National Uranium Resource Evaluation

INTERPRETATION OF NURE AERIAL RADIOMETRIC AND HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE DATA

FINAL REPORT

D.F. Saunders
D.K. Jordt
J.H. Galbraith

TEXAS INSTRUMENTS
INCORPORATED
Dallas, Texas

October 1980

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
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UNDER CONTRACT NO. EY-76-C-13-1664
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SECTION I
INTRODUCTION

A. OBJECTIVES

The usual approach in utilizing ARR (Aerial Radiometric Reconnaissance) and HSSR (Hydrogeochemical and Stream Sediment Reconnaissance) data in potential uranium resource assessment relies primarily on ground-checking anomalies to determine their cause and potential as resources. This study was designed to supplement that type of information by: 1) providing methods to identify possible uranium host rocks or source rocks based on local enrichments or depletions of uranium relative to geochemically related elements, and 2) trying to relate the ARR and HSSR data to quantitative regional (whole quadrangle) estimates of uranium favorability or resources. This report provides a summary description of the data products and quadrangles included in the study and tells where the data products for individual quadrangles may be consulted or copied.

The major objective was to provide the quadrangle data sets to the NURE quadrangle evaluation teams for their use in uranium resource estimation. A minor objective was to attempt to relate known uranium resources to the measured, whole-quadrangle, aerial radiometric and geochemical parameters quantitatively so that the data in relatively unexplored quadrangles could be used to predict resources for comparison with estimates based on other data. This report summarizes efforts toward the latter objective.

B. PREVIOUS REPORTS

Two reports have been placed on open file by Bendix Field Engineering Corporation and the U.S. Department of Energy (DOE) as a result of this work.

Norwine et al. (1979) is filed as GJBX-136(80) and reports the results of a preliminary study of the effects of near-surface moisture and biomass on the sensitivity of aerial gamma-ray spectrometer measurements. A set of test quadrangles was selected for use in investigating relationships among a group of environmental variables and ratios of whole-quadrangle mean stream sediment uranium and thorium contents to corresponding mean aerial radiometric uranium and thorium measurements. It was assumed that stream sediment values might be sufficiently representative of the average surface radioelement concentrations to be used in ground-calibrating the aerial systems.

Preliminary testing established strong statistical correlations between the radioelement ratios and moisture and biomass variables. However, it was recognized that moisture and biomass relationships represent a variety of variables affecting the aerial gamma-ray measurements, such as soil formation, including weathering effects. Also, the data suggested that in certain very humid areas placering effects caused the mean thorium and uranium content of stream sediments to be much greater than actual concentrations in the average surface rocks. These effects made the use of the stream sediment analyses impractical in locally calibrating the aerial systems.

A followup study used surface-to-aerial ratios based on analyses of fresh rock samples in humid regions and established that reasonable local correction factors could be developed using this approach. Developing such factors would require collecting representative surface samples of selected formations in a variety of humid environments to provide additional ground calibration data for refining the aerial data correction models.

The second open-file report, Texas Instruments (1980), is GJBX-137 (80) and presents the results of design and testing phases for methods subsequently used in processing and interpreting the available ARR and HSSR data from the priority selection of quadrangles. Examples of the data products for each quadrangle are included, along with an outline of the rationale for their creation.

Quadrangles used in the testing are:

ARR Tests	HSSR Tests
Rawlins	Seguin
Denver	Pueblo
Spokane	Austin
Ritzville	

C. ACKNOWLEDGMENTS

Texas Instruments is pleased to acknowledge valuable assistance and suggestions by Department of Energy and Bendix Field Engineering Corporation personnel in the Grand Junction, Colorado, office, especially Carl P. Lathan, Jr., Merle E. Crew, Robert C. Horton, Donald Livingston, and Roger C. Malan.

Dalton Atkins of Oak Ridge National Laboratory was very helpful in furnishing computer tapes containing the survey data and in expediting their delivery.

SECTION II

SUMMARY OF QUADRANGLE DATA PROCESSING

A. AERIAL RADIOMETRIC DATA

1. Data Products

The data packages for each quadrangle supplied to the quadrangle evaluators included:

- Statistical summary tables
  - table of quadrangle and formational means in concentration units
  - plot of quadrangle-adjusted eTh/eU vs eTh
  - plot of province-adjusted eTh/eU vs eTh
  - tables of source and host rocks determined from the two plots listed above
  - plot of eTh vs eU with "outliers" identified
  - summary table of radiometrically derived source and host rocks with remarks
- Outcrop data
  - outcrop, radiometric lithology, and source/host-rock map (1:250,000-scale Mylar positive film)
  - eTh profile map (1:250,000-scale Mylar positive film)
  - eTh vs eU plot of outcrop data with limits for source/host-rock identification.

Two complete sets of these data products for each quadrangle were delivered to Bendix Field Engineering Corporation technical personnel to help them estimate uranium resources. File copies of the outcrop, radiometric lithology, source/host rocks, and eTh profile maps at 1:250,000 scale will be placed on file at the Bendix Field Engineering Corporation Technical Library in Grand Junction, Colorado.

2. List of Processed Quadrangles

Table 2-1 lists the priority quadrangles for which aerial radiometric reconnaissance data packages were prepared.

Table 2-1. List of Quadrangles with Aerial Radiometric Data Interpretation Maps on File

Adel	Gillette	Plainview
Albuquerque	Glens Falls	Pocatello
Amarillo	Grand Canyon	Poplar Bluff
Ashton	Greeley	Portland
Augusta	Green Bay	Pratt
Austin	Greensboro	Prescott
Aztec	Hamilton	Presidio
Baker	Harrisburg	Price
Beaumont	Havre	Rapid City
Beeville	Hot Springs	Raton
Bozeman	Hutchinson	Rawlins
Brownsville	Iron River	Reno
Butte	Joplin	Rice Lake
Casper	Kingman	Richfield
Challis	Klamath Falls	Rock Springs
Charlottesville	La Junta	Salina
Cheyenne	Lamar	Salton Sea
Clifton	Lander	Sandpoint
Clinton	Laredo	Santa Fe
Cody	Las Vegas	Scranton
Corpus Christi	Lawton	Seguin
Cortez	Leadville	Sherman
Craig	Lemmon	Shiprock
Crystal City	Lewistown	Silver City
Dalhart	Lovelock	Socorro
Delta	Lubbock	Spartanburg
Denver	Manhattan	Spokane
Dickinson	Marfa	St. Cloud
Douglas	McAllen	Torrington
DuBois	McDermitt	Trinidad
Durango	Mesa	Tularosa
Dyersburg	Millett	Van Horn
Eau Clair	Moab	Vernal
Ekalaka	Newark	Vya
Elk City	Newcastle	Walker Lake
Elko	Nogales	Wells
Emory Peak	Ogden	White Sulphur Springs
Enid	Okanogan	Wichita
Flagstaff	Oklahoma City	Wichita Falls
Ft. Stockton	Palestine	Williams
Gallup	Pecos	Winnemucca

Total: 124

B. HYDROGEOCHEMICAL AND STREAM SEDIMENT DATA

1. Data Products

The variable-premise data package for HSSR evaluation of each quadrangle consists of a bound folio of computer printout covering the various treatments of the geochemical variables. These data are arranged in the following sections:

1) Definitions: Permutations and symbols are defined and derived. Elements used for the indices are cited.

2) Statistics: Covering all variables in sediments, stream waters, and well waters: number, mean, standard deviation, minimum, maximum, skewness, kurtosis.

3) Quadrangle maps: Computer-generated, at approximately 1:1,000,000 scale, in key, three levels of anomaly shown in each map. One map each for 21 uranium-related parameters.

4) Gradient distribution curves (GDCs) showing the top 160 samples by each U-permutation, with overprinted values on standardized scale showing how each sample on the curve rated in four other variables. The overprints are T-standardized so that 1.0 is anomaly threshold, 0.0 is quadrangle background.

5) Gradient distribution lists in key with each GDC, showing all variables measured in each sample. Merged with water data where sample sites are the same. Sorted according to the sample sequence in the respective overlying GDC. Element values are corrected for inert matrix fluctuations.

6) Correlation matrices:

   - Sediments: all elements, as analyzed
   - Stream waters: all elements, as analyzed
   - Ground waters: all elements, as analyzed
   - Sediments: two matrices of three critical uranium-related parameters versus all elements corrected for inert matrix.

7) Factor analysis

8) Master list of all elements as reported by laboratory.

Two copies of each folio were delivered to the NURE quadrangle evaluators for their use, and one copy has been placed on file at the Bendix Field Engineering Corporation Technical Library in Grand Junction, Colorado.

2. List of Processed Quadrangles

Table 2-2 lists the quadrangles for which geochemical data folios were prepared.

Table 2-2: List of Quadrangles with Hydrogeochemical and Stream Sediment Data Interpretations on File

Albuquerque	Grand Canyon	Poplar Bluff
Amarillo	Greensboro	Portland
Arminto	Harrisburg	Pratt
Ashland	Hot Springs	Prescott
Athens	Hutchinson	Presidio
Augusta	Iron River	Price
Austin	Joplin	Pueblo
Beaumont	Kingman	Rapid City
Beeville	Klamath Falls	Reno
Billings	La Junta	Rice Lake
Brownsville	Lamar	Richfield
Butte	Lander	Ritzville
Casper	Las Vegas	Rock Springs
Challis	Lawton	Salina
Clinton	Lemmon	Salton Sea
Corpus Christi	Llano	San Antonio
Cortez	Lovelock	Sandpoint
Craig	Manhattan	Scranton
Crystal City	Marfa	Seguin
Death Valley	McAllen	Sherman
Delta	McDermitt	Spartanburg
Dickinson	Mesa	Spokane
Dillon	Millett	St. Cloud
Dyersburg	Moab	Tonopah
Elko	Montrose	Torrington
Emory Peak	New Ulm	Trona
Enid	Okanogan	Walker Lake
Escalante	Oklahoma City	Wells
Flagstaff	Palestine	Wichita
Gillette	Plainview	Wichita Falls
Glens Falls	Pocatello	Williams
		Winnemucca

Total: 94

SECTION III

USE OF DATA IN PREDICTING LOCATIONS AND AMOUNTS OF RESOURCES

A. LOCATION PREDICTION WITHIN QUADRANGLES

1. Present Data Products

Examination of the quadrangle data products for the priority quadrangles has led to several conclusions as to their effectiveness in predicting the locations of possible economic deposits in the quadrangles. In general, there is good agreement between areas defined radiometrically as possible host rocks and known areas of mineralization and also between the known areas and regions indicated to be uranium-enriched by the special geochemical permutations of the HSSR data. The ARR and HSSR data generally indicate several other areas as being prospective for uranium, and these are in nearly all cases geologically feasible for possible uranium mineralization.

For the ARR data, a combination of the 1:250,000-scale Mylar uranium outcrop map with the Mylar host/source rock map (with the host and source outcrops highlighted with colored ink or wax pencil) can be effectively overlaid on the topographic or geologic maps at the same scale to identify the more promising prospects. In many cases the location can be defined well enough for ground followup with only the outcrop-type information. If not, the open-file, original survey maps can be consulted to locate the individual records contributing to the anomalous outcrop.

The approximately 1:1,000,000-scale HSSR anomaly maps can be used to identify the general locations of uranium-enriched regions in the quadrangle. The most useful of the several permutations appears to be UET (uranium excess over the normal amount of associated thorium). An anomalously high UET sample indicates that there may be a uranium prospect in the drainage area represented by that sample. To define this area one can refer to the data listings in the bound folio to determine the latitude and longitude of the sample. These may be plotted on standard topographic maps to allow the sampled drainage to be outlined. Further refinement of location of anomaly source will require further field work.

2. Possible Future Methods

An improvement might be made in the selection of ARR-indicated uranium-enriched or -depleted ARR outcrops. In the present data products this was done based on the U versus Th plot for the outcrop data. The normal "swarm" of points was determined as a linear function, with parallel limit lines on either side. Points with abnormally low or high uranium for a given thorium content (outside the limit lines) were defined as source rocks or host rocks respectively.

A recommended alternative approach could be based on UET (uranium excess over thorium) computed as described in paragraph III.B.1.b. The anomalously high or low UET values could be determined based on gradient distribution curves also shown in that paragraph and computer-plotted on map overlays at 1:250,000 scale, grading them as major, medium, or minor in intensity using different symbols. Using the gradient distribution curve to define anomalous samples is decidedly more effective than the relatively arbitrary approach used for the present data products (see Texas Instruments, 1980, and paragraphs III.B.1.b and III.B.2 of this report for more information on gradient distribution curves).

It is suggested that future HSSR data processing include at least the UET anomalies computer-plotted at 1:250,000 scale on map overlays to facilitate identification of their drainage basins.

B. URANIUM POTENTIAL PREDICTION IN ALASKA BY AERIAL RADIOMETRIC DATA

1. Introduction

a. Uraniferous Provinces

It has been commonly observed that most of the world's important uranium deposits are clustered in relatively few areas, suggesting that these regions represent uranium-rich portions of an originally inhomogeneous crust (Klepper and Wyant, 1957). These uraniferous provinces are characterized by the presence of several types of uranium deposits (Dodson, 1972). The deposits appear to persist through long periods of geologic time, with the uranium being moved from one type of deposit to another within each province by normal erosional, sedimentary, and igneous processes. These provinces are characterized further by higher than normal quantities of uranium in all the rocks and waters (Darnley, 1973; Darnley et al., 1977; Everhart, 1958; Scott and Barker, 1958).

These and similar observations led to the conclusion that new uranium deposits would be found more frequently in regions geochemically enriched in uranium than in those having low uranium content (Brink, 1974). Consequently, the recognition of uraniferous provinces is of great importance in uranium-deposit discovery (Bowie, 1977).

In previous studies of the application of aerial gamma-ray spectrometry to characterization of uraniferous geochemical provinces (Saunders, 1979; Saunders and Potts, 1978; Texas Instruments, 1977, 1979), it was concluded that:

- Uraniferous provinces can be identified and outlined using regional reconnaissance, high-sensitivity, aerial gamma-ray spectrometer measurements of eU,* eTh,* and K* (see also Darnley et al., 1977).
- Known or suspected uraniferous provinces are characterized by higher concentrations of <u>all three</u> natural radioelements, eU, eTh, and K, and lower <u>median</u> eU/eTh and eU/K values for whole quadrangles, as well as relatively large numbers of <u>local</u> anomalously <u>high</u> values of eU/eTh and eU/K.
- It may be possible to relate the magnitudes of regional mean radioelement data to the potential undiscovered uranium resources through careful calibration in regions with a variety of well-known uranium resources.

This evidence suggested that when relatively large amounts of uranium are present, there would be a high probability of sufficient mobile uranium available to be concentrated in potentially economic deposits if the proper geochemical processes had occurred. The low median eU/eTh and eU/K values were taken to indicate that the proper processes <u>have</u> concentrated part of the uranium in deposits, resulting in its removal from the "average" source rocks

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*eU = equivalent uranium measured as Bi-214.
eTh = equivalent thorium measured as Tl-208.
K = potassium measured as K-40.

viewed by the aerial spectrometer and preferentially separating it from the relatively immobile thorium and less-mobile potassium (Saunders and Potts, 1978).

Mean eU and eTh values (and also eU and K values) were strongly correlated for whole quadrangles (Saunders, 1979). Clark et al. (1966) showed similar strong correlations among the three natural radioelements. Thus it is suggested that deviations from these close relationships should be diagnostic of the degree of geochemical activity.

It may be reasoned that, under the chemically reducing conditions at depth in the young earth, conditions that are also commonly attributed to the earth's early Precambrian atmosphere (Cloud, 1976; Dimroth and Kimberly, 1976; Robertson et al., 1978), uranium and thorium, both in the +4 valence state, must have very closely accompanied one another geochemically (Adams et al., 1959; Gableman, 1977; Rogers et al., 1978). Only when chemically oxidizing conditions arose could uranium enter the +6 valence state and become more mobile than thorium, with consequent major separation to form uranium deposits. The thorium has only the +4 valence state and has remained relatively immobile. Thus, the regional distribution of thorium should reflect the original crustal inhomogeneities in uranium content better than uranium itself. These early Precambrian uraniferous crustal regions are believed to be ancestors of today's uraniferous geochemical provinces. The origin of these original crustal inhomogeneities is obscure but may be related to differing degrees of crustal differentiation from place to place; or if the earth were formed by accretion of solids, there may have been significant differences in the radioelement composition of the accreting fragments. Bowie (1977) concluded that early crust-mantle mixing by convective motion produced these uranium-enriched and uranium-depleted provinces. Enough uranium was available in those uraniferous provinces that geochemical weathering and perhaps igneous processes under oxidizing conditions could remove it from the "average" rocks and generate deposits. A high mean eTh/eU ratio would indicate that some of the uranium indeed had been moved, and this parameter may be useful as a rough estimate of the probable relative degree of mineralization in an area owing to secondary processes.

To a lesser degree than for thorium, potassium also may be used as a surrogate for uranium. It is somewhat less mobile than uranium but is reasonably well correlated with it in the primary geochemical cycle. As in the case of thorium, high mean potassium values may indicate uraniferous provinces or source rocks, and high K/eU values may indicate roughly the relative degree of uranium mineralization.

Other studies have supported this general concept. Stuckless and Nkomo (1978) concluded that high thorium content in the rocks of the Granite Mountains of Wyoming is more diagnostic of their potential as uranium source rocks than is the present-day uranium content because much of the latter has been recently lost through weathering, as evidenced by uranium-lead isotope contents. These granites are considered by many to be a source for the nearby uranium deposits. Malan (1976) observed that in Precambrian igneous rocks of the western United States, thorium, uranium, potassium, and Th/U increase systematically from intermediate to silicic phases, and the distributions of major uranium deposits in that region are spatially related to the patterns of radioelement enrichment in the Precambrian rocks. Adler (1977) concluded that the Th/U ratio may be a useful guide to ore-forming potential in the igneous environment. Rose et al. (1980) suggest that because uranium and thorium behave similarly in many processes, thorium can be used as a normalizing factor for predicting expected uranium in a variety of rocks. Texas Instruments (1980) used this type of relationship in the NURE program to identify uranium source and host rocks.

b. Objective of this Study

This work constitutes a refinement and extension of the study reported by Saunders (1979). The objective of this study was to explore further the relationships between quadrangle mean values for eU, eTh, and K and the favorability for uranium deposits in Alaska. The current state of knowledge about uranium resources in the area of interest does not yet permit calibrating favorability indexes or measurements in terms of well-known resource areas. Here, it is necessary to use the number of significant local high uranium anomalies in each quadrangle as a measure of its favorability for uranium, against which the whole-quadrangle mean values can be equated. This approach can provide only relative values for favorability and qualitative estimates for potential uranium resources; however, it may be useful as a guide to the more promising prospecting regions.

This study was limited to Alaskan data because of the relatively uniform, generally wet and cold soil environment, which differs from most of the remainder of the United States. Norwine et al. (1979) found that soil moisture, biomass, and amount of chemical weathering have a relatively large influence on the sensitivity of aerial radiometric measurements, and it was desired to avoid these uncontrolled variables as much as possible by limiting the study to the central Alaskan environment.

c. Sources of Data

The initial work (Saunders, 1979) involved data from 23 1-degree-by-3-degree, NTMS quadrangles in Alaska (Texas Instruments, 1976).

This has been supplemented by data from 27 additional Alaskan quadrangles (Aero Service, 1980 a through j; LKB Resources, 1978; Texas Instruments, 1978). In general, the flight lines were about 6.25 miles apart, giving detailed coverage of a little less than 1 percent of the surface. All of the data were gathered by instrumentation calibrated at the U.S. Department of Energy Dynamic Test Range at Lake Mead, Arizona, and the geologic formation averages in each quadrangle have been converted from counts per second to ppm eU, ppm eTh, or %K. Whole-quadrangle mean values were calculated as averages of the included formation means, weighted according to the number of records included in each.

d. Local Uranium Anomalies

The number of local high uranium anomalies in each quadrangle was determined by a uniform method of evaluation in 40 of the 50 quadrangles. Data in the other 10 quadrangles were not reported in a form readily adaptable to this form of evaluation. The method is based generally on a statistical approach described by Elkins (1940).

If single, statistically high points are considered, they are defined as anomalous if they exceed the mean value plus three standard deviations as calculated for the geologic formation in which they occur. Groupings of high points due to random variations are less probable than a scattering of the same points over the map unit. If an anomaly consists of adjacent high points, then a minimum acceptable significant anomaly must contain two adjacent points averaging at least between two and three standard deviations above the mean; or three adjacent points with two between one and two standard deviations and one between two and three standard deviations above the mean; or four adjacent points, all between one and two standard deviations above the mean. These criteria were applied to all the listed groupings of high points in eU, eU/eTh, and eU/K for the 40 quadrangles, and a further constraint was applied; i.e., for an anomaly to be considered a first-priority anomaly it must simultaneously satisfy the above statistical requirements for eU, eU/eTh, and eU/K (Saunders and Potts, 1978). This measure of uranium favorability is listed in the tables and figures for the 40 quadrangles as "UIN" and as Log_{10} (UIN+1) = "UINL."

The data on 23 quadrangles originally reported by Saunders (1979) were reinterpreted statistically on the same basis as the later 17 quadrangles for inclusion here.

2. Data Processing and Interpretation

a. General

Basic statistics for each variable were generated by the Statistical Analysis System (SAS), a software package distributed by SAS Institute (1979). SAS was also used to perform other statistical procedures, including the generation of correlation matrices and stepwise multiple linear regression analysis.

b. Correlation Matrix and Variables

A correlation matrix was prepared to determine which of several variables correlated best with the number of significant eU anomalies, UIN (or UINL = Log_{10} [UIN + 1]), used here as a measure of the uranium potential of each quadrangle. The results are summarized in Table 3-1, where:

AU is adjusted* quadrangle mean eU in ppm.

*"Adjusted" indicates that each quadrangle mean is divided by the mean for that variable for all the quadrangles in the data set.

ATh is adjusted quadrangle mean eTh in ppm.

AK is adjusted quadrangle mean K in %.

AThU is ratio of adjusted eTh to adjusted eU (ATh/AU).

AKU is ratio of adjusted K to adjusted eU (AK/AU).

UET is uranium excess over thorium = adjusted eU minus adjusted eTh (AU-ATh).

UEK is uranium excess over potassium = adjusted eU minus adjusted K (AU-AK).

Table 3-1. Correlation Matrix

	UIN	UINL	AU	ATh	AK	AThU	AKU	UET
AU	0.401	0.473						
ATh	0.750	0.819	0.687					
AK	0.683	0.790	0.670	0.825				
AThU	0.774	0.838	0.150	0.799	0.628			
AKU	0.478	0.596	0.125	0.411	0.705	0.660		
UET	-0.775	-0.814	-0.0681	-0.772	-0.546	-0.965	-0.533	
UEK	-0.618	-0.706	-0.0061	-0.495	-0.746	-0.713	-0.939	-0.675

Note: Single underline denotes valid correlation at >99% certainty.
Double underline denotes valid correlation at >99.9% certainty.

The data are adjusted to the mean of all the Alaskan quadrangles so that any quadrangle where the variable is "average" for Alaska will be expressed as 1.000. For example, if a quadrangle has the average eTh/eU ratio for Alaska, ATh/AU will be 1.000, and if there is a uranium enrichment with respect to thorium, ATh/AU will be less than 1.000, and a uranium depletion will result in ATh/AU being greater than 1.000. Similarly, UET = AU - ATh = 0.000 if uranium is present in average abundance with respect to thorium: however, positive values will indicate relative uranium enrichment and negative ones uranium depletion. Adjusted values provide a convenient basis for judging the relative amounts of apparent uranium enrichment (potential host rocks) and uranium depletion (possible source rocks).

