
Tvu
Qu
Tvu
-170
-172
-174
-176
-178
-180
-182
-184
-186
-188
-190
-192

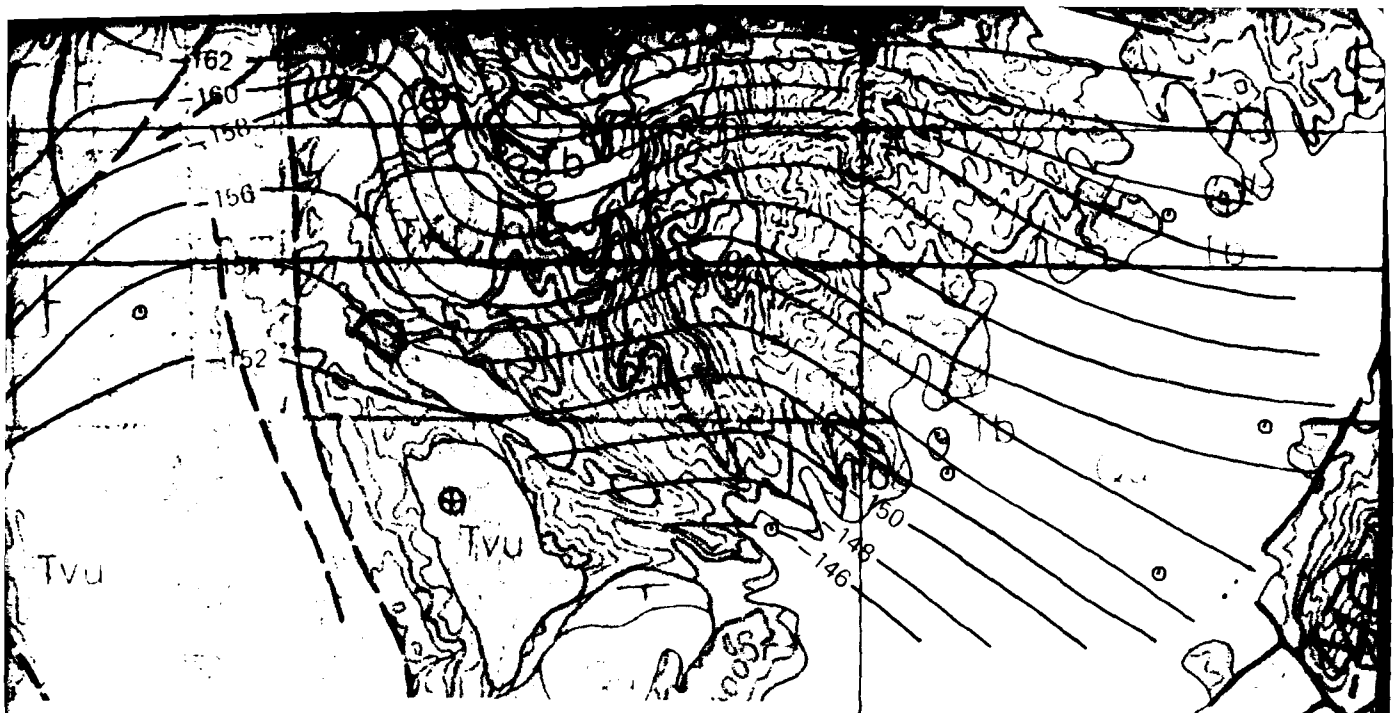

-176
-178
-180
-182
-184
-186
-188
-190
-192
-194
-196
-198
-200
-168


SOUTH PARK
Tvu
Qu
-194
-198
-196
-192
-190
-188
-186
-184
-182
-180
-178
-176
-174
-172
-170
-168
-166
-164
-162
-160
-158
-156
-152
U D


-198
-196
-194
-192
-190
-188
-186
-184
-182
-180
-178
-176
-174
-172
-170
-168
-166
-164
-162
-160
-158
-156
-154
-152
TVU
TVU
TVU


Tvu
Op
Ml
TKv
Tys
TKvs
Op
PIPI
Tvu
Op
NORTH
SCALE 1: 125,000
0 2 4
STATUTE MILES
0 2 4
KILOMETERS
EXPL
FAULTS SH
ALLUVIAL
ROCK (ALL
GRAVITY S
CONTOUR
GEOLOGIC