Examination of Table 3-1 shows that all the variables have a higher degree of correlation against UINL than against UIN, suggesting that UIN is related exponentially to the radioelements rather than linearly. Figure 3-1 illustrates that point. ATh and AK both show higher correlation against the log of the number of significant uranium anomalies than does AU itself, supporting the use of ATh and AK as surrogates for uranium in the Alaskan environment. The highest correlations with UINL are shown by AThU, ATh, UET, and AK.

Figures 3-2 and 3-3 are contour maps of ATh and AThU respectively that illustrate the distribution of uraniferous provinces in terms of regional highs. Regional highs in ATh and AThU indicate the most prospective regions as follows:

1. Kateel River, Melozitna, Tanana, Bettles, Beaver, Coleen (Yukon Region).
2. Big Delta, Eagle, Healy, Talkeetna Mts.
3. Lime Hills, Lake Clark.

The least prospective areas are:

1. Norton Bay, Nulato, Ruby, Ophir.
2. Marshall, Baird Inlet, Kuskokwim Bay, Hagemeister Is., Nushagak Bay, Naknek (Bethel Region).
3. Anchorage, Tyonek, Kenai (Cook Inlet area).

Figure 3-4, a contour map of UET values, shows regional lows in the more promising uranium areas and is almost identical to AThU (Figure 3-3) in its indications of uraniferous and barren provinces.

c. Gradient Distributions

A gradient distribution (GD) sort involves ordering the quadrangles by decreasing values of a given variable such as ATh (Table 3-2), and the values may be plotted in a gradient distribution curve as shown in Figure 3-5. U, Th, and K columns in Table 3-2 present the quadrangle average concentrations in ppm for uranium and thorium and percent for potassium. Figures 3-6 through 3-11 present gradient distribution curves for quadrangle mean AU, AThU, AK, AKU, UET, and UEK for comparison of individual quadrangle rankings according to each of these variables. It is seen that for AU, AThU, AK, and AKU the most promising quadrangles (high UIN) are grouped near the high end of the gradient distribution, and for UET and UEK they are at the low end. All of the variables produce a relatively effective separation of the more promising quadrangles from the relatively barren ones.

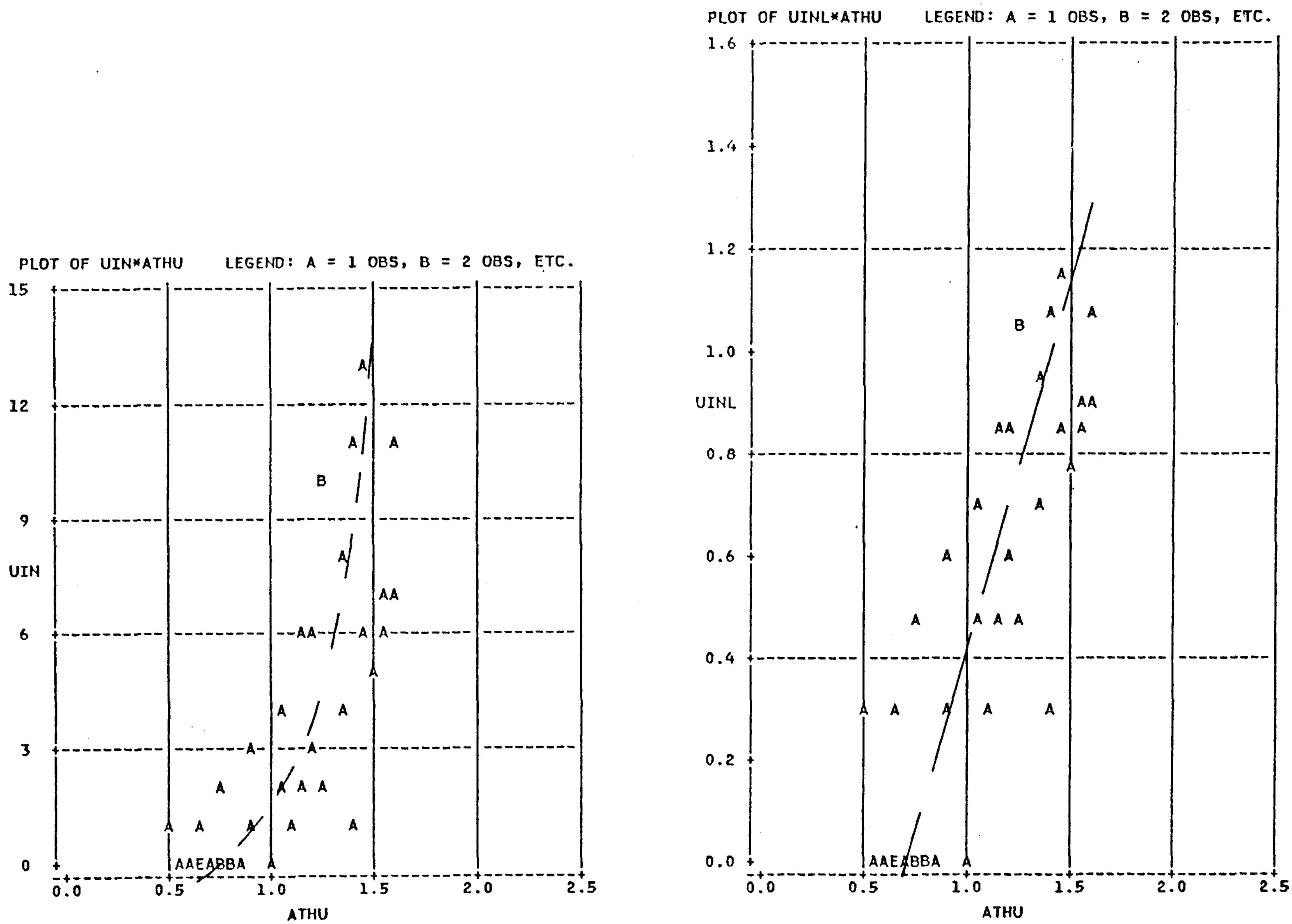


Figure 3-1. Plots of UIN and UINL versus AThU

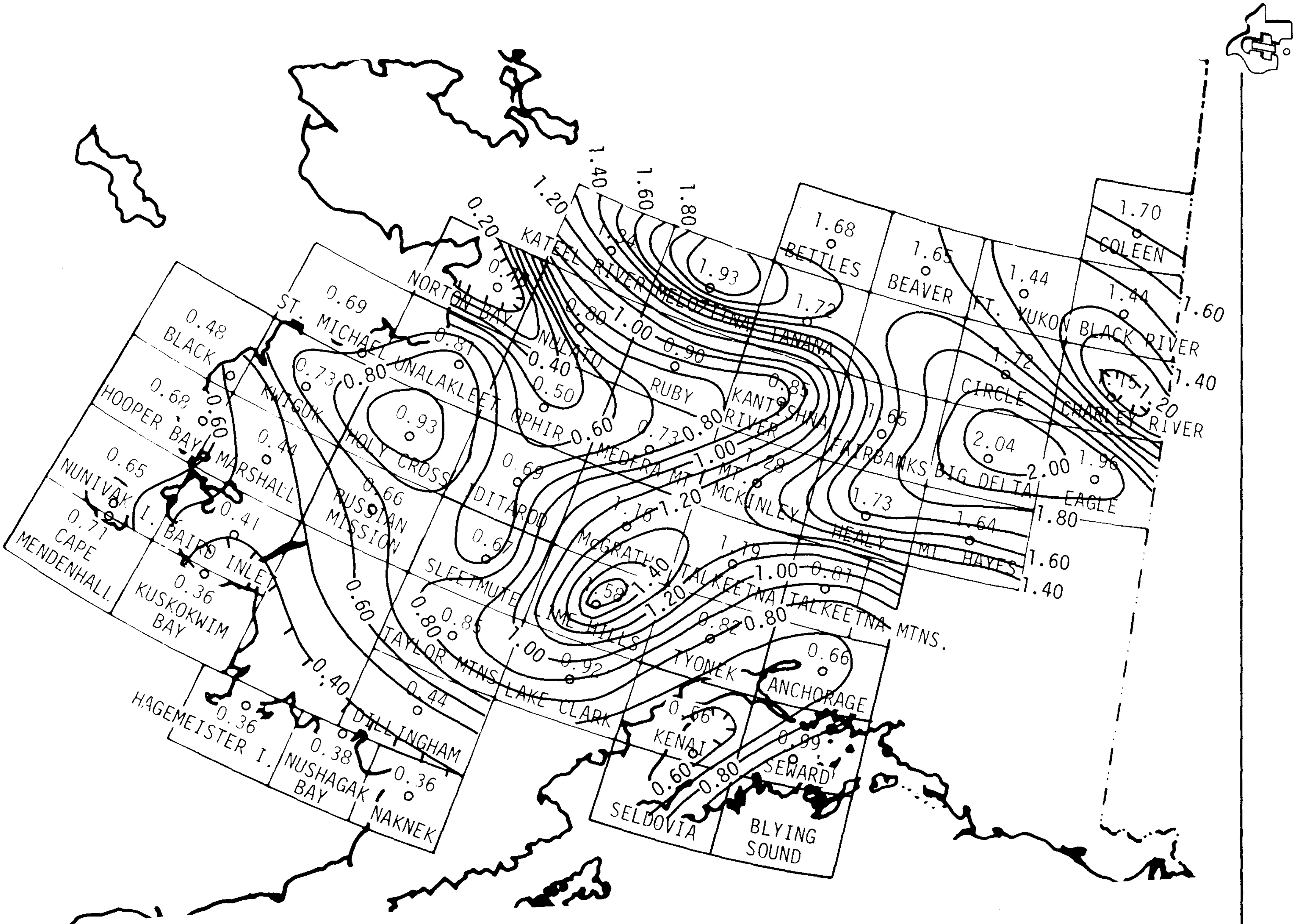


Figure 3-2. Contour Map of ATh

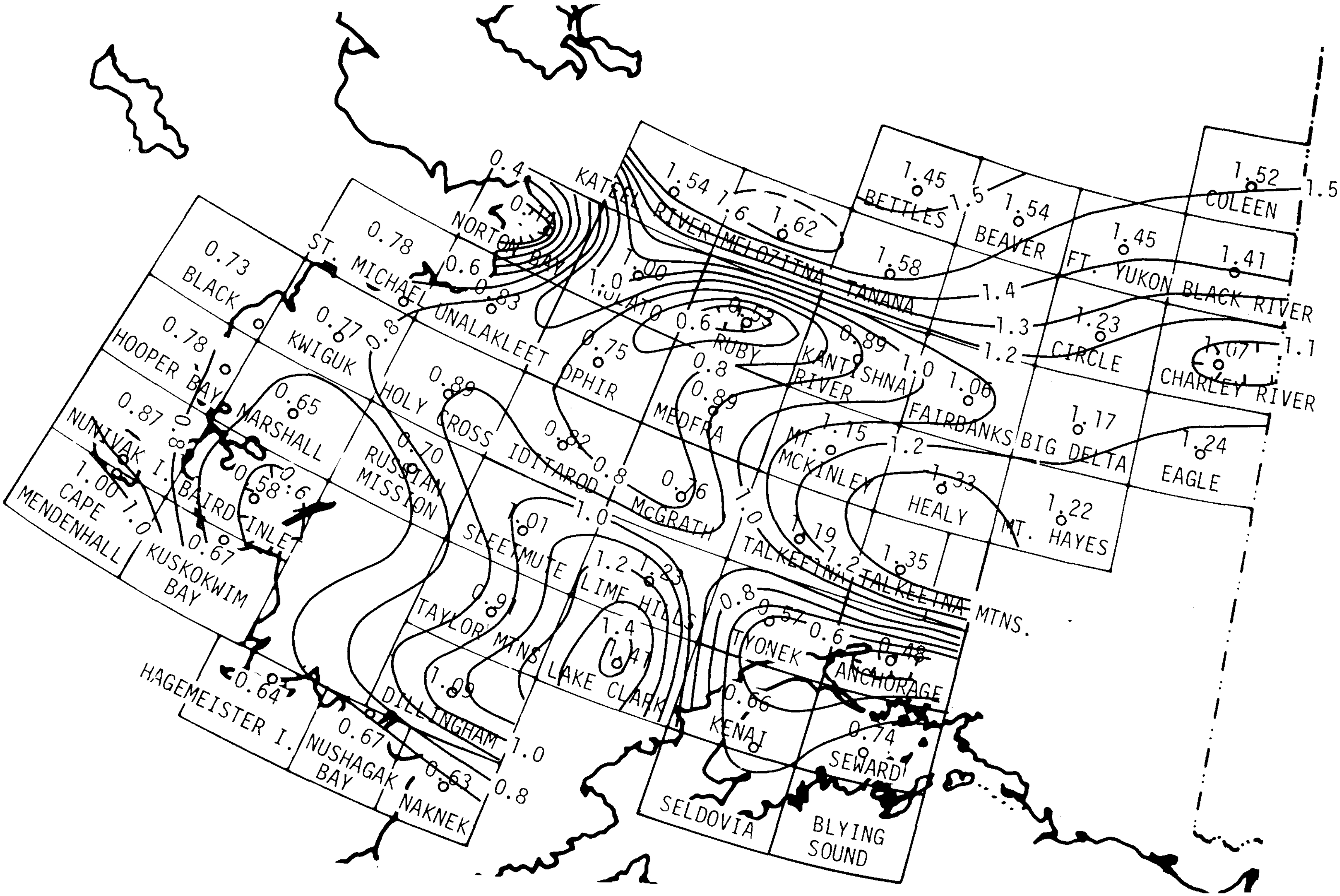


Figure 3-3. Contour Map of AThU

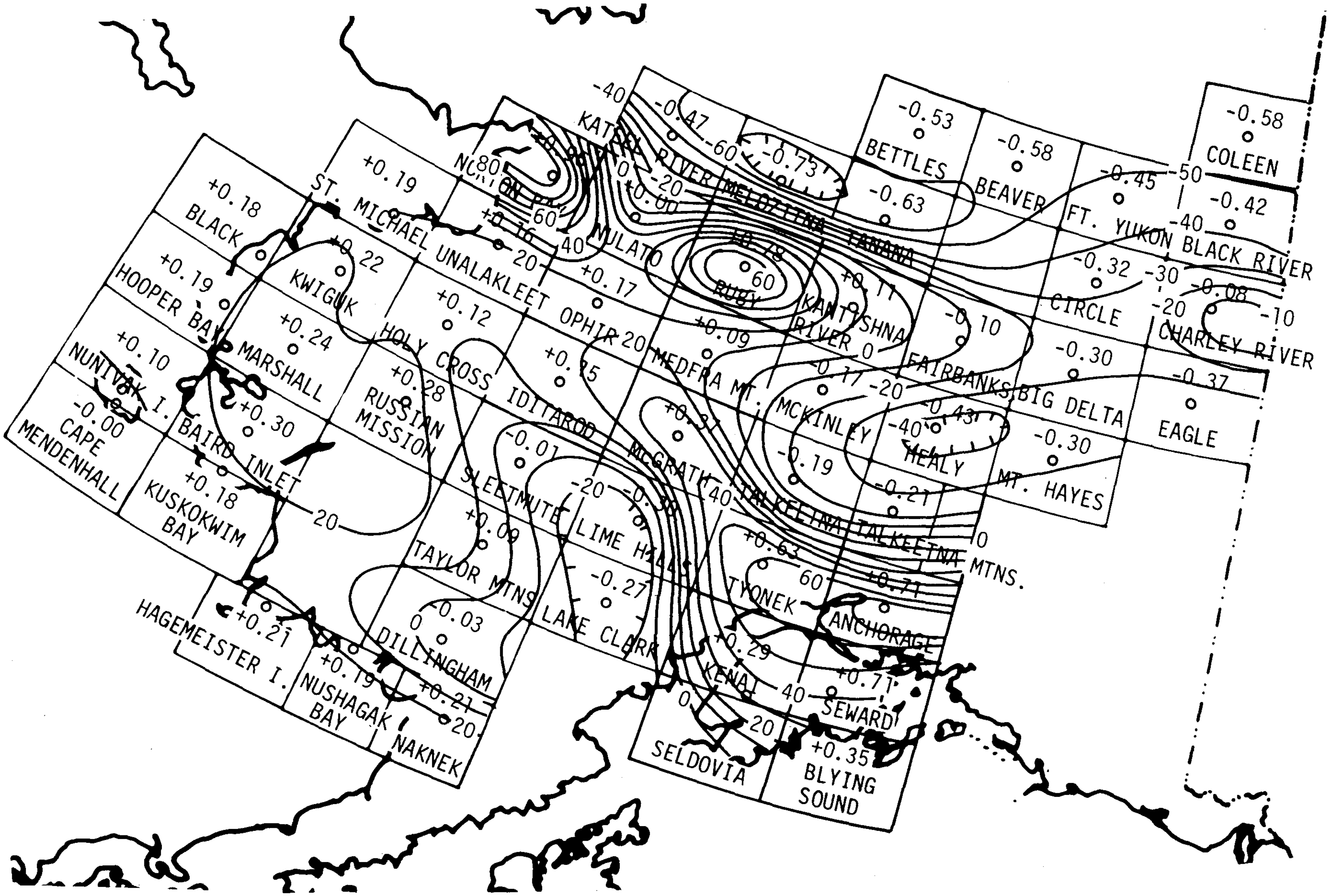


Figure 3-4. Contour Map of Uranium Excess Relative to Thorium (UET = AU-ATh)

Table 3-2. List of Alaska Quadrangles Sorted by Decreasing ATh

RANK	QUAD	UIN	UINL	U	TH	K	AU	ATH	AK	ATHU	UET	AKU	UEK	UI
1	BIG DELTA	2	0.477	2.3	6.9	1.11	1.74	2.04	1.76	1.17	-0.30	1.01	-0.02	3.42
2	EAGLE	10	1.041	2.0	6.7	1.28	1.59	1.96	2.03	1.24	-0.37	1.28	-0.44	4.17
3	MELOZITNA	7	0.903	1.5	6.6	0.85	1.19	1.93	1.35	1.62	-0.73	1.13	-0.15	3.62
4	HEALY	8	0.954	1.7	5.9	1.34	1.30	1.73	2.12	1.33	-0.43	1.63	-0.82	4.71
5	CIRCLE	2	0.477	1.8	5.9	0.85	1.40	1.72	1.35	1.23	-0.32	0.96	0.05	2.76
6	TANANA	11	1.079	1.4	5.9	0.86	1.09	1.72	1.36	1.58	-0.63	1.25	-0.27	3.57
7	COLEEN	5	0.778	1.4	5.6	0.85	1.12	1.70	1.35	1.52	-0.58	1.20	-0.22	3.40
8	BETTLES	13	1.146	1.5	5.7	0.79	1.15	1.68	1.25	1.45	-0.52	1.09	-0.10	3.03
9	BEAVER	7	0.903	1.4	5.6	0.84	1.07	1.65	1.33	1.54	-0.58	1.25	-0.26	3.41
10	FAIRBANKS	2	0.477	2.0	5.6	0.92	1.55	1.65	1.46	1.06	-0.10	0.94	0.09	2.58
11	MT. HAYES	3	0.602	1.7	5.6	1.00	1.34	1.64	1.58	1.22	-0.30	1.18	-0.25	3.23
12	LIME HILLS	10	1.041	1.7	5.4	1.31	1.28	1.58	2.08	1.23	-0.30	1.62	-0.79	4.25
13	FT. YUKON	6	0.845	1.3	4.9	0.80	0.99	1.44	1.27	1.45	-0.45	1.28	-0.28	3.07
14	BLACK R.	11	1.079	1.3	4.9	0.74	1.02	1.44	1.17	1.41	-0.42	1.15	-0.15	2.75
15	KATEEL R.	6	0.845	1.1	4.6	0.65	0.87	1.34	1.03	1.54	-0.47	1.18	-0.16	2.63
16	MT. MCKINLEY	6	0.845	1.4	4.3	0.85	1.11	1.28	1.35	1.15	-0.17	1.22	-0.24	2.59
17	TALKEETNA	6	0.845	1.3	4.0	0.98	1.00	1.19	1.55	1.19	-0.19	1.56	-0.55	3.07
18	MCGRATH	.	.	2.0	3.9	0.80	1.53	1.16	1.27	0.76	0.37	0.83	0.26	1.60
19	CHARLEY R.	4	0.699	1.4	3.9	0.64	1.08	1.15	1.01	1.07	-0.08	0.94	0.06	1.81
20	SEWARD/BLYING SOUND	2	0.477	1.7	3.4	0.75	1.34	0.99	1.19	0.74	0.35	0.89	0.15	1.47
21	HOLY CROSS	1	0.301	1.3	3.2	0.48	1.04	0.93	0.76	0.89	0.12	0.73	0.28	1.12
22	LAKE CLARK	1	0.301	0.8	3.1	1.01	0.66	0.92	1.60	1.41	-0.27	2.43	-0.94	3.74
23	RUBY	.	.	2.2	3.1	0.56	1.68	0.90	0.89	0.53	0.78	0.53	0.79	0.79
24	KANTISHNA RIVER	.	.	1.2	2.9	0.45	0.96	0.85	0.71	0.89	0.11	0.74	0.25	1.06
25	TAYLOR MTS.	3	0.602	1.2	2.9	0.66	0.94	0.85	1.05	0.91	0.09	1.12	-0.11	1.58
26	TYONEK	0	0.000	1.9	2.8	0.66	1.45	0.82	1.05	0.57	0.63	0.72	0.40	0.98
27	TALKEETNA MTS.	4	0.699	0.8	2.8	0.93	0.60	0.81	1.47	1.35	-0.21	2.44	-0.87	3.30
28	UNALAKLEET	.	.	1.3	2.8	0.45	0.98	0.81	0.71	0.83	0.17	0.73	0.26	0.99
29	NULATO	.	.	1.0	2.7	0.45	0.80	0.80	0.71	1.00	0.00	0.89	0.09	1.19
30	MEDFRA	.	.	1.1	2.5	0.64	0.83	0.73	1.01	0.89	0.09	1.22	-0.19	1.50
31	KWIGUK	0	0.000	1.2	2.5	0.35	0.94	0.73	0.55	0.77	0.22	0.59	0.39	0.71
32	CAPE MENDENHALL	0	0.000	0.9	2.4	0.40	0.70	0.71	0.63	1.00	-0.00	0.90	0.07	1.06
33	IDITAROD	.	.	1.1	2.3	0.44	0.84	0.69	0.70	0.82	0.15	0.83	0.15	0.95
34	ST. MICHAEL	0	0.000	1.1	2.3	0.37	0.88	0.69	0.59	0.78	0.19	0.66	0.30	0.76
35	HOOPER BAY	0	0.000	1.1	2.3	0.35	0.87	0.68	0.55	0.78	0.19	0.64	0.31	0.72
36	SLEETMUTE	.	.	0.8	2.3	0.46	0.66	0.67	0.73	1.01	-0.01	1.11	-0.07	1.23
37	ANCHORAGE	1	0.301	1.8	2.3	0.72	1.37	0.66	1.14	0.48	0.71	0.83	0.23	0.92
38	RUSSIAN MISSION	0	0.000	1.2	2.2	0.32	0.94	0.66	0.51	0.70	0.28	0.54	0.43	0.59
39	NUNIVAK IS.	0	0.000	1.0	2.2	0.35	0.75	0.65	0.55	0.87	0.10	0.74	0.20	0.80
40	KENAI/SELDOVIA	0	0.000	1.1	1.9	0.47	0.84	0.56	0.74	0.66	0.29	0.88	0.10	0.82
41	OPHIR	.	.	0.9	1.7	0.31	0.67	0.50	0.49	0.75	0.17	0.73	0.18	0.61
42	BLACK	0	0.000	0.9	1.6	0.19	0.67	0.48	0.30	0.73	0.18	0.45	0.36	0.36
43	MARSHALL	0	0.000	0.9	1.5	0.21	0.68	0.44	0.33	0.65	0.24	0.49	0.35	0.36
44	DILLINGHAM	1	0.301	0.5	1.5	0.40	0.40	0.44	0.63	1.09	-0.03	1.57	-0.23	1.15
45	BAIRD INLET	0	0.000	0.9	1.4	0.17	0.71	0.41	0.27	0.58	0.30	0.38	0.44	0.26
46	NUSHAGAK BAY	0	0.000	0.7	1.3	0.22	0.56	0.38	0.35	0.67	0.19	0.62	0.22	0.39
47	HAGEMEISTER IS.	0	0.000	0.7	1.2	0.26	0.57	0.36	0.41	0.64	0.21	0.72	0.16	0.44
48	KUSKOKWIM BAY	0	0.000	0.7	1.2	0.14	0.54	0.36	0.22	0.67	0.18	0.41	0.32	0.25
49	NAKNEK	1	0.301	0.7	1.2	0.28	0.56	0.36	0.44	0.63	0.21	0.79	0.12	0.47
50	NORTON BAY	.	.	1.4	0.5	0.65	1.12	0.16	1.03	0.14	0.96	0.92	0.09	0.25

N=50

RANK	QUAD	UIN
1	BIG DELTA	2
2	EAGLE	10
3	MELOZITNA	7
4	HEALY	8
5	CIRCLE	2
6	TANANA	11
7	COLEEN	5
8	BETTLES	13
9	BEAVER	7
10	FAIRBANKS	2
11	MT. HAYES	3
12	LIME HILLS	10
13	FT. YUKON	6
14	BLACK R.	11
15	KATEEL R.	6
16	MT. MCKINLEY	6
17	TALKEETNA	6
18	MCGRATH	.
19	CHARLEY R.	4
20	SEWARD/BLYING SO	2
21	HOLY CROSS	1
22	LAKE CLARK	1
23	RUBY	.
24	KANTISHNA RIVER	.
25	TAYLOR MTS.	3
26	TYONEK	0
27	TALKEETNA MTS.	4
28	UNALAKLEET	.
29	NULATO	.
30	MEDFRA	.
31	KWIGUK	0
32	CAPE MENDENHALL	0
33	IDITAROD	.
34	ST. MICHAEL	0
35	HOOPER BAY	0
36	SLEETMUTE	.
37	ANCHORAGE	1
38	RUSSIAN MISSION	0
39	NUNIVAK IS.	0
40	KENAI/SELDOVIA	0
41	OPHIR	.
42	BLACK	0
43	MARSHALL	0
44	DILLINGHAM	1
45	BAIRD INLET	0
46	NUSHAGAK BAY	0
47	HAGEMEISTER IS.	0
48	KUSKOKWIM BAY	0
49	NAKNEK	1
50	NORTON BAY	.

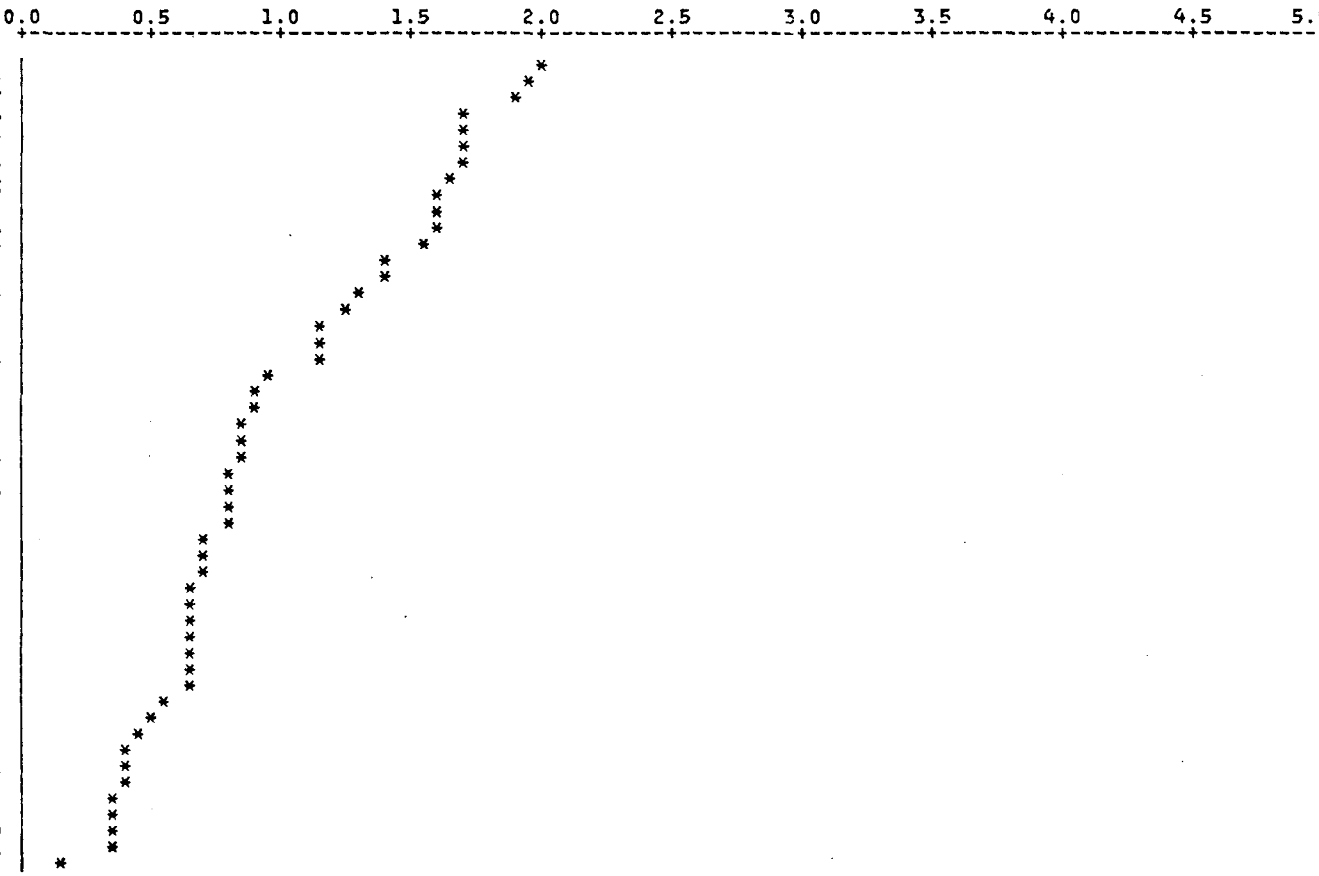


Figure 3-5. Gradient Distribution by Decreasing Values of ATh

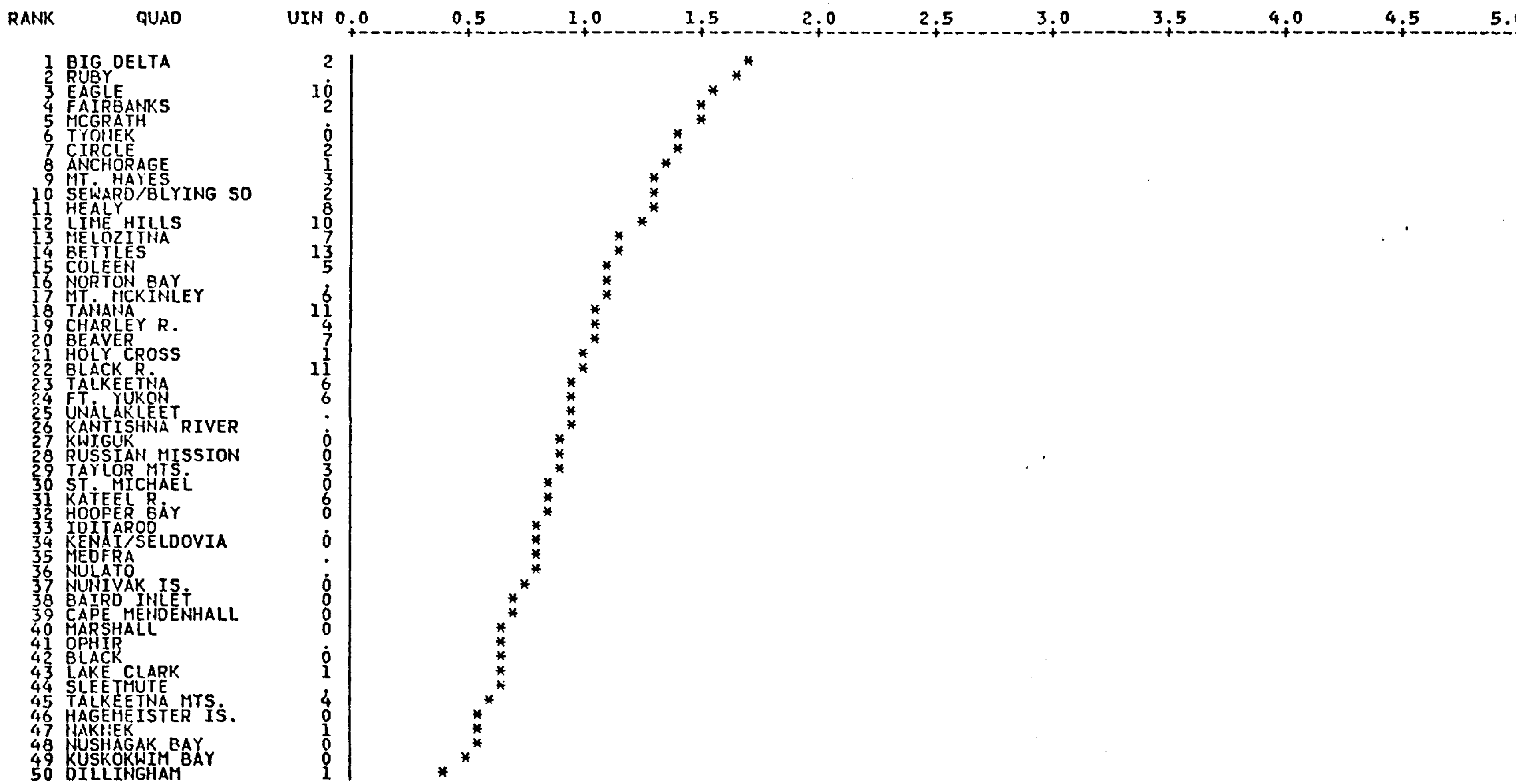
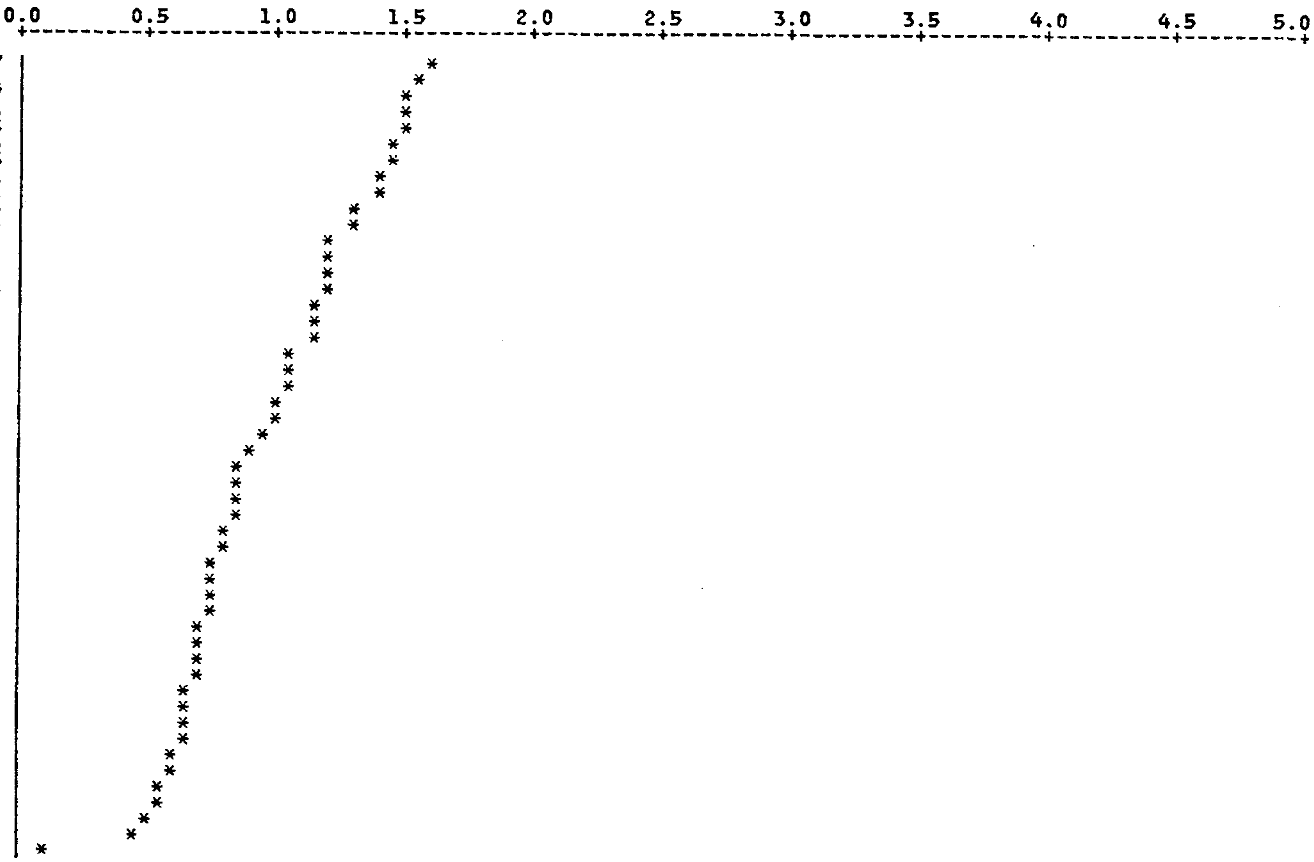


Figure 3-6. Gradient Distribution by Decreasing Values of AU



RANK	QUAD	UIN
1	MELOZITNA	7
2	TANANA	11
3	BEAVER	7
4	KATEEL R.	6
5	COLEEN	5
6	FT. YUKON	6
7	BETTLES	13
8	BLACK R.	11
9	LAKE CLARK	1
10	TALKEETNA MTS.	4
11	HEALY	8
12	EAGLE	10
13	LIME HILLS	10
14	CIRCLE	2
15	MT. HAYES	3
16	TALKEETNA	6
17	BIG DELTA	2
18	MT. MCKINLEY	6
19	DILLINGHAM	1
20	CHARLEY R.	4
21	FAIRBANKS	2
22	SLEETMUTE	.
23	CAPE MENDENHALL	0
24	NULATO	.
25	TAYLOR MTS.	3
26	KANTISHNA RIVER	.
27	HOLY CROSS	1
28	MEDFRA	.
29	NUNIVAK IS.	0
30	UNALAKLEET	.
31	IDITAROD	.
32	ST. MICHAEL	0
33	HOOPER BAY	0
34	KWIGUK	0
35	MCGRATH	.
36	OPHIR	.
37	SEWARD/BLYING SO	2
38	BLACK	0
39	RUSSIAN MISSION	0
40	NUSHAGAK BAY	0
41	KUSKOKWIM BAY	0
42	KENAI/SELDOVIA	0
43	MARSHALL	0
44	HAGEMEISTER IS.	0
45	NAKNEK	1
46	BAIRD INLET	0
47	TYONEK	0
48	RUBY	.
49	ANCHORAGE	1
50	NORTON BAY	.

Figure 3-7. Gradient Distribution by Decreasing Values of AThU

RANK	QUAD	UIN
1	HEALY	8
2	LIME HILLS	10
3	EAGLE	10
4	BIG DELTA	2
5	LAKE CLARK	1
6	MT. HAYES	3
7	TALKEETNA	6
8	TALKEETNA MTS.	4
9	FAIRBANKS	2
10	TANANA	11
11	CIRCLE	2
12	COLEEN	5
13	MELOZITNA	7
14	MT. MCKINLEY	6
15	BEAVER	7
16	FT. YUKON	6
17	MCGRATH	.
18	BETTLES	13
19	SEWARD/BLYING SO	2
20	BLACK R.	11
21	ANCHORAGE	1
22	TAYLOR MTS.	3
23	TYONEK	0
24	KATEEL R.	6
25	NORTON BAY	.
26	CHARLEY R.	4
27	MEDFRA	.
28	RUBY	.
29	HOLY CROSS	1
30	KENAI/SELDOVIA	0
31	SLEETMUTE	.
32	KANTISHNA RIVER	.
33	NULATO	.
34	UNALAKLEET	.
35	IDITAROD	.
36	CAPE MENDENHALL	0
37	DILLINGHAM	1
38	ST. MICHAEL	0
39	HOOPER BAY	0
40	KWIGUK	0
41	NUNIVAK IS.	0
42	RUSSIAN MISSION	0
43	OPHIR	.
44	NAKNEK	1
45	HAGEMEISTER IS.	0
46	NUSHAGAK BAY	0
47	MARSHALL	0
48	BLACK	0
49	BAIRD INLET	0
50	KUSKOKWIM BAY	0