5



EXPLANATION

- FAULTS SHOWN ON GEOLOGIC BASE MAP
- ALLUVIAL MATERIAL
- ROCK (ALL PATTERNS)
- GRAVITY STATIONS
- CONTOUR INTERVAL = 2.0 MILLIGALS
- GEOLOGIC BASE MAP: E.L. Howard (1978)

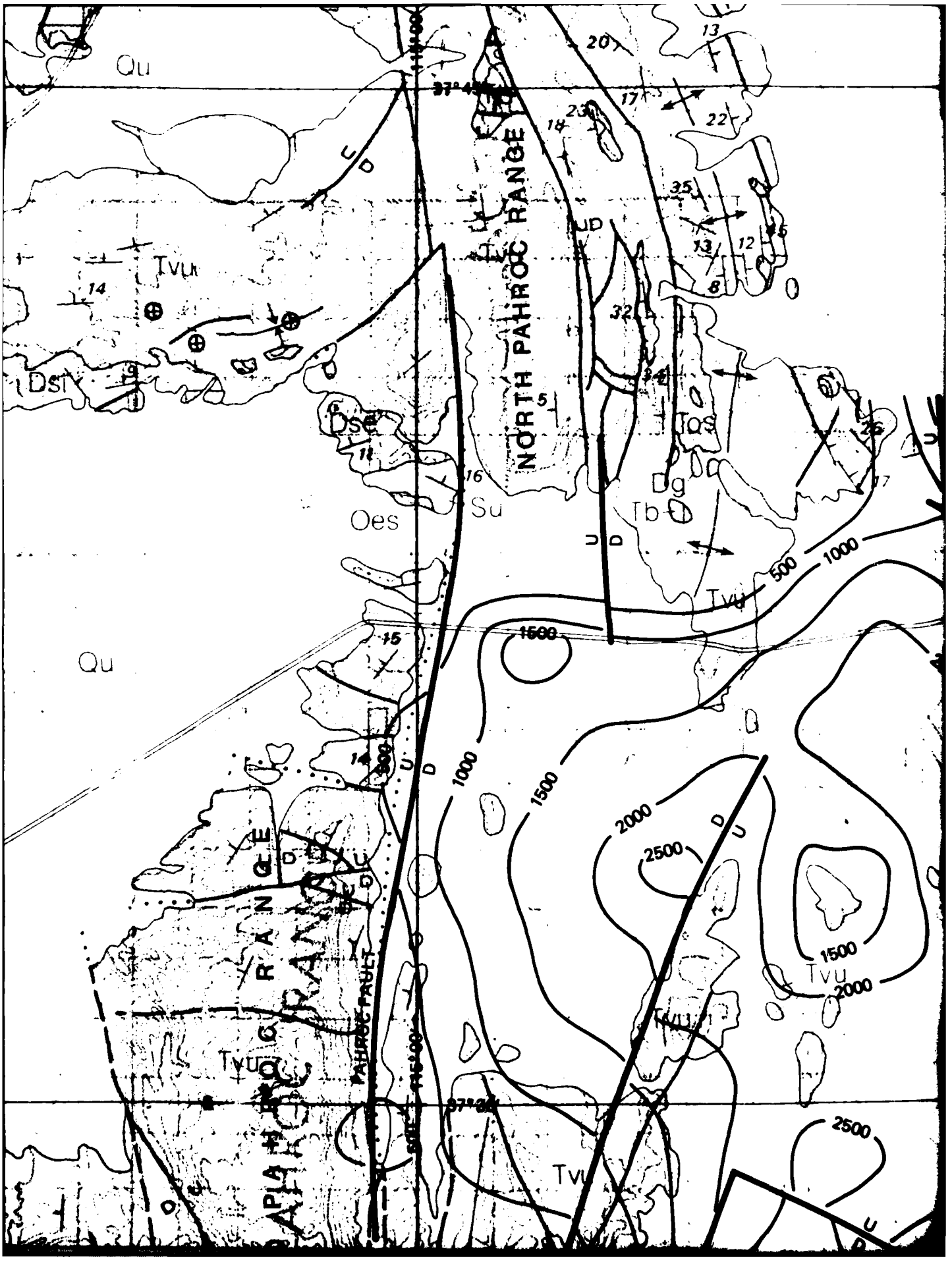
Ertec
The Earth Technology Corporation

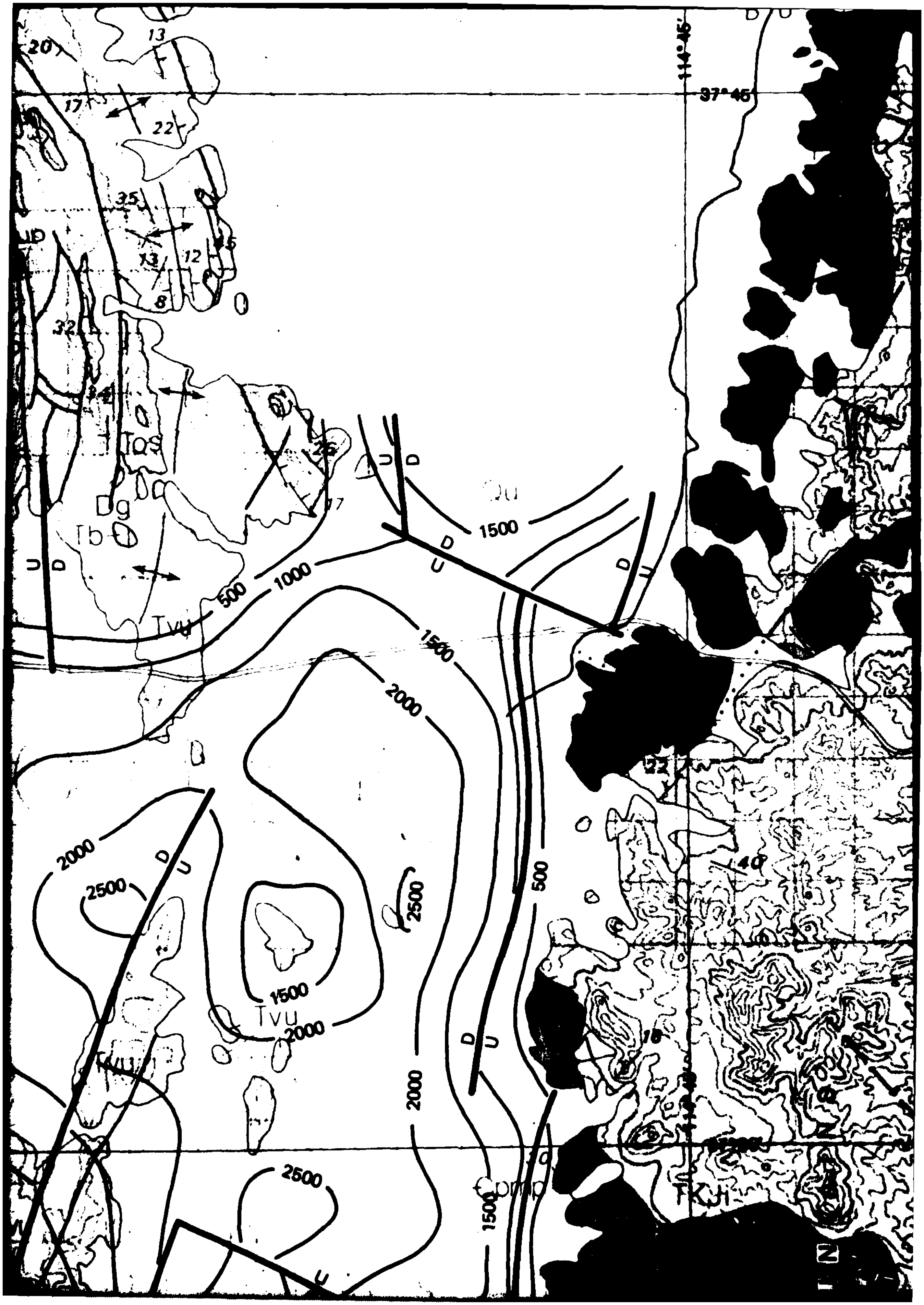
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX