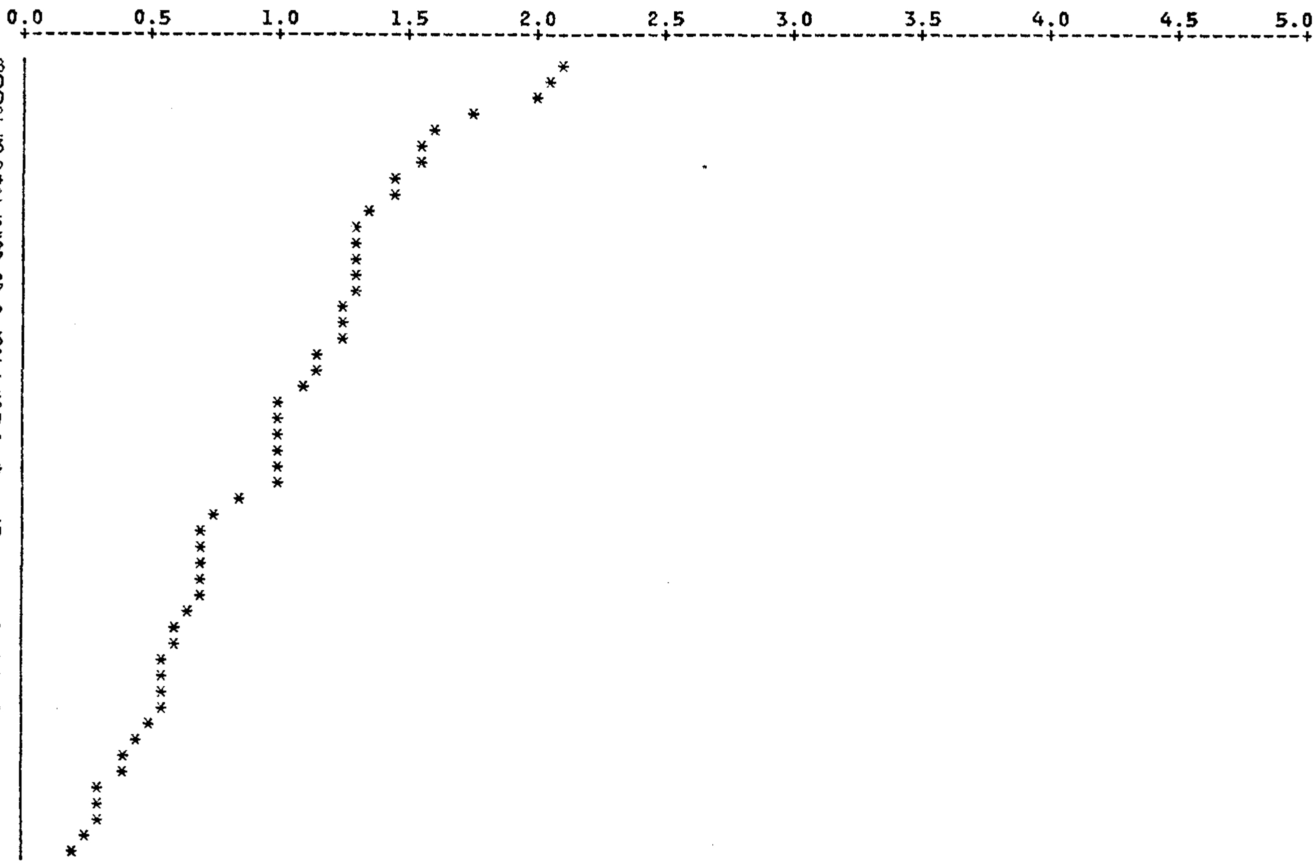


Figure 3-8. Gradient Distribution by Decreasing Values of AK

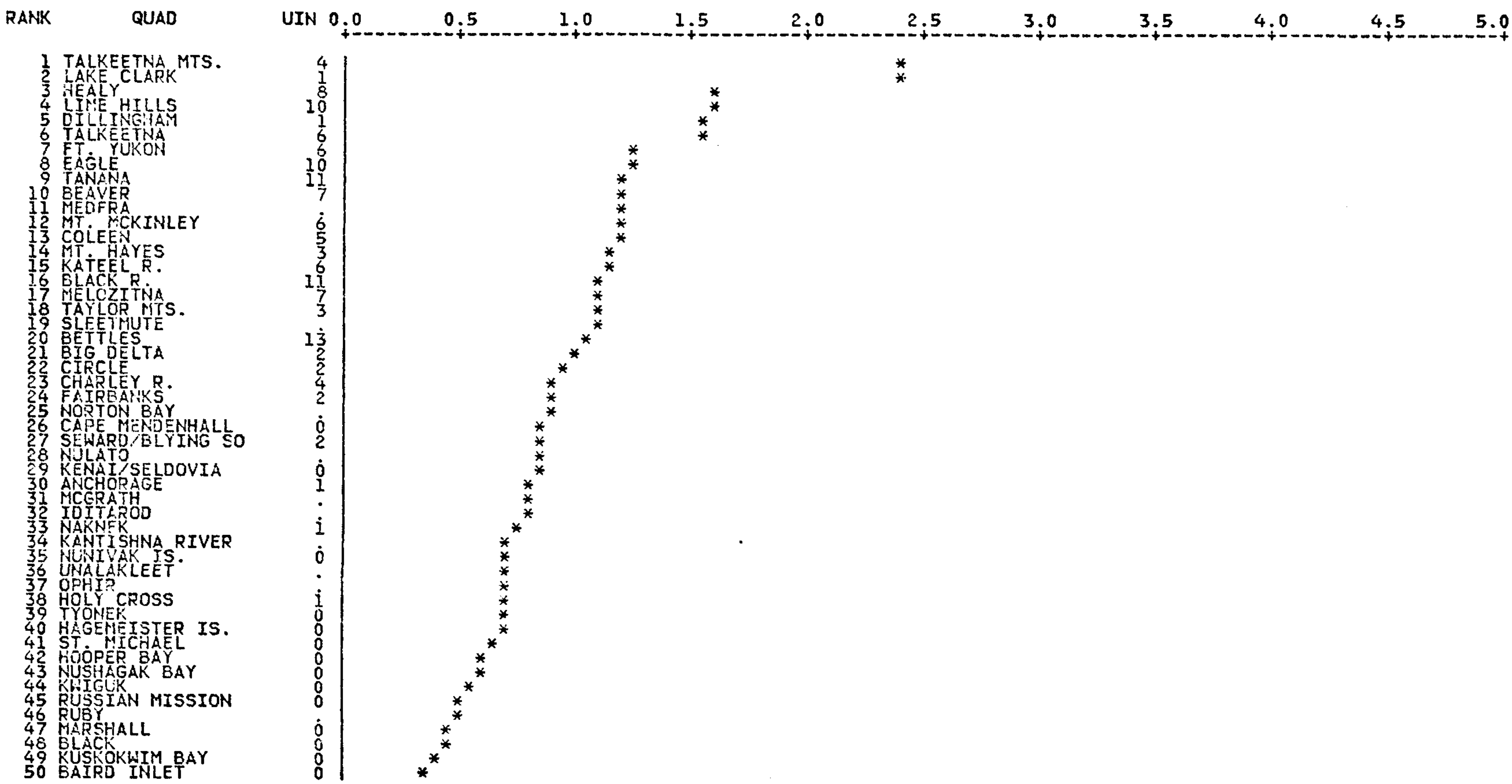


Figure 3-9. Gradient Distribution by Decreasing Values of AKU

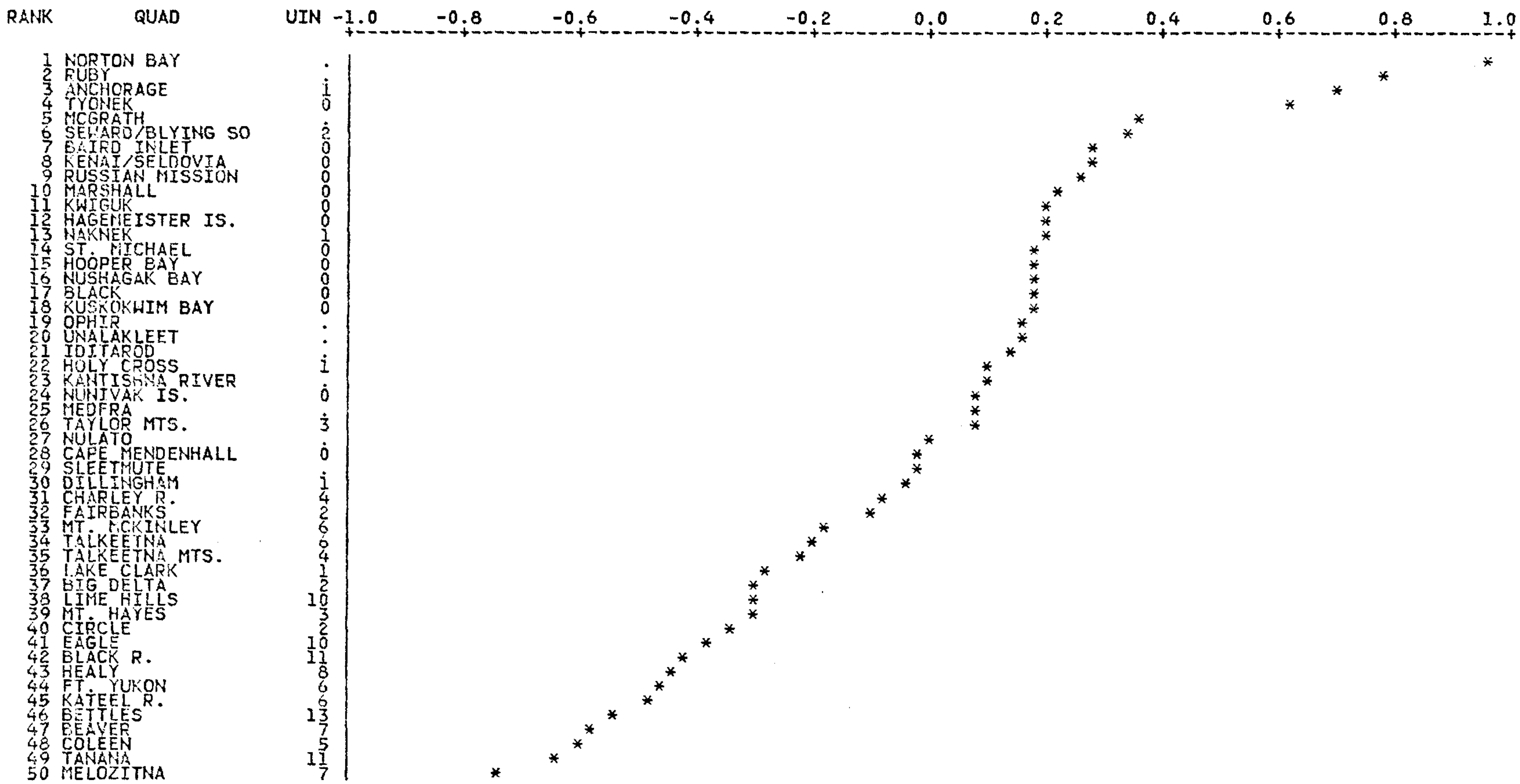


Figure 3-10. Gradient Distribution by Decreasing Values of UET

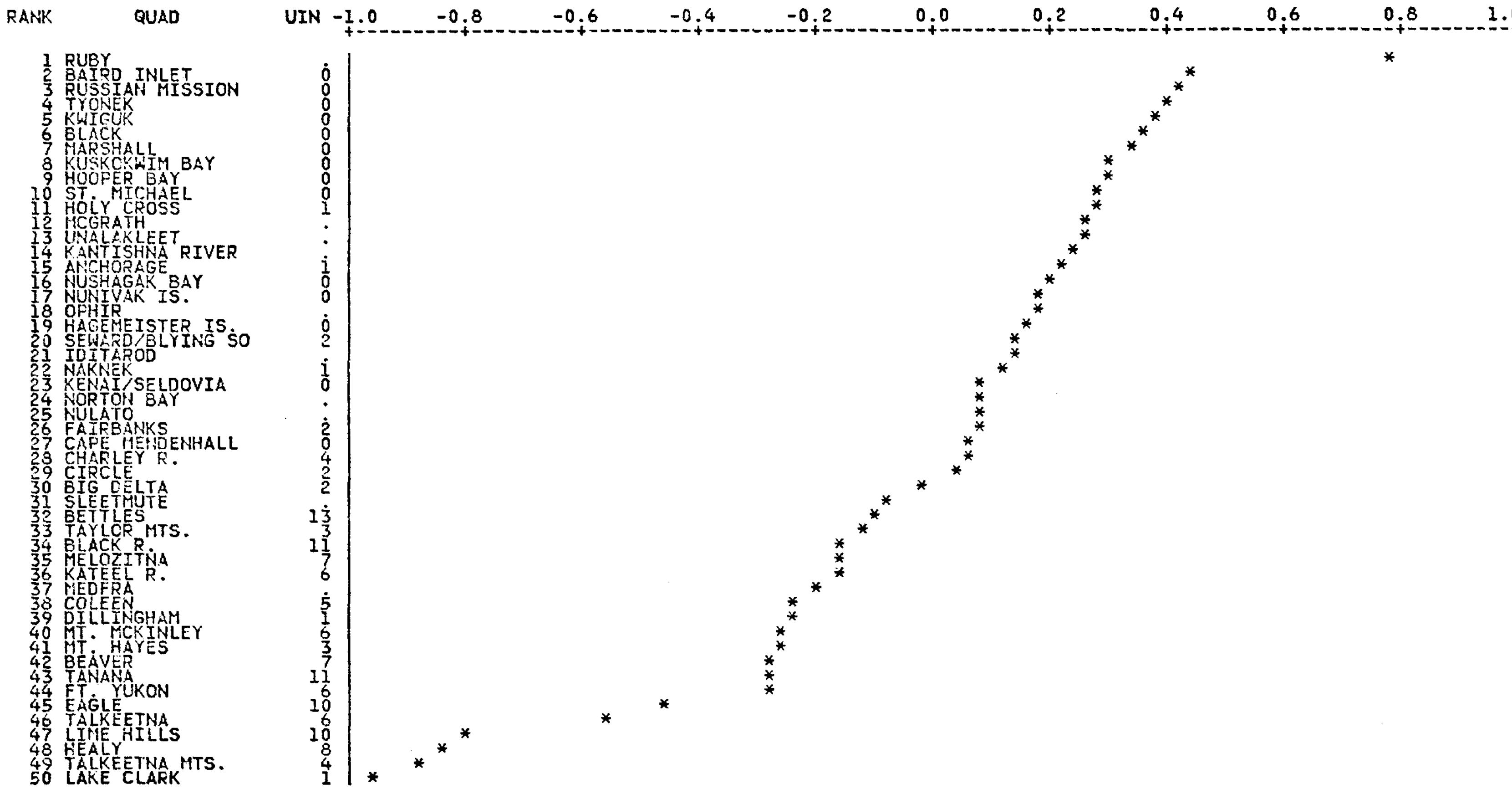


Figure 3-11. Gradient Distribution by Decreasing Values of UEK

d. Prediction of UIN

Choosing Log_{10} UIN (UINL) as the dependent variable, stepwise multiple linear regression resulted in the best four-variable model, represented by the following equation:

$$UINL = -0.668 - 0.262\ Th + 1.82\ K + 1.66\ AThU - 0.816\ AKU.$$

For this relationship, $R^2 = 0.824$, showing that 82.4 percent of the variance in UINL is accounted for, and no further significant improvement was found by adding the other variables. This equation was used to predict values of UIN for each quadrangle, as shown under the UINP column in Table 3-3. This table and the gradient distribution curve, Figure 3-12, exhibit the best overall ranking of the quadrangles.

The gradient distribution of UINP values (Figure 3-12) registers five distinct clusters of quadrangles separated by breaks in the slope of the curve. These may be classed as 1) highest, 2) high, 3) medium, 4) minor, and 5) minimum uranium potential.

e. Favorability Index

Saunders (1979) concluded that a favorability index, UI = Th·K/U, appeared to be a workable measure of quadrangle favorability. Values of UI computed for each quadrangle are included in Table 3-3 for comparison with the UINP ranking. The agreement in relative favorability is quite good, but the gradient distribution of the UI values (Figure 3-13) does not agree with that for UIN as well as does Figure 3-12, where UINP was predicted from the variables Th, K, Th/U, and K/U. It is concluded that the four-parameter equation based on the regional mean radiometric measurements provides the best prediction of the number of significant local high radiometric uranium anomalies.

Table 3-3. List of Alaska Quadrangles Sorted by Decreasing Values of Predicted UIN (UINP)

RANK	QUAD	UIN	UINP	UINL	UINLP	U	TH	K	AU	ATH	AK	ATHU	UET	AKU	UEK	UI
1	HEALY	8	12	0.954	1.103	1.7	5.9	1.34	1.30	1.73	2.12	1.33	-0.43	1.63	-0.82	4.71
2	LIME HILLS	10	10	1.041	1.030	1.7	5.4	1.31	1.28	1.58	2.08	1.23	-0.30	1.62	-0.79	4.25
3	TANANA	11	8	1.079	0.959	1.4	5.9	0.86	1.09	1.72	1.36	1.58	-0.63	1.25	-0.27	3.57
4	BEAVER	7	8	0.903	0.933	1.4	5.6	0.84	1.07	1.65	1.33	1.54	-0.58	1.25	-0.26	3.41
5	MELOZITNA	7	7	0.903	0.920	1.5	6.6	0.85	1.19	1.93	1.35	1.62	-0.73	1.13	-0.15	3.62
6	EAGLE	10	7	1.041	0.920	2.0	6.7	1.28	1.59	1.96	2.03	1.24	-0.37	1.28	-0.44	4.17
7	KATEEL R.	6	7	0.845	0.906	1.1	4.6	0.65	0.87	1.34	1.03	1.54	-0.47	1.18	-0.16	2.63
8	COLEEN	5	7	0.778	0.898	1.4	5.8	0.85	1.12	1.70	1.35	1.52	-0.58	1.20	-0.22	3.40
9	FT. YUKON	6	6	0.845	0.873	1.3	4.9	0.80	0.99	1.44	1.27	1.45	-0.45	1.28	-0.28	3.07
10	BETTLES	13	5	1.146	0.801	1.5	5.7	0.79	1.15	1.68	1.25	1.45	-0.52	1.09	-0.10	3.03
11	BLACK R.	11	5	1.079	0.796	1.3	4.9	0.74	1.02	1.44	1.17	1.41	-0.42	1.15	-0.15	2.75
12	TALKEETNA	6	5	0.845	0.760	1.3	4.0	0.98	1.00	1.19	1.55	1.19	-0.19	1.56	-0.55	3.07
13	MT. HAYES	3	5	0.602	0.755	1.7	5.6	1.00	1.34	1.64	1.58	1.22	-0.30	1.18	-0.25	3.23
14	LAKE CLARK	1	4	0.301	0.693	0.8	3.1	1.01	0.66	0.92	1.60	1.41	-0.27	2.43	-0.94	3.74
15	MT. MCKINLEY	6	4	0.845	0.661	1.4	4.3	0.85	1.11	1.28	1.35	1.15	-0.17	1.22	-0.24	2.59
16	BIG DELTA	2	3	0.477	0.652	2.3	6.9	1.11	1.74	2.04	1.76	1.17	-0.30	1.01	-0.02	3.42
17	CIRCLE	2	3	0.477	0.598	1.8	5.9	0.85	1.40	1.72	1.35	1.23	-0.32	0.96	0.05	2.76
18	TALKEETNA MTS.	4	2	0.699	0.543	0.8	2.8	0.93	0.60	0.81	1.47	1.35	-0.21	2.44	-0.87	3.30
19	FAIRBANKS	2	2	0.477	0.534	2.0	5.6	0.92	1.55	1.65	1.46	1.06	-0.10	0.94	0.09	2.58
20	CHARLEY R.	4	2	0.699	0.478	1.4	3.9	0.64	1.08	1.15	1.01	1.07	-0.08	0.94	0.06	1.81
21	TAYLOR MTS.	3	1	0.602	0.371	1.2	2.9	0.66	0.94	0.85	1.05	0.91	0.09	1.12	-0.11	1.58
22	NULATO	.	1	.	0.369	1.0	2.7	0.45	0.80	0.80	0.71	1.00	0.00	0.89	0.09	1.19
23	CAPE MENDENHALL	0	1	0.000	0.362	0.9	2.4	0.40	0.70	0.71	0.63	1.00	-0.00	0.90	0.07	1.06
24	SLEETMUTE	.	1	.	0.352	0.8	2.3	0.46	0.66	0.67	0.73	1.01	-0.01	1.11	-0.07	1.23
25	MCGRATH	.	1	.	0.334	2.0	3.9	0.80	1.53	1.16	1.27	0.76	0.37	0.83	0.26	1.60
26	SEWARD/BLYING SOUND	2	1	0.477	0.317	1.7	3.4	0.75	1.34	0.99	1.19	0.74	0.35	0.89	0.15	1.47
27	MEDFRA	.	1	.	0.314	1.1	2.5	0.64	0.83	0.73	1.01	0.89	0.09	1.22	-0.19	1.50
28	KANTISHNA RIVER	.	1	.	0.260	1.2	2.9	0.45	0.96	0.85	0.71	0.89	0.11	0.74	0.25	1.06
29	HOLY CROSS	1	1	0.301	0.257	1.3	3.2	0.48	1.04	0.93	0.76	0.89	0.12	0.73	0.28	1.12
30	NUNIVAK IS.	0	1	0.000	0.229	1.0	2.2	0.35	0.75	0.65	0.55	0.87	0.10	0.74	0.20	0.80
31	UNALAKLEET	.	1	.	0.210	1.3	2.8	0.45	0.98	0.81	0.71	0.83	0.17	0.73	0.26	0.99
32	IDITAROD	.	1	.	0.200	1.1	2.3	0.44	0.84	0.69	0.70	0.82	0.15	0.83	0.15	0.95
33	DILLINGHAM	1	1	0.301	0.189	0.5	1.5	0.40	0.40	0.44	0.63	1.09	-0.03	1.57	-0.23	1.15
34	ANCHORAGE	1	0	0.301	0.174	1.8	2.3	0.72	1.37	0.66	1.14	0.48	0.71	0.83	0.23	0.92
35	TYONEK	0	0	0.000	0.152	1.9	2.8	0.66	1.45	0.82	1.05	0.57	0.63	0.72	0.40	0.98
36	ST. MICHAEL	0	0	0.000	0.145	1.1	2.3	0.37	0.88	0.69	0.59	0.78	0.19	0.66	0.30	0.76
37	HOOPER BAY	0	0	0.000	0.137	1.1	2.3	0.35	0.87	0.68	0.55	0.78	0.19	0.64	0.31	0.72
38	KWIGUK	0	0	0.000	0.120	1.2	2.5	0.35	0.94	0.73	0.55	0.77	0.22	0.59	0.39	0.71
39	OPHIR	.	0	.	0.091	0.9	1.7	0.31	0.67	0.50	0.49	0.75	0.17	0.73	0.18	0.61
40	BLACK	0	0	0.000	0.064	0.9	1.6	0.19	0.67	0.48	0.30	0.73	0.18	0.45	0.36	0.36
41	KENAI/SELDOVIA	0	0	0.000	0.067	1.1	1.9	0.47	0.84	0.56	0.74	0.66	0.29	0.88	0.10	0.82
42	RUSSIAN MISSION	0	0	0.000	0.051	1.2	2.2	0.32	0.94	0.66	0.51	0.70	0.28	0.54	0.43	0.59
43	KUSKOKWIM BAY	0	0	0.000	0.037	0.7	1.2	0.14	0.54	0.36	0.22	0.67	0.18	0.41	0.32	0.25
44	RUBY	.	0	.	0.006	2.2	3.1	0.56	1.68	0.90	0.89	0.53	0.78	0.53	0.79	0.79
45	NUSHAGAK BAY	0	0	0.000	0.004	0.7	1.3	0.22	0.56	0.38	0.35	0.67	0.19	0.62	0.22	0.39
46	MARSHALL	0	0	0.000	0.000	0.9	1.5	0.21	0.68	0.44	0.33	0.65	0.24	0.49	0.35	0.36
47	HAGEMEISTER IS.	0	0	0.000	0.000	0.7	1.2	0.26	0.57	0.36	0.41	0.64	0.21	0.72	0.16	0.44
48	NAKNEK	1	0	0.301	0.000	0.7	1.2	0.28	0.56	0.36	0.44	0.63	0.21	0.79	0.12	0.47
49	BAIRD INLET	0	0	0.000	0.000	0.9	1.4	0.17	0.71	0.41	0.27	0.58	0.30	0.38	0.44	0.26
50	NORTON BAY	.	0	.	0.000	1.4	0.5	0.65	1.12	0.16	1.03	0.14	0.96	0.92	0.09	0.25

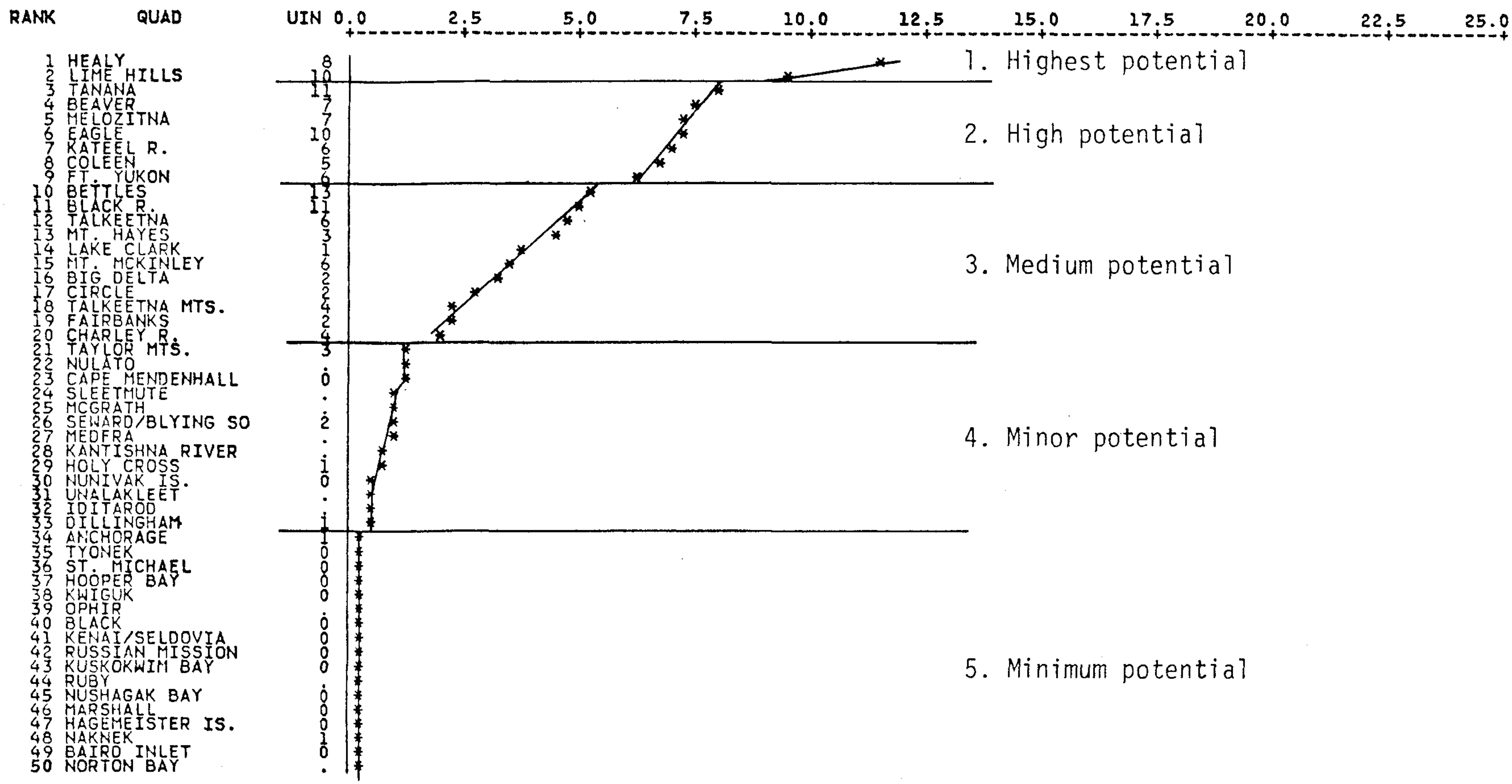


Figure 3-12. Gradient Distribution by Decreasing Values of UINP

RANK	QUAD	UIN
1	HEALY	8
2	LIME HILLS	10
3	EAGLE	10
4	LAKE CLARK	1
5	MELOZITNA	7
6	TANANA	11
7	BIG DELTA	2
8	BEAVER	7
9	COLEEN	5
10	TALKEETNA MTS.	4
11	MT. HAYES	3
12	TALKEETNA	6
13	FT. YUKON	6
14	BETTLES	13
15	CIRCLE	2
16	BLACK R.	11
17	KATEEL R.	6
18	MT. MCKINLEY	6
19	FAIRBANKS	2
20	CHARLEY R.	4
21	MCGRATH	
22	TAYLOR MTS.	3
23	MEDFRA	
24	SEWARD/BLYING SO	2
25	SLEETMUTE	.
26	NULATO	
27	DILLINGHAM	1
28	HOLY CROSS	1
29	CAPE MENDENHALL	0
30	KANTISHNA RIVER	.
31	UNALAKLEET	
32	TYONEK	0
33	IDITAROD	
34	ANCHORAGE	1
35	KENAI/SELDOVIA	0
36	NUNIVAK IS.	0
37	RUBY	
38	ST. MICHAEL	0
39	HOOPER BAY	0
40	KWIGUK	0
41	OPHIR	
42	RUSSIAN MISSION	0
43	NAKNEK	1
44	HAGEMEISTER IS.	0
45	NUSHAGAK BAY	0
46	BLACK	0
47	MARSHALL	0
48	BAIRD INLET	0
49	NORTON BAY	
50	KUSKOKWIM BAY	0

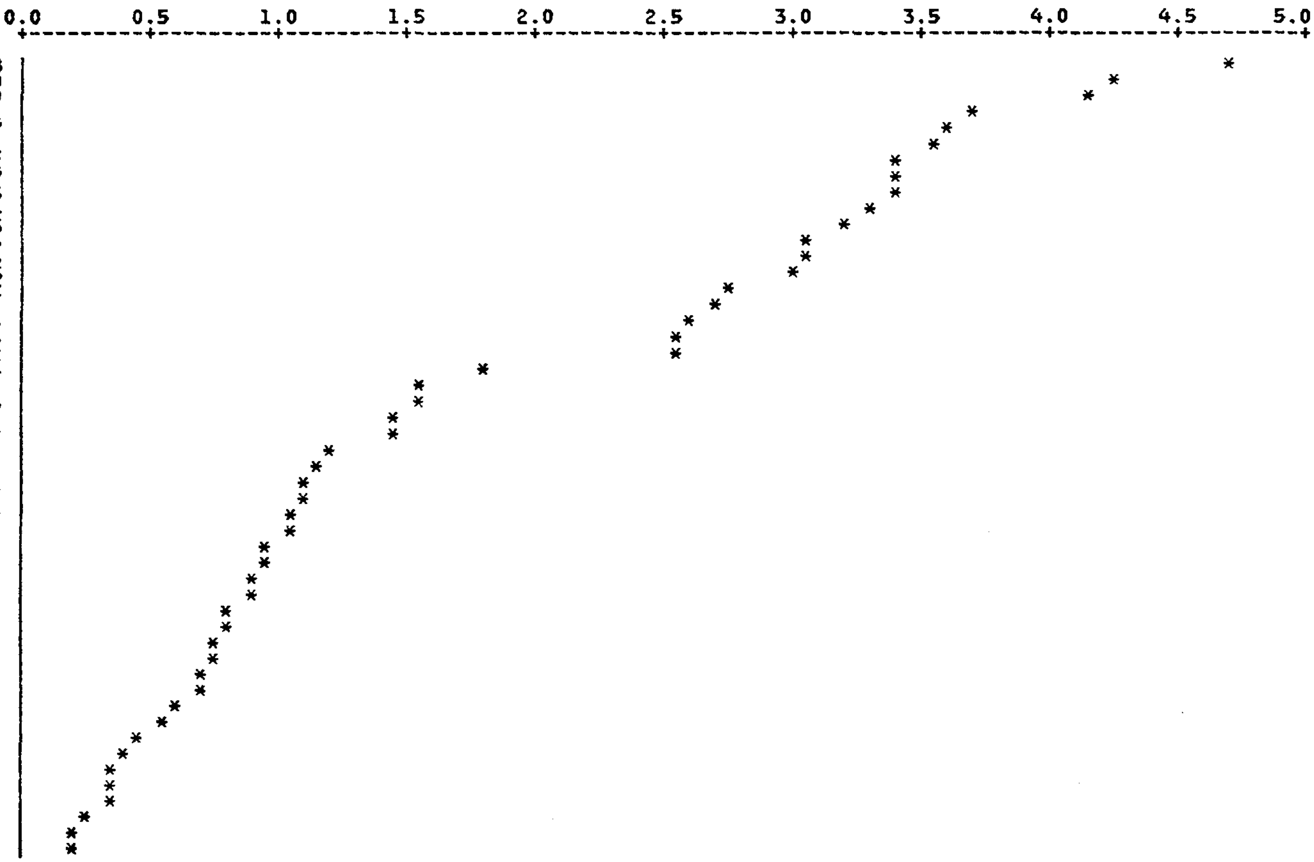


Figure 3-13. Gradient Distribution by Decreasing Values of UI

3. Conclusions

a. Validity of the Uraniferous Province Concept

The good relationships found between quadrangle mean radioelement parameters and the number of significant local high-uranium anomalies strongly support the uraniferous province concepts presented in the Introduction. It is concluded that in Alaska, aerial radiometric measurements of thorium (and to a lesser extent potassium) can be used effectively as a surrogate for uranium measurements to identify crustal regions that formed with abnormally high radioelement contents early in the earth's history. Thorium (and potassium) reflects the presence of these uraniferous provinces better than uranium itself under present oxidizing weathering conditions because thorium is relatively immobile chemically. Uranium may be leached from surface materials into ground waters, thus removing it from the view of the aerial gamma-ray spectrometers, whereas thorium remains in place, offering a clue as to the possible regional presence of downdip and otherwise concealed uranium accumulations.

b. Prediction of Uranium Potential by Aerial Radiometric Data

Additionally, the results show that regional radiometric data can be used to predict quantitatively the number of local significant high-uranium anomalies, and, in the future, it should be possible to equate, at least semi-quantitatively, the magnitudes of the regional Th, K Th/U, and K/U data to potential undiscovered uranium resources and thus refine their estimation. This extension of the present work will require sufficient future exploration to calibrate adequately the method in some representative Alaskan quadrangles.

The results also suggest that it is possible to define uraniferous provinces adequately using a first-stage reconnaissance gamma-ray spectrometer survey with a much wider flight-line spacing than has been used in the NURE program. A 15- to 20-mile grid coverage should be sufficient to delineate the most promising regions for detailed followup aerial coverage to define areas for surface studies. This type of two-stage aerial reconnaissance program should be more cost effective than a single-stage program.

C. URANIUM INVENTORY PREDICTION IN CONTERMINOUS UNITED STATES

1. Aerial Radiometric Data

a. Whole-Quadrangle Averages

1) Radiometric Parameters

The initial approach to relating uranium resources to aerial radiometric measurements was outlined by Texas Instruments (1980). It consisted of investigations of the relationships of several variables (all based on whole-quadrangle eU, eTh and K average values), including possible uranium favorability indexes, to semiquantitative measures of the amount of mineable uranium in each quadrangle. Recently, whole-quadrangle estimates of "uranium inventory" have been made available by the U.S. Department of Energy. These estimates are believed to be the most suitable measures against which radiometric variables may be compared. The uranium inventory for a quadrangle includes all uranium past production, reserves, and potential resources above 0.01 percent U_3O_8 measured in tons of contained U_3O_8. Table 3-4 lists whole-quadrangle mean aerial radiometric parameters and estimated uranium inventories for 193 quadrangles in the conterminous United States. The inventories (UINV) were computed from 1980, unpublished, preproduction inventories and estimated potential uranium resources (by formation) furnished by DOE.

The radiometric variables are as follows in Table 3-4:

U - mean eU in parts per million (ppm)
TH - mean eTh in parts per million (ppm)
K - mean K in percent
THU - mean eTh/eU
KU - mean K/eU
THK - mean eTh/K

These were computed from lists of geologic formation means obtained from the open-filed survey reports. Each formation value was weighted according to the number of included records.

Table 3-4. Radiometric Variables and Estimated Uranium Inventories for Selected 1-Degree-by-2-Degree NTMS Quadrangles in the Conterminous United States

QUAD	PROV	U	TH	K	THU	KU	THK	UINV
ABILENE	11	1.7	6.9	0.91	3.97	0.52	7.59	0
ADEL	4	2.3	10.7	1.90	4.55	0.81	5.63	13585
ALBUQUERQUE	6	2.5	9.0	1.74	3.62	0.70	5.20	1149127
ALLIANCE	9	1.8	7.6	1.72	4.11	0.93	4.40	1452
AMARILLO	9	1.7	7.0	1.81	4.22	1.09	3.87	34782
ARDMORE	11	2.3	6.8	0.90	3.02	0.40	7.56	0
ARMINTO	7	2.4	9.5	2.39	3.89	0.98	3.97	116398
ASHLAND	10	1.2	3.5	1.06	2.91	0.89	3.26	0
ASHTON	5	2.4	8.6	1.49	3.53	0.61	5.78	1013
ATHENS	15	2.0	8.8	0.74	4.33	0.36	11.95	1190
AUGUSTA	13	1.7	7.2	0.17	4.31	0.10	42.12	6915
AUSTIN	12	1.6	6.1	0.67	3.92	0.43	9.18	31964
AZTEC	6	2.3	12.2	1.71	5.31	0.75	7.11	136388
BAKER	3	1.4	5.5	1.29	3.93	0.91	4.29	0
BALTIMORE	15	2.0	7.3	1.35	3.68	0.69	5.37	1303
BEAUMONT	12	1.7	4.7	0.22	2.86	0.13	21.55	20696
BEEVILLE	12	1.2	3.8	0.43	3.17	0.36	8.84	139721
BELOIT	9	2.8	11.5	1.93	4.12	0.69	5.96	0
BILLINGS	7	2.2	7.5	1.55	3.44	0.71	4.86	1154
BOISE	3	2.5	7.6	1.77	3.01	0.70	4.28	19472
BOZEMAN	5	2.0	7.7	1.59	3.83	0.79	4.86	75985
BROKEN BOW	9	2.1	8.5	1.79	4.10	0.86	4.74	0
BROWNFIELD	9	1.2	4.9	1.07	4.10	0.90	4.56	5815
BROWNSVILLE	12	1.2	3.4	0.95	2.88	0.80	3.61	0
BROWNWOOD	11	0.7	0.5	0.31	0.70	0.44	1.58	0
BUTTE	5	2.3	7.4	1.77	3.26	0.78	4.20	180800
CALIENTE	4	3.1	14.1	2.31	4.50	0.74	6.10	592
CASPER	7	3.3	16.7	2.70	5.04	0.81	6.20	975107
CEDAR CITY	4	1.6	11.6	1.55	7.18	0.96	7.46	3820
CHALLIS	5	2.4	10.5	2.12	4.42	0.89	4.94	15836
CHARLESTON	15	1.9	6.5	0.86	3.50	0.46	7.60	0
CHARLOTTE	15	2.3	10.3	0.95	4.52	0.42	10.84	15048
CHARLOTTESVILLE	15	1.8	6.0	0.93	3.44	0.53	6.51	321
CHEYENNE	7	2.4	9.5	2.27	3.95	0.94	4.21	3201
CHOTEAU	5	1.8	5.8	1.44	3.18	0.78	4.06	0
CLIFTON	4	3.0	11.9	2.75	4.03	0.93	4.33	0
CLINTON	11	1.7	6.7	2.07	3.95	1.22	3.23	6782
CLOVIS	9	1.8	7.8	1.63	4.48	0.93	4.81	3984
CODY	7	2.2	6.6	1.34	2.98	0.60	4.96	4490
CORPUS CHRISTI	12	1.3	3.7	0.75	2.96	0.60	4.97	1202
CORTEZ	6	1.7	6.0	1.12	3.43	0.64	5.33	88494
CRAIG	7	2.7	8.5	1.73	3.15	0.64	4.91	42781
CRYSTAL CITY	12	1.6	4.6	0.67	2.84	0.41	6.87	102580
CUT BANK	5	2.8	8.5	1.20	3.06	0.43	7.08	0
DALHART	9	2.1	6.2	1.32	2.90	0.62	4.67	4538
DALLAS	11	1.9	6.8	0.63	3.47	0.32	10.75	0
DEATH VALLEY	4	2.6	11.4	2.47	4.36	0.95	4.61	41809
DEL RIO	9	1.1	4.6	0.43	4.28	0.40	10.65	0
DELTA	4	3.2	13.7	2.15	4.28	0.67	6.37	50054
DENVER	8	3.5	17.1	2.87	4.87	0.82	5.95	146303
DICKINSON	9	2.1	5.8	1.22	2.78	0.58	4.76	17160
DILLON	5	2.1	7.3	1.61	3.48	0.77	4.54	43232
DODGE CITY	9	2.4	10.1	2.28	4.12	0.93	4.43	0
DOUGLAS	4	4.4	17.0	3.42	3.88	0.78	4.98	0
DUBOIS	5	1.8	6.6	1.15	3.71	0.65	5.70	6383
DURANGO	8	2.1	8.5	1.41	4.13	0.68	6.03	29076
DYERSBURG	13	2.2	6.4	1.14	2.89	0.51	5.63	4275
EAGLE PASS	12	1.2	7.9	1.06	6.39	0.86	7.42	0
EAU CLAIRE	11	1.3	3.5	1.09	2.77	0.87	3.20	0
EKALAKA	7	2.5	8.8	1.86	3.50	0.74	4.74	17476
ELK CITY	5	1.5	7.9	1.89	5.28	1.27	4.16	1026
ELKO	4	2.2	8.4	1.44	3.82	0.65	5.86	347
EMORY PEAK	4	1.9	7.6	2.07	3.99	1.09	3.69	10188
ENID	11	2.0	8.8	1.30	4.32	0.64	6.75	0
ESCALANTE	6	1.3	4.2	1.21	3.22	0.93	3.46	42191
FLAGSTAFF	6	2.0	6.9	1.40	3.52	0.71	4.95	70075
FLORENCE	13	1.3	5.3	0.12	4.16	0.09	44.00	18
FREMONT	9	1.9	8.1	1.42	4.35	0.76	5.73	0
FT. STOCKTON	4	1.6	6.8	1.68	4.35	1.08	4.04	4250
GALLUP	6	2.1	8.0	1.61	3.74	0.76	4.94	562445
GEORGETOWN	13	1.2	4.8	0.18	4.07	0.15	26.89	0
GILLETTE	7	3.0	9.3	1.52	3.06	0.50	6.11	50426
GLENS FALLS	14	1.3	5.1	1.42	3.95	1.11	3.56	5878
GOLDFIELD	4	4.4	12.6	2.20	2.87	0.50	5.75	1771
GRAND CANYON	6	1.8	4.1	0.95	2.23	0.52	4.31	59029
GRAND ISLAND	9	2.7	11.0	2.01	4.07	0.74	5.47	0
GREAT BEND	9	2.6	10.8	2.02	4.08	0.76	5.35	0
GREAT FALLS	9	3.9	8.8	1.19	2.22	0.30	7.35	0
GREELEY	8	3.1	10.9	2.42	3.46	0.77	4.50	39511
GREEN BAY	11	1.3	3.7	1.26	2.93	1.01	2.90	4
GREENSBORO	15	2.0	7.1	0.88	3.51	0.44	8.06	12376
GREENVILLE	15	2.7	11.2	1.00	4.18	0.37	11.21	225
HAILEY	5	2.3	11.0	2.13	4.67	0.91	5.15	6813
HAMILTON	5	2.2	6.7	1.54	3.09	0.71	4.34	5057
HANCOCK	10	2.3	0.8	1.00	0.35	0.44	0.79	0
HARRISBURG	14	2.8	5.9	0.92	2.14	0.33	6.47	5678
HARTFORD	14	1.9	6.5	1.24	3.44	0.66	5.25	2432
HAVRE	9	3.6	9.8	1.26	2.76	0.35	7.79	3732
HOT SPRINGS	9	5.2	8.4	1.30	1.64	0.25	6.50	64720
HOUSTON	12	1.4	5.9	0.50	4.06	0.34	11.76	3670
HUTCHINSON	11	1.9	8.2	1.15	4.29	0.60	7.17	311
IDAHO FALLS	4	2.5	8.8	1.65	3.50	0.66	5.31	0
IRON MOUNTAIN	10	1.4	5.9	0.50	4.06	0.34	11.76	0
IRON RIVER	10	1.2	3.3	1.12	2.73	0.93	2.93	0
JOHNSON CITY	15	1.1	3.8	1.C8	3.35	0.95	3.54	659
JOPLIN	11	2.2	9.3	0.87	4.20	0.39	10.67	0

Table 3-4 (Contd)

QUAD	PROV	U	TH	K	THU	KU	THK	UINV
JORDAN VALLEY	4	3.6	19.7	2.22	5.40	0.61	8.86	20880
KINGMAN	4	3.3	13.5	2.56	4.13	0.78	5.27	385
KLAMATH FALLS	4	1.1	3.0	0.91	2.87	0.86	3.34	2512
KNOXVILLE	15	1.7	8.0	1.17	4.67	0.68	6.83	120
LA JUNTA	9	2.7	11.0	2.09	4.07	0.77	5.26	0
LAKE CHAMPLAIN	14	1.1	4.2	1.27	3.81	1.14	3.33	0
LAMAR	9	2.9	12.4	2.79	4.25	0.96	4.44	915
LANDER	7	2.6	18.7	2.22	7.10	0.84	8.41	35620
LAS VEGAS	4	2.4	3.8	0.70	1.60	0.30	5.43	2131
LAWTON	11	1.7	7.7	1.57	4.47	0.91	4.93	26150
LEADVILLE	8	2.3	9.5	1.79	4.17	0.79	5.31	14831
LEMMON	9	1.8	5.8	1.21	3.31	0.69	4.79	52424
LEWISTOWN	9	2.4	7.3	1.75	3.04	0.73	4.15	2263
LINCOLN	9	2.1	9.4	1.42	4.41	0.67	6.61	0
LITTLE ROCK	11	1.9	5.4	0.54	2.81	0.28	9.94	0
LLANO	9	1.2	4.9	1.01	4.19	0.86	4.89	36
LOVELOCK	4	2.4	10.6	2.51	4.43	1.05	4.22	36
LUBBOCK	9	1.5	7.0	1.58	4.78	1.08	4.42	3565
MANHATTAN	11	2.4	10.0	1.40	4.07	0.57	7.13	379
MARBLE CANYON	6	1.6	4.0	1.20	2.52	0.75	3.34	18150
MARFA	4	2.0	11.9	2.84	5.86	1.39	4.21	983
MARQUETTE	10	0.9	2.2	0.92	2.38	0.98	2.43	0
MCALLEN	12	1.4	3.5	0.99	2.57	0.72	3.58	52696
MESA	4	3.2	9.8	2.81	3.01	0.87	3.47	37941
MILLETT	4	3.6	13.0	2.56	3.63	0.72	5.08	3372
MOAB	6	3.5	6.3	1.37	1.77	0.39	4.58	334742
MONTROSE	8	2.9	10.5	2.13	3.61	0.73	4.93	70214
NEEDLES	4	3.3	10.5	2.29	3.19	0.70	4.59	0
NEWARK	14	2.9	5.6	0.98	1.94	0.34	5.76	8799
NEWCASTLE	7	2.9	10.4	1.88	3.58	0.65	5.55	298458
NOGALES	4	4.0	15.5	3.61	3.84	0.89	4.29	2676
O'NEILL	9	1.5	5.3	1.61	3.45	1.06	3.26	0
OGDEN	5	2.2	7.5	1.35	3.37	0.60	5.59	0
OKANOGAN	5	1.8	5.8	1.70	3.23	0.96	3.38	56019
OKLAHOMA CITY	11	1.4	6.9	0.98	4.83	0.68	7.09	0
PALESTINE	12	1.7	4.8	0.41	2.75	0.24	11.68	1691
PECOS	9	1.7	5.5	1.20	3.19	0.69	4.63	0
PLAINVIEW	11	1.5	7.6	1.77	5.02	1.17	4.28	33750
POCATELLO	4	2.9	9.9	1.72	3.43	0.60	5.74	4052
POPLAR BLUFF	11	2.1	5.3	0.74	2.51	0.35	7.09	1068
PORTLAND	14	2.2	7.6	1.38	3.52	0.64	5.54	8094
PRATT	9	2.1	8.5	2.25	3.98	1.05	3.78	0
PRESCOTT	4	3.1	10.1	2.09	3.21	0.66	4.84	740209
PRESIDIO	4	1.9	7.8	2.11	4.04	1.09	3.70	576
PRICE	6	2.3	7.1	1.47	3.08	0.64	4.84	2328
PUEBLO	8	3.3	13.0	2.90	3.89	0.87	4.48	158665
RAPID CITY	9	2.6	8.4	1.62	3.24	0.62	5.20	8252
RATON	8	2.6	9.9	1.64	3.84	0.63	6.06	46913
RAWLINS	7	2.6	8.3	1.80	3.16	0.69	4.58	184867
RENO	4	3.3	9.6	2.57	2.87	0.77	3.75	3132
RICE LAKE	10	1.3	4.2	1.05	3.36	0.83	4.03	417
RICHFIELD	4	3.2	12.1	1.96	3.78	0.61	6.18	26064
RICHMOND	13	1.3	3.9	0.32	3.05	0.25	12.31	1456
RITZVILLE	3	3.6	7.9	2.96	2.18	0.81	2.68	31283
ROCK SPRINGS	7	2.8	9.7	1.99	3.48	0.72	4.86	28181
SALINA	6	4.8	7.8	1.42	1.61	0.29	5.47	63545
SALT LAKE CITY	5	1.6	5.9	1.21	3.56	0.73	4.86	0
SALTON SEA	4	3.1	10.7	2.37	3.44	0.76	4.50	2180
SAN ANTONIO	12	1.0	6.0	0.59	5.81	0.57	10.24	204
SANDPOINT	5	2.1	6.7	1.56	3.17	0.74	4.29	34162
SANTA FE	8	2.1	8.1	1.31	3.90	0.63	6.22	70695
SAVANNAH	13	1.3	4.4	0.16	3.50	0.13	27.81	0
SCRANTON	14	2.1	5.1	0.80	2.42	0.38	6.40	21587
SEGUIN	12	1.3	5.7	0.61	4.26	0.46	9.36	33326
SHELBY	9	2.8	7.5	1.84	2.73	0.66	4.10	0
SHERMAN	11	1.9	7.0	0.67	3.70	0.36	10.39	5974
SHIPROCK	6	2.0	7.3	1.70	3.61	0.84	4.31	377253
SILVER CITY	4	4.2	15.1	3.66	3.60	0.87	4.13	1293
SIOUX CITY	9	2.1	8.1	1.60	3.79	0.74	5.09	0
SOCORRO	4	1.9	8.9	1.97	4.58	1.01	4.54	85655
SPARTANBURG	15	1.8	7.7	0.90	4.38	0.51	8.57	7051
SPOKANE	5	3.0	6.8	1.53	2.25	0.51	4.43	11957
ST. JOHNS	6	4.0	8.4	1.37	2.10	0.34	6.15	32672
THERMOPOLIS	7	2.3	16.8	1.78	7.45	0.79	9.46	17889
TONOPAH	4	3.7	10.6	2.02	2.87	0.55	5.23	4356
TOOELE	4	2.0	5.6	1.11	2.85	0.57	5.04	0
TORRINGTON	7	3.0	13.2	2.24	4.46	0.76	5.89	34841
TRINIDAD	8	4.6	6.0	2.26	1.28	0.49	2.64	8250
TRONA	4	3.2	8.8	1.92	2.76	0.60	4.57	6974
TUCSON	4	3.7	13.3	3.52	3.64	0.96	3.78	842
TUCUMCARI	9	1.7	6.8	1.56	4.11	0.94	4.37	3490
TULAROSA	4	2.7	11.0	2.27	4.09	0.84	4.87	17312
TULSA	11	1.9	7.3	0.80	3.79	0.42	9.09	0
TWIN FALLS	4	4.0	12.9	2.96	3.19	0.73	4.37	10821
VAN HORN	4	1.9	5.5	1.36	2.96	0.73	4.07	0
VERNAL	5	2.3	5.9	1.27	2.58	0.55	4.67	50227
VYA	4	2.6	8.0	1.75	3.07	0.67	4.58	20006
WALKER LAKE	4	3.7	14.5	2.91	3.90	0.78	4.98	26660
WASHINGTON	13	1.6	5.3	0.67	3.39	0.42	7.99	2118
WELLS	4	2.6	11.4	1.66	4.36	0.64	6.86	19464
WHITE SPHR SPRIN	5	2.0	6.9	1.48	3.43	0.73	4.68	22926
WICHITA	11	2.2	9.3	1.48	4.31	0.69	6.30	0
WICHITA FALLS	11	1.8	8.5	1.28	4.72	0.71	6.64	67929
WILLIAMS	6	2.5	7.0	1.34	2.83	0.54	5.24	16784
WILLIAMSPORT	14	1.2	4.6	0.59	3.72	0.48	7.81	458
WINNEMUCCA	4	2.6	10.2	2.06	3.89	0.78	4.96	6569
WINSTON SALEM	15	2.1	8.2	1.11	3.94	0.53	7.38	21220

PROV is the physiographic province in which the quadrangle is located (see Texas Instruments, 1980, for map).