COMPLETE BOUGUER ANOMALY CONTOURS DELAMAR VALLEY, NEVADA

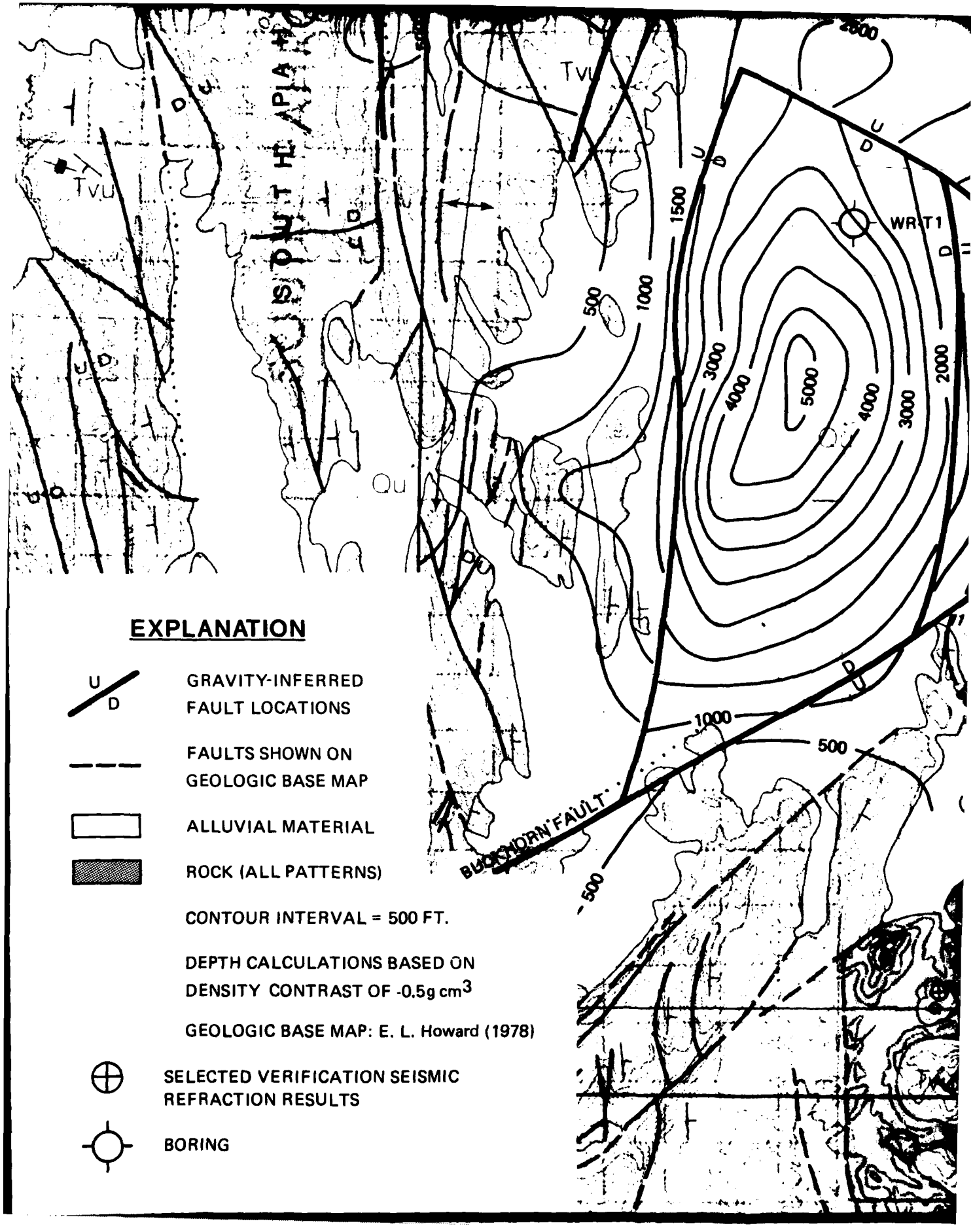
20 JUL 81

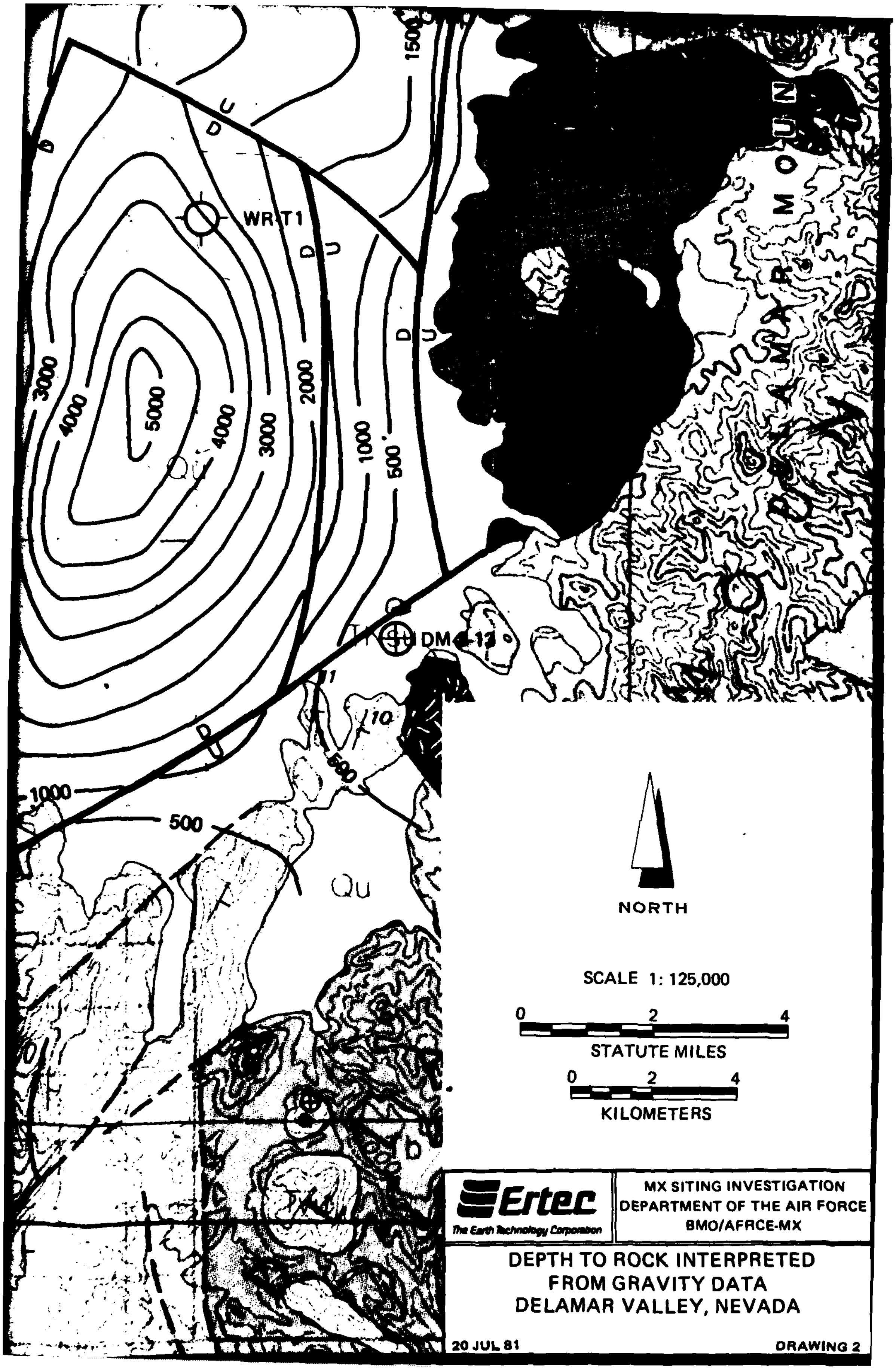
DRAWING 1


Qu
Tvu
Dsl
Dse
Oes
Su
Tqs
Dg
Tb
Qu
Tvu
Tvu
Tvu
Tvu
NORTH PAHROC RANGE
PAHROC RANGE
PAHROC FAULT
500
1000
1500
2000
2500
1500
2000
2500
U
D



37°45'
114°45'
Qu
Tvu
Tqs
Dg
Tb
500
1000
1500
2000
2500


Tvu
Qu
WR-T1
2500
2000
1500
1000
500
3000
4000
5000
BLACKHORN FAULT
EXPLANATION
U
D
GRAVITY-INFERRED FAULT LOCATIONS
FAULTS SHOWN ON GEOLOGIC BASE MAP
ALLUVIAL MATERIAL
ROCK (ALL PATTERNS)
CONTOUR INTERVAL = 500 FT.
DEPTH CALCULATIONS BASED ON DENSITY CONTRAST OF -0.5g cm3
GEOLOGIC BASE MAP: E. L. Howard (1978)
SELECTED VERIFICATION SEISMIC REFRACTION RESULTS
BORING


WR-T1
DM-13
5000
4000
3000
2000
1000
500
1500
Qu
NORTH
SCALE 1: 125,000
0 2 4
STATUTE MILES
0 2 4
KILOMETERS
Ertec
The Earth Technology Corporation
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE
BMO/AFRCE-MX
DEPTH TO ROCK INTERPRETED
FROM GRAVITY DATA
DELAMAR VALLEY, NEVADA
20 JUL 81
DRAWING 2