1- Pacific Coast and Sierra Nevada (north)
2- Pacific Coast and Sierra Nevada (south)
3- Columbia Plateaus
4- Basin and Range
5- Northern Rockies
6- Colorado Plateau
7- Wyoming Basins
8- Colorado and Southern Rockies
9- Great Plains
10- Southern Canadian Shield
11- Central Lowlands
12- Coastal Plain (Texas)
13- Coastal Plain (southeast)
14- Appalachian Highlands (north)
15- Appalachian Highlands (south)

Table 3-5 lists several other radiometric parameters and possible favorability indexes for the quadrangles:

AU — U (quadrangle) divided by mean U for province

ATH — Th (quadrangle) divided by mean Th for province

AK — K (quadrangle) divided by mean K for province

ATHU — ThU (quadrangle) divided by mean ThU for province

AKU — KU (quadrangle) divided by mean KU for province

ATHK — ThK (quadrangle) divided by mean ThK for province

Note: Adjusting the values to the province mean provides at least a partial correction for provincial environment differences that influence the sensitivity of gamma-ray measurements and the geochemical behavior of uranium, thorium and potassium.

UET — excess eU over eTh = AU - ATh

UEK — excess eU over K = AU - AK

Note: These quantities are estimates of the amount of uranium in excess of the amount that would normally accompany (in that province) the quantity of thorium, and potassium present.

Table 3-5. Radiometric Parameters for Selected 1-Degree-by-2-Degree NTMS Quadrangles in the Conterminous United States

QUAD	AU	ATH	AK	ATHU	AKU	ATHK	UET	UEK	UI	SUMT	SUMK	SUM
ABILENE	0.97	1.02	0.84	1.08	0.83	1.13	-0.05	0.13	3.6	2.09	1.67	3.76
ADEL	0.82	0.99	0.86	1.20	1.03	1.13	-0.18	-0.04	8.7	2.19	1.89	4.08
ALBUQUERQUE	1.01	1.29	1.24	1.19	1.11	1.05	-0.28	-0.23	6.3	2.48	2.35	4.83
ALLIANCE	0.81	0.95	1.08	1.11	1.24	0.85	-0.14	-0.27	7.1	2.06	2.31	4.38
AMARILLO	0.73	0.88	1.13	1.14	1.44	0.74	-0.15	-0.40	7.6	2.02	2.58	4.60
ARDMORE	1.25	1.00	0.83	0.82	0.64	1.13	0.25	0.43	2.7	1.82	1.47	3.28
ARMINTO	0.92	0.87	1.23	0.94	1.32	0.71	0.06	-0.30	9.3	1.80	2.55	4.35
ASHLAND	0.86	1.04	1.13	1.11	1.21	0.78	-0.18	-0.27	3.1	2.15	2.33	4.48
ASHTON	1.13	1.16	0.96	1.01	0.82	1.20	-0.03	0.18	5.3	2.17	1.78	3.94
ATHENS	1.05	1.14	0.74	1.10	0.67	1.50	-0.09	0.31	3.2	2.24	1.41	3.65
AUGUSTA	1.11	1.34	0.43	1.19	0.43	1.77	-0.23	0.68	0.7	2.53	0.86	3.39
AUSTIN	1.13	1.22	1.02	1.06	0.87	1.01	-0.09	0.11	2.6	2.28	1.89	4.17
AZTEC	0.93	1.73	1.22	1.75	1.19	1.44	-0.80	-0.29	9.1	3.48	2.41	5.89
BAKER	0.56	0.79	0.64	1.29	1.13	1.14	-0.23	-0.08	5.1	2.08	1.77	3.86
BALTIMORE	1.02	0.94	1.35	0.93	1.27	0.67	0.08	-0.34	5.0	1.87	2.62	4.49
BEAUMONT	1.19	0.94	0.34	0.77	0.27	2.37	0.25	0.86	0.6	1.71	0.61	2.32
BEEVILLE	0.86	0.76	0.66	0.85	0.73	0.97	0.11	0.21	1.4	1.61	1.39	3.00
BELOIT	1.23	1.44	1.21	1.12	0.92	1.15	-0.21	0.02	8.0	2.56	2.12	4.68
BILLINGS	0.83	0.69	0.80	0.83	0.96	0.87	0.14	0.03	5.3	1.51	1.75	3.27
BOISE	1.00	1.08	0.88	0.99	0.87	1.14	-0.08	0.12	5.3	2.07	1.75	3.82
BOZEMAN	0.94	1.04	1.02	1.09	1.06	1.01	-0.10	-0.08	6.1	2.13	2.08	4.21
BROKEN BOW	0.91	1.07	1.12	1.11	1.15	0.91	-0.15	-0.21	7.3	2.18	2.27	4.44
BROWNFIELD	0.52	0.61	0.67	1.11	1.19	0.88	-0.09	-0.15	4.4	1.72	1.86	3.53
BROWNSVILLE	0.86	0.68	1.45	0.78	1.62	0.40	0.17	-0.60	2.7	1.46	3.07	4.54
BROWNWOOD	0.39	0.07	0.29	0.19	0.71	0.24	0.32	0.10	0.2	0.26	0.99	1.25
BUTTE	1.06	1.00	1.14	0.93	1.04	0.87	0.06	-0.08	5.8	1.93	2.18	4.11
CALIENTE	1.09	1.31	1.05	1.18	0.94	1.23	-0.22	0.04	10.4	2.49	1.99	4.48
CASPER	1.26	1.52	1.39	1.21	1.10	1.10	-0.27	-0.13	13.6	2.74	2.49	5.22
CEDAR CITY	0.56	1.07	0.70	1.89	1.23	1.50	-0.51	-0.14	11.1	2.96	1.93	4.89
CHALLIS	1.10	1.41	1.36	1.26	1.20	1.03	-0.31	-0.26	9.4	2.67	2.56	5.24
CHARLESTON	0.97	0.85	0.86	0.88	0.85	0.95	0.12	0.10	3.0	1.73	1.71	3.45
CHARLOTTE	1.18	1.33	0.95	1.14	0.77	1.36	-0.16	0.22	4.3	2.48	1.72	4.20
CHARLOTTESVILLE	0.91	0.78	0.93	0.87	0.98	0.81	0.13	-0.02	3.2	1.65	1.91	3.56
CHEYENNE	0.92	0.87	1.17	0.95	1.27	0.75	0.05	-0.25	9.0	1.82	2.43	4.25
CHOTEAU	0.86	0.79	0.92	0.91	1.05	0.84	0.07	-0.07	4.6	1.70	1.98	3.67
CLIFTON	1.03	1.11	1.24	1.05	1.18	0.87	-0.08	-0.22	11.1	2.16	2.43	4.59
CLINTON	0.94	0.98	1.91	1.07	1.95	0.48	-0.04	-0.96	8.2	2.05	3.86	5.91
CLOVIS	0.77	0.98	1.02	1.21	1.23	0.92	-0.21	-0.25	7.3	2.20	2.25	4.45
CODY	0.84	0.61	0.69	0.72	0.81	0.88	0.24	0.16	4.0	1.32	1.50	2.82
CORPUS CHRISTI	0.91	0.74	1.15	0.80	1.21	0.55	0.16	-0.24	2.2	1.54	2.36	3.90
CORTEZ	0.71	0.85	0.80	1.13	1.02	1.08	-0.15	-0.09	3.8	1.98	1.82	3.80
CRAIG	1.02	0.77	0.89	0.76	0.87	0.87	0.25	0.13	5.4	1.53	1.75	3.29
CRYSTAL CITY	1.17	0.92	1.02	0.77	0.84	0.76	0.25	0.14	1.9	1.68	1.86	3.55
CUT BANK	1.29	1.15	0.77	0.87	0.58	1.47	0.15	0.52	3.7	2.02	1.35	3.37
DALHART	0.94	0.77	0.83	0.78	0.82	0.90	0.16	0.11	3.8	1.56	1.65	3.21
DALLAS	1.09	1.00	0.58	0.94	0.51	1.60	0.09	0.51	2.2	1.94	1.09	3.03
DEATH VALLEY	0.91	1.06	1.12	1.15	1.21	0.93	-0.15	-0.21	10.8	2.20	2.32	4.53
DEL RIO	0.47	0.58	0.27	1.16	0.53	2.05	-0.10	0.20	1.8	1.73	0.80	2.53
DELTA	1.11	1.27	0.97	1.13	0.86	1.28	-0.16	0.14	9.2	2.40	1.83	4.23
DENVER	1.19	1.64	1.38	1.32	1.15	1.16	-0.45	-0.19	14.0	2.96	2.53	5.49
DICKINSON	0.92	0.73	0.76	0.75	0.77	0.92	0.19	0.16	3.4	1.48	1.54	3.02
DILLON	0.98	0.99	1.03	0.99	1.03	0.94	-0.01	-0.06	5.6	1.98	2.06	4.04
DODGE CITY	1.08	1.27	1.43	1.12	1.23	0.85	-0.19	-0.35	9.4	2.38	2.66	5.04
DOUGLAS	1.52	1.58	1.55	1.02	0.99	1.00	-0.06	-0.02	13.3	2.60	2.54	5.14
DUBOIS	0.82	0.88	0.74	1.06	0.87	1.18	-0.06	0.08	4.3	1.94	1.61	3.55
DURANGO	0.70	0.82	0.68	1.12	0.96	1.18	-0.12	0.02	5.8	1.94	1.64	3.58
DYERSBURG	1.48	1.20	2.89	0.80	2.17	0.24	0.28	-1.41	3.3	2.00	5.06	7.06
EAGLE PASS	0.88	1.56	1.62	1.73	1.75	0.82	-0.68	-0.74	6.8	3.29	3.37	6.66
EAU CLAIRE	0.70	0.51	1.00	0.75	1.38	0.48	0.19	-0.30	3.0	1.26	2.38	3.64
EKALAKA	0.95	0.80	0.95	0.84	1.00	0.84	0.15	-0.00	6.5	1.65	1.95	3.60
ELK CITY	0.69	1.06	1.21	1.51	1.70	0.86	-0.37	-0.52	10.0	2.57	2.92	5.48
ELKO	0.77	0.78	0.65	1.00	0.83	1.18	-0.02	0.11	5.5	1.79	1.48	3.27
EMORY PEAK	0.66	0.71	0.94	1.05	1.38	0.74	-0.05	-0.27	8.3	1.76	2.32	4.08
ENID	1.13	1.29	1.20	1.17	1.02	1.00	-0.16	-0.07	5.6	2.46	2.22	4.68
ESCALANTE	0.53	0.60	0.86	1.06	1.48	0.70	-0.07	-0.34	3.9	1.66	2.35	4.00
FLAGSTAFF	0.80	0.99	1.00	1.16	1.13	1.00	-0.19	-0.20	4.9	2.14	2.13	4.27
FLORENCE	0.85	0.99	0.30	1.15	0.40	1.85	-0.14	0.54	0.5	2.13	0.70	2.84
FREMONT	0.82	1.02	0.89	1.18	1.01	1.10	-0.20	-0.06	6.2	2.20	1.89	4.09
FT. STOCKTON	0.54	0.63	0.76	1.14	1.37	0.81	-0.09	-0.22	7.3	1.77	2.13	3.90
GALLUP	0.86	1.13	1.15	1.23	1.20	1.00	-0.27	-0.29	6.0	2.36	2.35	4.71
GEORGETOWN	0.79	0.90	0.46	1.12	0.64	1.13	-0.11	0.34	0.7	2.03	1.09	3.12
GILLETTE	1.15	0.85	0.78	0.73	0.68	1.09	0.30	0.37	4.6	1.58	1.46	3.04
GLENS FALLS	0.66	0.90	1.32	1.27	1.75	0.65	-0.24	-0.66	5.6	2.17	3.07	5.25
GOLDFIELD	1.53	1.17	1.00	0.75	0.64	1.16	0.36	0.53	6.3	1.93	1.63	3.56
GRAND CANYON	0.74	0.58	0.68	0.73	0.83	0.87	0.16	0.06	2.1	1.32	1.50	2.82

Table 3-5 (Contd)

QUAD	AU	ATH	AK	ATHU	AKU	ATHK	UET	UEK	UI	SUMT	SUMK	SUM
GRAND ISLAND	1.19	1.38	1.26	1.10	0.99	1.05	-0.19	-0.07	8.2	2.48	2.24	4.73
GREAT BEND	1.17	1.36	1.26	1.10	1.01	1.03	-0.19	-0.10	8.2	2.46	2.27	4.73
GREAT FALLS	1.74	1.10	0.74	0.60	0.40	1.41	0.64	1.00	2.6	1.70	1.14	2.84
GREELEY	1.07	1.05	1.16	0.94	1.08	0.88	0.02	-0.10	8.4	1.99	2.24	4.23
GREEN BAY	0.70	0.54	1.16	0.79	1.61	0.43	0.16	-0.46	3.7	1.33	2.77	4.10
GREENSBORO	1.04	0.92	0.88	0.89	0.81	1.01	0.13	0.16	3.1	1.81	1.69	3.49
GREENVILLE	1.38	1.45	1.00	1.06	0.69	1.40	-0.07	0.38	4.2	2.51	1.69	4.20
HAILEY	1.09	1.48	1.37	1.33	1.22	1.07	-0.39	-0.28	9.9	2.81	2.58	5.40
HAMILTON	1.00	0.90	0.99	0.88	0.96	0.90	0.10	0.02	4.8	1.78	1.95	3.73
HANCOCK	1.63	0.24	1.06	0.13	0.60	0.19	1.40	0.57	0.3	0.37	1.66	2.03
HARRISBURG	1.43	1.06	0.86	0.69	0.52	1.17	0.37	0.58	2.0	1.75	1.38	3.13
HARTFORD	0.98	1.16	1.15	1.10	1.04	0.95	-0.19	-0.18	4.3	2.27	2.19	4.46
HAVRE	1.57	1.23	0.79	0.75	0.47	1.50	0.34	0.78	3.5	1.98	1.26	3.23
HOT SPRINGS	2.28	1.06	0.81	0.44	0.33	1.25	1.21	1.46	2.1	1.50	1.15	2.65
HOUSTON	1.04	1.17	0.76	1.09	0.70	1.29	-0.13	0.28	2.0	2.27	1.46	3.73
HUTCHINSON	1.07	1.21	1.06	1.16	0.95	1.07	-0.14	0.01	4.9	2.37	2.01	4.39
IDAHO FALLS	0.87	0.81	0.75	0.92	0.84	1.07	0.05	0.12	5.8	1.73	1.59	3.32
IRON MOUNTAIN	1.05	1.77	0.53	1.54	0.47	2.80	-0.73	0.52	2.0	3.32	1.00	4.31
IRON RIVER	0.87	0.99	1.19	1.04	1.27	0.70	-0.12	-0.32	3.1	2.03	2.46	4.48
JOHNSON CITY	0.59	0.49	1.08	0.85	1.75	0.44	0.09	-0.49	3.6	1.34	2.84	4.18
JOPLIN	1.23	1.36	0.80	1.14	0.63	1.59	-0.13	0.43	3.7	2.50	1.43	3.93
JORDAN VALLEY	1.26	1.82	1.00	1.42	0.78	1.78	-0.56	0.26	12.0	3.24	1.78	5.03
KINGMAN	1.13	1.25	1.16	1.09	1.00	1.06	-0.12	-0.02	10.6	2.34	2.16	4.49
KLAMATH FALLS	0.37	0.28	0.41	0.75	1.09	0.67	0.09	-0.04	2.6	1.04	1.50	2.54
KNOXVILLE	0.88	1.03	1.17	1.18	1.27	0.86	-0.15	-0.29	5.5	2.22	2.44	4.66
LA JUNTA	1.19	1.38	1.31	1.10	1.03	1.01	-0.19	-0.12	8.5	2.48	2.33	4.82
LAKE CHAMPLAIN	0.57	0.76	1.18	1.22	1.81	0.60	-0.18	-0.61	4.8	1.98	2.99	4.97
LAMAR	1.29	1.56	1.75	1.15	1.27	0.85	-0.27	-0.46	11.8	2.71	3.01	5.72
LANDER	0.99	1.70	1.14	1.71	1.14	1.50	-0.71	-0.14	15.8	3.41	2.28	5.69
LAS VEGAS	0.82	0.35	0.32	0.42	0.38	1.09	0.47	0.51	1.1	0.77	0.69	1.47
LAWTON	0.96	1.14	1.45	1.21	1.45	0.73	-0.17	-0.48	7.0	2.35	2.89	5.24
LEADVILLE	0.77	0.92	0.86	1.13	1.10	1.04	-0.14	-0.09	7.5	2.05	1.96	4.01
LEMMON	0.77	0.73	0.76	0.90	0.92	0.92	0.04	0.01	4.0	1.63	1.67	3.30
LEWISTOWN	1.05	0.91	1.10	0.82	0.97	0.80	0.14	-0.04	5.3	1.74	2.07	3.80
LINCOLN	0.94	1.18	0.89	1.19	0.88	1.27	-0.24	0.05	6.3	2.37	1.77	4.14
LITTLE ROCK	1.06	0.79	0.50	0.76	0.45	1.48	0.27	0.57	1.5	1.55	0.95	2.50
LLANO	0.52	0.62	0.63	1.13	1.13	0.94	-0.10	-0.11	4.2	1.75	1.77	3.52
LOVELOCK	0.83	0.98	1.14	1.17	1.34	0.85	-0.15	-0.31	11.1	2.15	2.47	4.62
LUBBOCK	0.64	0.88	0.99	1.29	1.43	0.85	-0.23	-0.35	7.6	2.17	2.42	4.59
MANHATTAN	1.37	1.47	1.29	1.10	0.91	1.06	-0.10	0.08	5.7	2.57	2.20	4.77
MARBLE CANYON	0.64	0.57	0.86	0.83	1.20	0.68	0.07	-0.21	3.0	1.40	2.06	3.46
MARFA	0.71	1.11	1.29	1.54	1.77	0.85	-0.40	-0.58	16.6	2.65	3.06	5.71
MARQUETTE	0.68	0.68	0.98	0.91	1.33	0.58	0.00	-0.30	2.2	1.58	2.30	3.89
MCALLEN	0.99	0.70	1.51	0.69	1.46	0.39	0.29	-0.52	2.5	1.40	2.97	4.37
MESA	1.12	0.91	1.27	0.79	1.10	0.70	0.22	-0.15	8.5	1.70	2.38	4.07
MILLETT	1.24	1.21	1.16	0.96	0.91	1.02	0.04	0.08	9.3	2.16	2.07	4.23
MOAB	1.43	0.89	0.98	0.58	0.62	0.93	0.54	0.46	2.4	1.48	1.59	3.07
MONTROSE	0.99	1.01	1.02	0.98	1.03	0.96	-0.02	-0.04	7.7	1.99	2.05	4.04
NEEDLES	1.14	0.97	1.04	0.84	0.89	0.92	0.17	0.10	7.3	1.82	1.92	3.74
NEWARK	1.50	1.01	0.91	0.62	0.53	1.04	0.49	0.59	1.9	1.63	1.44	3.07
NEWCASTLE	1.10	0.95	0.97	0.86	0.87	0.99	0.15	0.14	6.7	1.81	1.84	3.65
NOGALES	1.40	1.44	1.63	1.01	1.14	0.86	-0.04	-0.23	13.9	2.45	2.77	5.22
O'NEILL	0.67	0.66	1.01	0.93	1.40	0.63	0.01	-0.34	5.6	1.59	2.41	4.00
OGDEN	1.04	1.02	0.87	0.96	0.81	1.16	0.02	0.17	4.6	1.98	1.68	3.66
OKANOGAN	0.83	0.78	1.09	0.92	1.28	0.70	0.05	-0.26	5.5	1.70	2.37	4.07
OKLAHOMA CITY	0.80	1.02	0.90	1.31	1.08	1.06	-0.22	-0.10	4.7	2.33	1.99	4.31
PALESTINE	1.25	0.95	0.63	0.74	0.48	1.29	0.30	0.63	1.1	1.70	1.11	2.80
PECOS	0.77	0.70	0.75	0.86	0.91	0.89	0.07	0.02	3.8	1.56	1.66	3.22
PLAINVIEW	0.84	1.11	1.63	1.36	1.87	0.64	-0.27	-0.79	8.9	2.47	3.50	5.97
POCATELLO	1.00	0.92	0.78	0.90	0.76	1.16	0.08	0.22	5.9	1.82	1.54	3.36
POPLAR BLUFF	1.16	0.77	0.68	0.68	0.56	1.06	0.39	0.48	1.9	1.45	1.25	2.70
PORTLAND	1.12	1.37	1.28	1.13	1.00	1.00	-0.25	-0.16	4.9	2.49	2.29	4.78
PRATT	0.94	1.07	1.41	1.08	1.39	0.73	-0.12	-0.46	8.9	2.14	2.80	4.95
PRESCOTT	1.09	0.94	0.95	0.84	0.84	0.97	0.16	0.15	6.7	1.78	1.79	3.57
PRESIDIO	0.67	0.72	0.95	1.06	1.39	0.74	-0.05	-0.29	8.5	1.79	2.35	4.13
PRICE	0.94	1.01	1.05	1.01	1.01	0.98	-0.08	-0.11	4.5	2.02	2.06	4.09
PUEBLO	1.13	1.25	1.39	1.06	1.22	0.87	-0.12	-0.26	11.3	2.31	2.61	4.92
RAPID CITY	1.15	1.06	1.01	0.88	0.83	1.00	0.09	0.13	5.2	1.93	1.84	3.77
RATON	0.88	0.96	0.79	1.04	0.89	1.18	-0.08	0.09	6.3	2.00	1.68	3.68
RAWLINS	0.99	0.75	0.92	0.76	0.93	0.82	0.24	0.06	5.7	1.51	1.86	3.37
RENO	1.16	0.89	1.16	0.76	0.98	0.75	0.27	-0.00	7.4	1.65	2.14	3.79
RICE LAKE	0.91	1.28	1.12	1.28	1.13	0.96	-0.37	-0.20	3.5	2.55	2.25	4.80
RICHFIELD	1.11	1.12	0.89	1.00	0.78	1.24	-0.01	0.22	7.4	2.12	1.67	3.79
RICHMOND	0.86	0.74	0.81	0.84	1.05	0.52	0.12	0.05	1.0	1.58	1.86	3.44
RITZVILLE	1.44	1.13	1.48	0.72	1.00	0.71	0.31	-0.03	6.4	1.85	2.48	4.32
ROCK SPRINGS	1.05	0.88	1.02	0.84	0.97	0.86	0.17	0.03	6.9	1.72	1.99	3.71

Table 3-5 (Contd)

QUAD	AU	ATH	AK	ATHU	AKU	ATHK	UET	UEK	UI	SUMT	SUMK	SUM
SALINA	1.96	1.11	1.01	0.53	0.47	1.11	0.85	0.95	2.3	1.63	1.48	3.12
SALT LAKE CITY	0.77	0.79	0.78	1.02	0.98	1.01	-0.03	-0.01	4.3	1.81	1.76	3.57
SALTON SEA	1.08	0.99	1.07	0.90	0.97	0.91	0.09	0.00	8.1	1.89	2.05	3.94
SAN ANTONIO	0.75	1.20	0.90	1.57	1.15	1.13	-0.45	-0.15	3.4	2.77	2.05	4.82
SANDPOINT	0.98	0.90	1.00	0.90	0.99	0.89	0.08	-0.02	4.9	1.81	1.99	3.80
SANTA FE	0.71	0.78	0.63	1.06	0.88	1.21	-0.06	0.08	5.1	1.84	1.51	3.35
SAVANNAH	0.85	0.83	0.41	0.97	0.53	1.17	0.02	0.44	0.6	1.80	0.94	2.74
SCRANTON	1.09	0.92	0.74	0.77	0.60	1.16	0.18	0.35	1.9	1.69	1.34	3.03
SEGUIN	0.96	1.14	0.93	1.15	0.92	1.03	-0.17	0.03	2.6	2.29	1.86	4.14
SHELBY	1.22	0.95	1.15	0.74	0.88	0.79	0.27	0.07	5.0	1.69	2.03	3.72
SHERMAN	1.05	1.02	0.62	1.00	0.57	1.55	0.02	0.43	2.5	2.03	1.18	3.21
SHIPROCK	0.82	1.04	1.21	1.19	1.33	0.87	-0.22	-0.39	6.1	2.23	2.55	4.77
SILVER CITY	1.46	1.40	1.66	0.95	1.11	0.83	0.05	-0.20	13.2	2.35	2.77	5.12
SIOUX CITY	0.95	1.02	1.00	1.03	0.99	0.98	-0.08	-0.05	6.1	2.05	1.99	4.04
SOCORRO	0.68	0.83	0.89	1.21	1.29	0.91	-0.15	-0.22	9.0	2.04	2.18	4.21
SPARTANBURG	0.91	1.00	0.90	1.11	0.95	1.07	-0.09	0.01	3.9	2.11	1.85	3.96
SPOKANE	1.40	0.91	0.98	0.64	0.68	0.92	0.49	0.42	3.4	1.56	1.66	3.22
ST. JOHNS	1.62	1.20	0.98	0.69	0.55	1.24	0.42	0.64	2.9	1.89	1.52	3.41
THERMOPOLIS	0.85	1.53	0.91	1.79	1.06	1.68	-0.68	-0.06	13.3	3.32	1.98	5.30
TONOPAH	1.28	0.98	0.91	0.76	0.70	1.05	0.30	0.36	5.8	1.74	1.61	3.35
TOOELE	0.68	0.52	0.50	0.75	0.72	1.01	0.16	0.18	3.2	1.27	1.22	2.49
TORRINGTON	1.12	1.20	1.15	1.07	1.02	1.05	-0.08	-0.03	10.0	2.27	2.17	4.45
TRINIDAD	1.57	0.57	1.09	0.35	0.68	0.51	1.00	0.49	2.9	0.92	1.77	2.69
TRONA	1.10	0.81	0.87	0.73	0.77	0.92	0.29	0.23	5.3	1.54	1.64	3.18
TUCSON	1.27	1.24	1.59	0.96	1.22	0.76	0.03	-0.32	12.8	2.19	2.82	5.01
TUCUMCARI	0.73	0.86	0.98	1.11	1.24	0.84	-0.12	-0.24	6.4	1.97	2.22	4.19
TULAROSA	0.94	1.02	1.03	1.08	1.07	0.98	-0.09	-0.09	9.3	2.10	2.10	4.20
TULSA	1.07	1.07	0.74	1.03	0.66	1.35	0.00	0.33	3.0	2.09	1.40	3.49
TWIN FALLS	1.40	1.20	1.34	0.84	0.93	0.88	0.21	0.07	9.5	2.04	2.27	4.31
VAN HORN	0.65	0.51	0.62	0.78	0.93	0.82	0.13	0.03	4.0	1.29	1.54	2.83
VERNAL	1.07	0.80	0.82	0.74	0.74	0.97	0.27	0.25	3.3	1.54	1.56	3.09
VYA	0.91	0.74	0.79	0.81	0.85	0.92	0.16	0.11	5.4	1.55	1.65	3.20
WALKER LAKE	1.29	1.34	1.32	1.02	1.00	1.00	-0.05	-0.03	11.3	2.37	2.31	4.68
WASHINGTON	1.06	1.00	1.70	0.93	1.79	0.34	0.06	-0.64	2.3	1.93	3.49	5.42
WELLS	0.91	1.06	0.75	1.15	0.81	1.38	-0.15	0.15	7.2	2.20	1.56	3.76
WHITE SULPHUR SPRIN	0.94	0.93	0.95	0.98	0.98	0.97	0.01	-0.01	5.1	1.91	1.93	3.84
WICHITA	1.20	1.37	1.36	1.17	1.09	0.94	-0.17	-0.16	6.4	2.54	2.45	4.99
WICHITA FALLS	1.00	1.25	1.18	1.28	1.13	0.99	-0.25	-0.18	6.0	2.53	2.31	4.84
WILLIAMS	1.00	1.00	0.96	0.93	0.86	1.06	0.00	0.05	3.8	1.93	1.82	3.75
WILLIAMSPORT	0.64	0.82	0.55	1.19	0.75	1.42	-0.18	0.09	2.2	2.02	1.30	3.32
WINNEMUCCA	0.91	0.95	0.93	1.02	1.00	1.00	-0.04	-0.02	8.0	1.97	1.93	3.90
WINSTON SALEM	1.07	1.06	1.11	1.00	0.99	0.92	0.01	-0.04	4.4	2.06	2.10	4.16

UI = Th . K/U

Note: This index was introduced by Saunders (1979).

SUMT = ATh + AThU

SUMK = AK + AKU

SUM = SUMT + SUMK

Note: These indexes are designed to identify areas of uranium source rocks; i.e., high thorium or potassium or both and relative depletion of uranium over thorium or potassium or both.

2) Relationships to Uranium Resources

Preliminary studies indicated that quadrangles characterized by general uranium enrichment relative to thorium (mean positive UET values) differed markedly from uranium-depleted ones (mean negative UET values), and it was advantageous to consider them separately. Table 3-6 shows correlation coefficients for three data sets: 1) all quadrangles, 2) +UET quadrangles and 3) -UET quadrangles. In this table the radiometric variables are correlated against UINV plus RESV,* RESVL, and UINVL. The latter quantities are the $\log_{10}$ of RESV and UINV respectively. The top number for each pair of variables is the correlation coefficient, and the bottom one is the level of validity of the correlation, which depends on the number of samples being compared.

Preproduction uranium inventory (RESV) and total uranium inventory (UINV) are not particularly well correlated with any of the radiometric variables; however, RESVL and UINVL do show reasonably valid relationships to U, Th, K, and UI. UINVL shows a slightly higher level of validity. Thus it appears that the uranium inventories are more exponential than linear functions of the radiometric variables. Based on this evidence, UINVL was chosen as the dependent variable in a stepwise multiple linear regression employing all the radiometric variables. This resulted in the following best seven-variable model for the data set including all quadrangles:

$$\text{UINVL} = 100.5 + 161.4\text{U} - 405.1\ \text{KU} - 3.272\ \text{ThK} - 178.7\ \text{AU} + 211.8\ \text{AThU} + 392.1\ \text{AKU} - 74.67\ \text{SUM}.$$

*RESV = preproduction inventory (production plus reserves) for quadrangles that have had significant production of uranium ores.

Table 3-6A. Correlation Coefficients for All Quadrangles (level of validity in percent)

	UINV	UINVL	RESV	RESVL
U	0.14 (95)	0.26 (99.9)	0.16 (77)	0.45 (99)
Th	0.16 (87)	0.22 (99.9)	0.22 (90)	0.33 (99)
K	0.14 (95)	0.22 (99.9)	0.19 (85)	0.39 (99)
ThU	0.02 (21)	0.02 (21)	0.06 (33)	-0.17 (80)
KU	0.03 (29)	0.04 (42)	0.00 (0)	-0.13 (68)
ThK	-0.06 (57)	-0.10 (81)	0.00 (0)	-0.13 (65)
AU	0.06 (61)	0.11 (87)	0.12 (64)	0.26 (95)
ATh	0.13 (92)	0.07 (68)	0.25 (94)	0.13 (67)
AK	0.10 (85)	0.11 (88)	0.22 (90)	0.00 (3)
UET	-0.07 (63)	0.03 (35)	-0.12 (62)	0.14 (69)
UEK	-0.05 (47)	-0.02 (18)	-0.05 (30)	0.24 (93)
UI	0.13 (93)	0.18 (99)	0.19 (85)	0.26 (95)
SUMT	0.10 (84)	0.04 (42)	0.20 (87)	0.02 (10)
SUMK	0.07 (67)	0.08 (74)	0.12 (62)	-0.17 (79)
SUM	0.10 (85)	0.08 (72)	0.19 (84)	-0.11 (58)
UINV	1.00 (100)	0.39 (99.9)	0.90 (99.9)	0.56 (99.9)
UINVL	0.39 (99.9)	1.00 (100)	0.37 (99)	0.95 (99.9)
RESV	0.90 (99.9)	0.37 (99)	1.00 (100)	0.50 (99.9)
RESVL	0.56 (99.9)	0.95 (99.9)	0.50 (99.9)	1.00 (100)

Table 3-6B. Correlation Coefficients for +UET and -UET Quadrangles (level of validity in percent)

	+UET Quadrangles				-UET Quadrangles			
	UINV	UINVL	RESV	RESVL	UINV	UINVL	RESV	RESVL
U	0.14 (83)	0.31 (99)	0.22 (73)	0.37 (95)	0.18 (93)	0.20 (96)	0.20 (71)	0.55 (99)
Th	0.14 (80)	0.27 (99)	0.22 (73)	0.35 (94)	0.16 (89)	0.23 (98)	0.17 (63)	0.44 (99)
K	0.12 (75)	0.26 (99)	0.17 (61)	0.28 (85)	0.15 (86)	0.20 (96)	0.17 (63)	0.54 (99)
ThU	0.01 (9)	0.02 (14)	-0.03 (13)	-0.08 (32)	-0.03 (22)	0.08 (60)	-0.05 (23)	-0.17 (62)
KU	0.02 (13)	0.00 (0)	-0.15 (54)	-0.30 (88)	0.01 (7)	0.10 (68)	-0.02 (10)	0.08 (33)
ThK	-0.06 (42)	-0.09 (61)	0.09 (36)	0.22 (75)	-0.06 (48)	-0.10 (67)	-0.08 (31)	-0.30 (89)
AU	0.07 (50)	0.23 (97)	0.17 (62)	0.27 (84)	0.09 (66)	-0.04 (33)	0.21 (73)	0.24 (80)
ATh	0.06 (45)	0.24 (98)	0.21 (72)	0.33 (92)	0.14 (85)	-0.01 (4)	0.23 (75)	0.16 (59)
AK	0.02 (13)	0.18 (91)	0.11 (41)	-0.15 (57)	0.16 (88)	0.05 (40)	0.22 (74)	0.13 (50)
UET	0.03 (24)	0.06 (45)	0.09 (34)	0.14 (51)	-0.11 (75)	-0.05 (38)	-0.09 (38)	-0.05 (20)
UEK	0.04 (31)	0.02 (15)	0.11 (41)	0.34 (92)	-0.09 (64)	-0.09 (64)	-0.06 (27)	0.08 (32)
UI	0.11 (69)	0.21 (95)	0.12 (47)	0.19 (68)	0.13 (81)	0.22 (97)	0.15 (57)	0.44 (98)
SUMT	0.04 (31)	0.17 (89)	0.14 (52)	0.24 (78)	0.12 (77)	0.02 (17)	0.15 (56)	0.02 (6)
SUMK	-0.02 (12)	0.09 (61)	-0.06 (24)	-0.39 (96)	0.11 (75)	0.09 (65)	0.12 (48)	0.04 (15)
SUM	0.01 (4)	0.15 (83)	0.01 (4)	-0.22 (75)	0.15 (87)	0.08 (58)	0.16 (59)	0.03 (13)
UINV	1.00 (100)	0.42 (99.9)	0.59 (99.9)	0.53 (99)	1.00 (100)	0.40 (99.9)	0.97 (99.9)	0.61 (99.9)
UINVL	0.42 (99.9)	1.00 (100)	0.38 (95)	0.96 (99.9)	0.40 (99.9)	1.00 (100)	0.42 (98)	0.94 (99.9)
RESV	0.59 (99.9)	0.38 (95)	1.00 (100)	0.54 (99)	0.97 (99.9)	0.42 (98)	1.00 (100)	0.55 (99)
RESVL	0.53 (99)	0.96 (99.9)	0.54 (99)	1.00 (100)	0.61 99.9	0.94 (99.9)	0.55 (99)	1.00 (100)

For this equation, $R^2 = 0.14$, indicating that only 14 percent of the variance in the UINVL data is accounted for. Table 3-7 lists the predicted values (UINVP) for UINV based on that equation. Quadrangles with UINV exceeding 50,000 tons of U_3O_8 have been highlighted to demonstrate more clearly their distribution on the list. The more productive quadrangles (highlighted in the UINV column) are seen to be somewhat bunched near the top of the list, but the prediction is not accurate enough to be useful quantitatively. Quadrangles where UINVP is within a factor of 2 of UINV are highlighted in the UINVP column.

A similar stepwise multiple linear regression applied to the +UET quadrangles data set resulted in the following best seven-variable model:

$$\text{UINVL} = 293.4 + 255.3\ \text{U} - 120.1\ \text{Th} + 154.0\ \text{ThU} - 689.3\ \text{KU} - 15.69\ \text{ThK} - 283.8\ \text{UET} + 79.65\ \text{UI}.$$

$R^2 = 0.17$, indicating 17 percent of the UINVL variance is accounted for. Table 3-8 lists the predicted values for UINV, and the highlighted quadrangles are seen to be rather well scattered from the top to the bottom of the data set, indicating this prediction to be even less productive than that with all the quadrangles.

The data set with only -UET quadrangles gave the best results. The best seven-variable model for UINVL as dependent variable follows:

$$\text{UINVL} = 750.5 + 373.0\ \text{U} - 584.2\ \text{K} + 166.9\ \text{ThU} - 604.4\ \text{KU} - 595.4\ \text{AU} + 658.3\ \text{AKU} + 100.8\ \text{UI}.$$

$R^2 = 0.26$, showing 26 percent of the UINVL variance accounted for. The predicted UINVL values (Table 3-9) show all the highlighted quadrangles bunched at the top of the data set. Thus, a good qualitative indication of uranium favorability is obtained; however, the relationship is not satisfactory for any quantitative prediction of uranium inventory.

Table 3-7. Predicted UINV Values for All Quadrangles Based on Seven-Variable Model

QUAD	PROV	U	TH	K	THU	KU	THK	RESV	UINV	UINVP
TRINIDAD	8	4.6	6.0	2.26	1.28	0.49	2.64	.	8250	109330
WASHINGTON	13	1.6	5.3	0.67	3.39	0.42	7.99	.	2118	43008
GOLDFIELD	4	4.4	12.6	2.20	2.87	0.50	5.75	.	1771	40954
DYERSBURG	13	2.2	6.4	1.14	2.69	0.51	5.63	.	4275	38774
SALINA	6	4.8	7.8	1.42	1.61	0.29	5.47	5600	63545-	36948-
HOT SPRINGS	9	5.2	8.4	1.30	1.64	0.25	6.50	700	64720-	20033
DOUGLAS	4	4.4	17.0	3.42	3.88	0.78	4.98	.	0	18365
DENVER	8	3.5	17.1	2.87	4.87	0.82	5.95	8400	146303-	17496
JORDAN VALLEY	4	3.6	19.7	2.22	5.40	0.61	8.86	.	20880	14662-
TWIN FALLS	4	4.0	12.9	2.96	3.19	0.73	4.37	.	10821	13754-
TONOPAH	4	3.7	10.6	2.02	2.87	0.55	5.23	.	4356	12864
PUEBLO	8	3.3	13.0	2.90	3.89	0.87	4.48	26400	158665-	11473
SILVER CITY	4	4.2	15.1	3.66	3.60	0.87	4.13	.	1293	11298
ST. JOHNS	6	4.0	8.4	1.37	2.10	0.34	6.15	.	32672	10717
GREELEY	8	3.1	10.9	2.42	3.46	0.77	4.50	900	39511	9742
NOGALES	4	4.0	15.5	3.61	3.84	0.89	4.29	.	2676	9212
WALKER LAKE	4	3.7	14.5	2.91	3.90	0.78	4.98	3000	26660	8962
MILLETT	4	3.6	13.0	2.56	3.63	0.72	5.08	300	3372	8549
MONTROSE	8	2.9	10.5	2.13	3.61	0.73	4.93	6600	70214-	8047
RICHFIELD	4	3.2	12.1	1.96	3.78	0.61	6.18	900	26064	6975
DELTA	4	3.2	13.7	2.15	4.28	0.67	6.37	500	50054-	6946
RATON	8	2.6	9.9	1.64	3.84	0.63	6.06	.	46913	6409
MOAB	6	3.5	6.3	1.37	1.77	0.39	4.58	155500	334742-	6235
CALIENTE	4	3.1	14.1	2.31	4.50	0.74	6.10	.	592	6011
NEEDLES	4	3.3	10.5	2.29	3.19	0.70	4.59	.	0	5898
KINGMAN	4	3.3	13.5	2.56	4.13	0.78	5.27	.	385	5641
TRONA	4	3.2	8.8	1.92	2.76	0.60	4.57	.	6974	5637-
AZTEC	6	2.3	12.2	1.71	5.31	0.75	7.11	.	136388-	5600
PRESCOTT	4	3.1	10.1	2.09	3.21	0.66	4.84	43600	740209-	5301
TUCSON	4	3.7	13.3	3.52	3.64	0.96	3.78	.	842	5162
RENO	4	3.3	9.6	2.57	2.87	0.77	3.75	.	3132	5107-
LEADVILLE	8	2.3	9.5	1.79	4.17	0.79	5.31	1500	14831	4811
POCATELLO	4	2.9	9.9	1.72	3.43	0.60	5.74	.	4052	4442-
SALTON SEA	4	3.1	10.7	2.37	3.44	0.76	4.50	.	2180	4314-
THERMOPOLIS	7	2.3	16.8	1.78	7.45	0.79	9.46	.	17889	4295
CEDAR CITY	4	1.6	11.6	1.55	7.18	0.96	7.46	.	3320	4173-
LANDER	7	2.6	18.7	2.22	7.10	0.84	8.41	9200	35620	4160
CASPER	7	3.3	16.7	2.70	5.04	0.81	6.20	392500	975107-	3981
WELLS	4	2.6	11.4	1.66	4.36	0.64	6.86	700	19464	3930
DURANGO	8	2.1	8.5	1.41	4.13	0.68	6.03	.	29076	3870
GILLETTE	7	3.0	9.3	1.52	3.06	0.50	6.11	5500	50426-	3711
MESA	4	3.2	9.8	2.81	3.01	0.87	3.47	.	37941	3685
SANTA FE	8	2.1	8.1	1.31	3.90	0.63	6.22	.	70695-	3669
GREAT FALLS	9	3.9	8.8	1.19	2.22	0.30	7.35	.	0	3307
ALBUQUERQUE	6	2.5	9.0	1.74	3.62	0.70	5.20	472000	1149127-	3158
CLIFTON	4	3.0	11.9	2.75	4.03	0.93	4.33	.	0	3136
TORRINGTON	7	3.0	13.2	2.24	4.46	0.76	5.89	.	34841	3046
GALLUP	6	2.1	8.0	1.61	3.74	0.76	4.94	204400	562445-	2997
TULAROSA	4	2.7	11.0	2.27	4.09	0.84	4.87	.	17312	2933
RICHMOND	13	1.3	3.9	0.32	3.05	0.25	12.31	.	1456	2888-
NEWCASTLE	7	2.9	10.4	1.88	3.58	0.65	5.55	173600	298458-	2882
SHIPROCK	6	2.0	7.3	1.70	3.61	0.84	4.31	14100	377253-	2827
WINNEMUCCA	4	2.6	10.2	2.06	3.89	0.78	4.96	.	6569	2812
FLAGSTAFF	6	2.0	6.9	1.40	3.52	0.71	4.95	600	70075	2579
IDAHO FALLS	4	2.5	8.8	1.65	3.50	0.66	5.31	.	0	2578
ADEL	4	2.3	10.7	1.90	4.55	0.81	5.63	.	13585	2571
VYA	4	2.6	8.0	1.75	3.07	0.67	4.58	.	20006	2544
WILLIAMS	6	2.5	7.0	1.34	2.83	0.54	5.24	.	16784	2498
JOHNSON CITY	15	1.1	3.8	1.08	3.35	0.95	3.54	.	659	2487
DEATH VALLEY	4	2.6	11.4	2.47	4.36	0.95	4.61	4100	41809	2464
PRICE	6	2.3	7.1	1.47	3.08	0.64	4.84	100	2328	2445-
ROCK SPRINGS	7	2.8	9.7	1.99	3.48	0.72	4.86	.	28181	2247
ESCALANTE	6	1.3	4.2	1.21	3.22	0.93	3.46	12300	42191	2210
CORTEZ	6	1.7	6.0	1.12	3.43	0.64	5.33	56100	88494-	2184
CRAIG	7	2.7	8.5	1.73	3.15	0.64	4.91	3700	42781	2124
ELKO	4	2.2	8.4	1.44	3.82	0.65	5.85	.	347	2050
HAVRE	9	3.6	9.8	1.28	2.75	0.35	7.79	.	3732	1818-
LAS VEGAS	4	2.4	3.8	0.70	1.60	0.30	5.43	.	2131	1818
RAWLINS	7	2.6	8.3	1.80	3.16	0.69	4.58	12100	184867-	1818
LOVELOCK	4	2.4	10.6	2.51	4.43	1.05	4.22	.	36	1784
EKALAKA	7	2.5	8.8	1.86	3.50	0.74	4.74	.	17476	1705
EAGLE PASS	12	1.2	7.9	1.06	6.39	0.85	7.42	0	0	1664
MARFA	4	2.0	11.9	2.84	5.86	1.39	4.21	.	983	1623-
KNOXVILLE	15	1.7	8.0	1.17	4.67	0.68	6.83	.	120	1544
RITZVILLE	3	3.6	7.9	2.96	2.16	0.81	2.68	.	31283	1441
SOCORRO	4	1.9	8.9	1.97	4.58	1.01	4.54	72000	85655-	1432

Table 3-7 (Contd)

QUAD	PROV	U	TH	K	THU	KU	THK	RESV	UINV	UINVP
CHEYENNE	7	2.4	9.5	2.27	3.95	0.94	4.21	.	3201	1392
MARBLE CANYON	6	1.6	4.0	1.20	2.52	0.75	3.34	1400	18150	1374
ARMINTO	7	2.4	9.5	2.39	3.89	0.98	3.97	44500	116398-	1318
BILLINGS	7	2.2	7.5	1.55	3.44	0.71	4.86	300	1154	1253-
CODY	7	2.2	6.6	1.34	2.98	0.60	4.96	.	4490	1245
GRAND CANYON	6	1.8	4.1	0.95	2.23	0.52	4.31	4500	59029-	1200
TOOELE	4	2.0	5.6	1.11	2.85	0.57	5.04	.	0	1124
BALTIMORE	15	2.0	7.3	1.35	3.68	0.69	5.37	.	1303	1024-
PRESIDIO	4	1.9	7.8	2.11	4.04	1.09	3.70	.	576	997-
LAKE CHAMPLAIN	14	1.1	4.2	1.27	3.81	1.14	3.33	0	0	987
EMORY PEAK	4	1.9	7.6	2.07	3.99	1.08	3.69	.	10188	972
SPARTANBURG	15	1.8	7.7	0.90	4.38	0.51	8.57	.	7051	950
BOISE	3	2.5	7.6	1.77	3.01	0.70	4.28	.	19472	897
SAN ANTONIO	12	1.0	6.0	0.59	5.81	0.57	10.24	9	204	894
VAN HORN	4	1.9	5.5	1.36	2.96	0.73	4.07	.	0	891
FT. STOCKTON	4	1.6	6.8	1.68	4.35	1.08	4.04	.	4250	882
WINSTON SALEM	15	2.1	8.2	1.11	3.94	0.53	7.38	.	21220	834
GLENS FALLS	14	1.3	5.1	1.42	3.95	1.11	3.56	.	5878	829
CHARLOTTESVILLE	15	1.8	6.0	0.93	3.44	0.53	6.51	.	321	771
CHARLOTTE	15	2.3	10.3	0.95	4.52	0.42	10.84	.	15048	707
CHARLESTON	15	1.9	6.5	0.86	3.50	0.46	7.60	0	0	672
GREENSBORO	15	2.0	7.1	0.88	3.51	0.44	8.06	.	12376	643
CUT BANK	5	2.8	8.5	1.20	3.06	0.43	7.08	.	0	639
GREENVILLE	15	2.7	11.2	1.00	4.18	0.37	11.21	.	225	620
PLAINVIEW	11	1.5	7.6	1.77	5.02	1.17	4.28	.	33750	618
SPOKANE	5	3.0	6.8	1.53	2.25	0.51	4.43	.	11957	615
ATHENS	15	2.0	8.8	0.74	4.33	0.36	11.95	.	1190	607
BELOIT	9	2.8	11.5	1.93	4.12	0.69	5.96	.	0	589
LINCOLN	9	2.1	9.4	1.42	4.41	0.67	6.61	.	0	553
RAPID CITY	9	2.6	8.4	1.62	3.24	0.62	5.20	600	8252	541
BAKER	3	1.4	5.5	1.29	3.93	0.91	4.29	0	0	537
GRAND ISLAND	9	2.7	11.0	2.01	4.07	0.74	5.47	.	0	515
SHELBY	9	2.8	7.5	1.84	2.73	0.66	4.10	.	0	506
OKLAHOMA CITY	11	1.4	6.9	0.98	4.83	0.68	7.09	0	0	504
GREAT BEND	9	2.6	10.8	2.02	4.08	0.76	5.35	.	0	492
LA JUNTA	9	2.7	11.0	2.09	4.07	0.77	5.26	.	0	485
WILLIAMSPORT	14	1.2	4.6	0.59	3.72	0.48	7.81	.	458	473-
ELK CITY	5	1.5	7.9	1.89	5.28	1.27	4.16	.	1026	468
FREMONT	9	1.9	8.1	1.42	4.35	0.76	5.73	.	0	464
BROWNSVILLE	12	1.2	3.4	0.95	2.88	0.80	3.61	0	0	462
ASHTON	5	2.4	8.6	1.49	3.53	0.61	5.78	.	1013	451
SIOUX CITY	9	2.1	8.1	1.60	3.79	0.74	5.09	.	0	420
LUBBOCK	9	1.5	7.0	1.58	4.78	1.08	4.42	.	3565	411
OGDEN	5	2.2	7.5	1.35	3.37	0.60	5.59	.	0	411
CLOVIS	9	1.8	7.8	1.63	4.48	0.93	4.81	.	3984	400
DALHART	9	2.1	6.2	1.32	2.90	0.62	4.67	.	4538	385
LEWISTOWN	9	2.4	7.3	1.75	3.04	0.73	4.15	.	2263	384
BROKEN BOW	9	2.1	8.5	1.79	4.10	0.86	4.74	.	0	382
DICKINSON	9	2.1	5.8	1.22	2.78	0.58	4.76	2300	17160	382
DUBOIS	5	1.8	6.6	1.15	3.71	0.65	5.70	.	6383	379
NEWARK	14	2.9	5.6	0.98	1.94	0.34	5.76	.	8799	373
VERNAL	5	2.3	5.9	1.27	2.58	0.55	4.67	6000	50227-	373
LLANO	9	1.2	4.9	1.01	4.19	0.86	4.89	.	36	371
HAILEY	5	2.3	11.0	2.13	4.67	0.91	5.15	.	6813	369
DEL RIO	9	1.1	4.6	0.43	4.28	0.40	10.65	0	0	363
GEORGETOWN	13	1.2	4.8	0.18	4.07	0.15	26.89	.	0	363
LAWTON	11	1.7	7.7	1.57	4.47	0.91	4.93	.	26150	360
HARTFORD	14	1.9	6.5	1.24	3.44	0.66	5.25	.	2432	360
WICHITA FALLS	11	1.8	8.5	1.28	4.72	0.71	6.64	.	67929-	359
BOZEMAN	5	2.0	7.7	1.59	3.83	0.79	4.86	.	75935-	354
CHALLIS	5	2.4	10.5	2.12	4.42	0.89	4.94	100	15836	351
DODGE CITY	9	2.4	10.1	2.28	4.12	0.93	4.43	.	0	350
HARRISBURG	14	2.8	5.9	0.92	2.14	0.33	6.47	.	5678	349
BROWNFIELD	9	1.2	4.9	1.07	4.10	0.90	4.56	.	5815	347
ALLIANCE	9	1.8	7.6	1.72	4.11	0.93	4.40	.	1452	345
TUCUMCARI	9	1.7	6.8	1.56	4.11	0.94	4.37	.	3490	341
LAMAR	9	2.9	12.4	2.79	4.25	0.96	4.44	.	915	337
WHITE SULPHUR SPRIN	5	2.0	6.9	1.48	3.43	0.73	4.66	.	22926	332
LEMMON	9	1.8	5.8	1.21	3.31	0.69	4.79	1500	52424-	331
DILLON	5	2.1	7.3	1.61	3.48	0.77	4.54	.	43232	327
GREEN BAY	11	1.3	3.7	1.26	2.93	1.01	2.90	0	4	327
SALT LAKE CITY	5	1.6	5.9	1.21	3.56	0.73	4.86	.	0	326
PORTLAND	14	2.2	7.6	1.38	3.52	0.64	5.54	.	8094	321
HAMILTON	5	2.2	6.7	1.54	3.09	0.71	4.34	.	5057	318
PECOS	9	1.7	5.5	1.20	3.19	0.69	4.63	0	0	315
BUTTE	5	2.3	7.4	1.77	3.26	0.78	4.20	.	180800-	312
SANDPOINT	5	2.1	6.7	1.56	3.17	0.74	4.29	800	34162	309

Table 3-7 (Contd)

QUAD	PROV	U	TH	K	THU	KU	THK	RESV	UINV	UINVP
CLINTON	11	1.7	6.7	2.07	3.95	1.22	3.23	.	6782	306
AMARILLO	9	1.7	7.0	1.81	4.22	1.09	3.87	.	34782	302
KLAMATH FALLS	4	1.1	3.0	0.91	2.87	0.86	3.34	500	2512	287
HUTCHINSON	11	1.9	8.2	1.15	4.29	0.60	7.17	0	311	286-
SCRANTON	14	2.1	5.1	0.80	2.42	0.38	6.40	.	21587	280
ABILENE	11	1.7	6.9	0.91	3.97	0.52	7.59	.	0	280
EAU CLAIRE	11	1.3	3.5	1.09	2.77	0.87	3.20	0	0	278
CHOTEAU	5	1.8	5.8	1.44	3.18	0.78	4.06	.	0	276
PRATT	9	2.1	8.5	2.25	3.98	1.05	3.78	0	0	273
ENID	11	2.0	8.8	1.30	4.32	0.64	6.75	.	0	269
WICHITA	11	2.2	9.3	1.48	4.31	0.69	6.30	0	0	242
TULSA	11	1.9	7.3	0.80	3.79	0.42	9.09	.	0	234
CORPUS CHRISTI	12	1.3	3.7	0.75	2.96	0.60	4.97	.	1202	233
JOPLIN	11	2.2	9.3	0.87	4.20	0.39	10.67	.	0	228
OKANOGAN	5	1.8	5.8	1.70	3.23	0.96	3.38	28600	56019-	228
MCALLEN	12	1.4	3.5	0.99	2.57	0.72	3.58	.	52695-	226
O'NEILL	9	1.5	5.3	1.61	3.45	1.06	3.26	.	0	225
SHERMAN	11	1.9	7.0	0.67	3.70	0.36	10.39	.	5974	216
MANHATTAN	11	2.4	10.0	1.40	4.07	0.57	7.13	.	379	206-
ARDMORE	11	2.3	6.8	0.90	3.02	0.40	7.56	.	0	202
DALLAS	11	1.9	6.8	0.63	3.47	0.32	10.75	.	0	197
POPLAR BLUFF	11	2.1	5.3	0.74	2.51	0.35	7.09	.	1068	185
SEGUIN	12	1.3	5.7	0.61	4.26	0.46	9.36	.	33326	182
LITTLE ROCK	11	1.9	5.4	0.54	2.81	0.28	9.94	.	0	168
SAVANNAH	13	1.3	4.4	0.16	3.50	0.13	27.81	.	0	160
BEEVILLE	12	1.2	3.8	0.43	3.17	0.36	8.84	27000	139721 -	121
AUSTIN	12	1.6	6.1	0.67	3.92	0.43	9.18	.	31964	103
HOUSTON	12	1.4	5.9	0.50	4.06	0.34	11.76	.	3670	95
CRYSTAL CITY	12	1.6	4.6	0.67	2.84	0.41	6.87	27000	102580 -	80
BROWNWOOD	11	0.7	0.5	0.31	0.70	0.44	1.58	.	0	66
PALESTINE	12	1.7	4.8	0.41	2.75	0.24	11.68	.	1691	39
AUGUSTA	13	1.7	7.2	0.17	4.31	0.10	42.12	.	6915	38
FLORENCE	13	1.3	5.3	0.12	4.16	0.09	44.00	.	18	38
IRON MOUNTAIN	10	1.4	5.9	0.50	4.06	0.34	11.76	.	0	36
MARQUETTE	10	0.9	2.2	0.92	2.38	0.98	2.43	.	0	30
RICE LAKE	10	1.3	4.2	1.05	3.36	0.83	4.03	.	417	28
ASHLAND	10	1.2	3.5	1.06	2.91	0.89	3.26	.	0	24
IRON RIVER	10	1.2	3.3	1.12	2.73	0.93	2.93	.	0	20
BEAUMONT	12	1.7	4.7	0.22	2.86	0.13	21.55	.	20696	17
HANCOCK	10	2.3	0.8	1.00	0.35	0.44	0.79	.	0	10

Table 3-8. Predicted UINV Values for +UET Quadrangles Based on a Seven-Variable Model

QUAD	PROV	U	TH	K	THU	KU	THK	UINV	UINVP
TRINIDAD	8	4.6	6.0	2.26	1.28	0.49	2.64	8250	205220
SALINA	6	4.8	7.8	1.42	1.61	0.29	5.47	63545-	88301-
TUCSON	4	3.7	13.3	3.52	3.64	0.96	3.78	842	59617
SILVER CITY	4	4.2	15.1	3.66	3.60	0.87	4.13	1293	54277
RITZVILLE	3	3.6	7.9	2.96	2.18	0.81	2.68	31283	19921-
MOAB	6	3.5	6.3	1.37	1.77	0.39	4.58	334742-	15205
ST. JOHNS	6	4.0	8.4	1.37	2.10	0.34	6.15	32672	11377
HOT SPRINGS	9	5.2	8.4	1.30	1.64	0.25	6.50	64720-	9540
TWIN FALLS	4	4.0	12.9	2.96	3.19	0.73	4.37	10821	7724-
GREELEY	8	3.1	10.9	2.42	3.46	0.77	4.50	39511	6855
MESA	4	3.2	9.8	2.81	3.01	0.87	3.47	37941	5325
WILLIAMS	6	2.5	7.0	1.34	2.83	0.54	5.24	16784	4554
MILLETT	4	3.6	13.0	2.56	3.63	0.72	5.08	3372	4318-
ARMINTO	7	2.4	9.5	2.39	3.89	0.98	3.97	116398-	4256
SALTON SEA	4	3.1	10.7	2.37	3.44	0.76	4.50	2180	4134-
CHEYENNE	7	2.4	9.5	2.27	3.95	0.94	4.21	3201	4042-
RENO	4	3.3	9.6	2.57	2.87	0.77	3.75	3132	3963-
LAS VEGAS	4	2.4	3.8	0.70	1.60	0.30	5.43	2131	3677-
NEEDLES	4	3.3	10.5	2.29	3.19	0.70	4.59	0	2965
NEWARK	14	2.9	5.6	0.98	1.94	0.34	5.76	8799	2914
HARRISBURG	14	2.8	5.9	0.92	2.14	0.33	6.47	5678	2531
PRESCOTT	4	3.1	10.1	2.09	3.21	0.66	4.84	740209-	2249
SCRANTON	14	2.1	5.1	0.80	2.42	0.38	6.40	21587	2212
OGDEN	5	2.2	7.5	1.35	3.37	0.60	5.59	0	2021
WHITE SULPHUR SPRIN	5	2.0	6.9	1.48	3.43	0.73	4.68	22926	1979
TRONA	4	3.2	8.8	1.92	2.76	0.60	4.57	6974	1939
BUTTE	5	2.3	7.4	1.77	3.26	0.78	4.20	180800-	1875
RAPID CITY	9	2.6	8.4	1.62	3.24	0.62	5.20	8252	1847
IDAHO FALLS	4	2.5	8.8	1.65	3.50	0.66	5.31	0	1835
TONOPAH	4	3.7	10.6	2.02	2.87	0.55	5.23	4356	1734
BEEVILLE	12	1.2	3.8	0.43	3.17	0.36	8.84	139721-	1729
WASHINGTON	13	1.6	5.3	0.67	3.39	0.42	7.99	2118	1717-
VYA	4	2.6	8.0	1.75	3.07	0.67	4.58	20006	1529
POCATELLO	4	2.9	9.9	1.72	3.43	0.60	5.74	4052	1432
SHELBY	9	2.8	7.5	1.84	2.73	0.66	4.10	0	1368
LEWISTOWN	9	2.4	7.3	1.75	3.04	0.73	4.15	2263	1360-
GRAND CANYON	6	1.8	4.1	0.95	2.23	0.52	4.31	59029-	1331
SANDPOINT	5	2.1	6.7	1.56	3.17	0.74	4.29	34162	1314
SPOKANE	5	3.0	6.8	1.53	2.25	0.51	4.43	11957	1308
ROCK SPRINGS	7	2.8	9.7	1.99	3.48	0.72	4.86	28181	1297
EKALAKA	7	2.5	8.8	1.86	3.50	0.74	4.74	17476	1256
GOLDFIELD	4	4.4	12.6	2.20	2.87	0.50	5.75	1771	1251-
LEMMON	9	1.8	5.8	1.21	3.31	0.69	4.79	52424-	1248
HAMILTON	5	2.2	6.7	1.54	3.09	0.71	4.34	5057	1248
BALTIMORE	15	2.0	7.3	1.35	3.68	0.69	5.37	1303	1246-
WINSTON SALEM	15	2.1	8.2	1.11	3.94	0.53	7.38	21220	1209
TULSA	11	1.9	7.3	0.80	3.79	0.42	9.09	0	1126
DALHART	9	2.1	6.2	1.32	2.90	0.62	4.67	4538	999
PECOS	9	1.7	5.5	1.20	3.19	0.69	4.63	0	989
TOOELE	4	2.0	5.6	1.11	2.85	0.57	5.04	0	974
CHARLOTTESVILLE	15	1.8	6.0	0.93	3.44	0.53	6.51	321	967
BILLINGS	7	2.2	7.5	1.55	3.44	0.71	4.86	1154	962-
RICHMOND	13	1.3	3.9	0.32	3.05	0.25	12.31	1456	962
NEWCASTLE	7	2.9	10.4	1.88	3.58	0.65	5.55	298458-	952
GREAT FALLS	9	3.9	8.8	1.19	2.22	0.30	7.35	0	934
DICKINSON	9	2.1	5.8	1.22	2.78	0.58	4.76	17160	915
VERNAL	5	2.3	5.9	1.27	2.58	0.55	4.67	50227-	914
CUT BANK	5	2.8	8.5	1.20	3.06	0.43	7.08	0	903
RAWLINS	7	2.6	8.3	1.80	3.16	0.69	4.58	184867	895
CHARLESTON	15	1.9	6.5	0.86	3.50	0.46	7.60	0	867
CHOTEAU	5	1.8	5.8	1.44	3.18	0.78	4.06	0	851
CRAIG	7	2.7	8.5	1.73	3.15	0.64	4.91	42781	834
SHERMAN	11	1.9	7.0	0.67	3.70	0.36	10.39	5974	794
CODY	7	2.2	6.6	1.34	2.98	0.60	4.96	4490	666
GREENSBORO	15	2.0	7.1	0.88	3.51	0.44	8.06	12376	665
CRYSTAL CITY	12	1.6	4.5	0.67	2.84	0.41	6.87	102580-	630
VAN HORN	4	1.9	5.5	1.36	2.96	0.73	4.07	0	622
DYERSBURG	13	2.2	6.4	1.14	2.89	0.51	5.63	4275	560
DALLAS	11	1.9	6.8	0.63	3.47	0.32	10.75	0	503
GILLETTE	7	3.0	9.3	1.52	3.06	0.50	6.11	50426-	481
ARDMORE	11	2.3	6.8	0.90	3.02	0.40	7.56	0	470
OKANOGAN	5	1.8	5.8	1.70	3.23	0.96	3.38	56019-	459
CORPUS CHRISTI	12	1.3	3.7	0.75	2.96	0.60	4.97	1202	448
POPLAR BLUFF	11	2.1	5.3	0.74	2.51	0.35	7.09	1068	444
HAVRE	9	3.6	9.8	1.26	2.76	0.35	7.79	3732	431
LITTLE ROCK	11	1.9	5.4	0.54	2.81	0.28	9.94	0	410
MARBLE CANYON	6	1.6	4.0	1.20	2.52	0.75	3.34	18150	346
PALESTINE	12	1.7	4.8	0.41	2.75	0.24	11.68	1691	288
O'NEILL	9	1.5	5.3	1.61	3.45	1.06	3.26	0	260
JOHNSON CITY	15	1.1	3.8	1.08	3.35	0.95	3.54	659	88
BROWNSVILLE	12	1.2	3.4	0.95	2.88	0.80	3.61	0	81
MCALLEN	12	1.4	3.5	0.99	2.57	0.72	3.58	52696-	71
KLAMATH FALLS	4	1.1	3.0	0.91	2.87	0.86	3.34	2512	62
EAU CLAIRE	11	1.3	3.5	1.09	2.77	0.87	3.20	0	42
HANCOCK	10	2.3	0.8	1.00	0.35	0.44	0.79	0	26
SAVANNAH	13	1.3	4.4	0.16	3.50	0.13	27.81	0	24
BEAUMONT	12	1.7	4.7	0.22	2.86	0.13	21.55	20696	23
GREEN BAY	11	1.3	3.7	1.26	2.93	1.01	2.90	4	20
BROWNWOOD	11	0.7	0.5	0.31	0.70	0.44	1.58	0	14
MARQUETTE	10	0.9	2.2	0.92	2.38	0.98	2.43	0	7

Table 3-9. Predicted UINV Values for -UET Quadrangles Based on a Seven-Variable Model

QUAD	PROV	U	TH	K	THU	KU	THK	UINV	UINVP
DENVER	8	3.5	17.1	2.87	4.87	0.82	5.95	146303-	215001-
JORDAN VALLEY	4	3.6	19.7	2.22	5.40	0.61	8.86	20980	123956
LANDER	7	2.6	18.7	2.22	7.10	0.84	8.41	35620	74096
ESCALANTE	6	1.3	4.2	1.21	3.22	0.93	3.46	42191	67464-
MARFA	4	2.0	11.9	2.84	5.86	1.39	4.21	983	36201
RATON	8	2.6	9.9	1.64	3.84	0.63	6.06	46913	21508
LAKE CHAMPLAIN	14	1.1	4.2	1.27	3.81	1.14	3.33	0	20477
CASPER	7	3.3	16.7	2.70	5.04	0.81	6.20	975107-	18323
CORTEZ	6	1.7	6.0	1.12	3.43	0.64	5.33	88494-	18042
PRICE	6	2.3	7.1	1.47	3.08	0.64	4.84	2328	16084
FLAGSTAFF	6	2.0	6.9	1.40	3.52	0.71	4.95	70075-	14677
AZTEC	6	2.3	12.2	1.71	5.31	0.75	7.11	136388-	13644
SHIPROCK	6	2.0	7.3	1.70	3.61	0.84	4.31	377253-	13279
MONTROSE	8	2.9	10.5	2.13	3.61	0.73	4.93	70214-	13211
GALLUP	6	2.1	8.0	1.61	3.74	0.75	4.94	562445-	12181
SANTA FE	8	2.1	8.1	1.31	3.90	0.63	6.22	70695-	12169
LEADVILLE	8	2.3	9.5	1.79	4.17	0.79	5.31	14831	10921-
ALBUQUERQUE	6	2.5	9.0	1.74	3.62	0.70	5.20	1149127-	10660
DELTA	4	3.2	13.7	2.15	4.28	0.67	6.37	50054-	9448
RICHFIELD	4	3.2	12.1	1.96	3.78	0.61	6.18	26064	9417
DURANGO	8	2.1	8.5	1.41	4.13	0.68	6.03	29076	9370
PUEBLO	8	3.3	13.0	2.90	3.89	0.87	4.48	158665-	8909
GLENS FALLS	14	1.3	5.1	1.42	3.95	1.11	3.56	5878	8664 -
CALIENTE	4	3.1	14.1	2.31	4.50	0.74	6.10	592	8217
KNOXVILLE	15	1.7	8.0	1.17	4.67	0.68	6.83	120	5164
WELLS	4	2.6	11.4	1.66	4.36	0.64	6.86	19464	4547
THERMOPOLIS	7	2.3	16.8	1.78	7.45	0.79	9.46	17889	4239
KINGMAN	4	3.3	13.5	2.56	4.13	0.78	5.27	385	3857
TORRINGTON	7	3.0	13.2	2.24	4.46	0.76	5.89	34841	3774
PLAINVIEW	11	1.5	7.6	1.77	5.02	1.17	4.28	33750	3720
DOUGLAS	4	4.4	17.0	3.42	3.88	0.78	4.98	0	3572
ELKO	4	2.2	8.4	1.44	3.82	0.65	5.86	347	2912
WALKER LAKE	4	3.7	14.5	2.91	3.90	0.78	4.98	26660	2822
GEORGETOWN	13	1.2	4.8	0.18	4.07	0.15	26.89	0	2480
ADEL	4	2.3	10.7	1.90	4.55	0.81	5.63	13585	2131
WINNEMUCCA	4	2.6	10.2	2.06	3.89	0.78	4.96	6559	1835
TULAROSA	4	2.7	11.0	2.27	4.09	0.84	4.87	17312	1729
DEATH VALLEY	4	2.6	11.4	2.47	4.36	0.95	4.61	41809	1627
SPARTANBURG	15	1.8	7.7	0.90	4.38	0.51	8.57	7051	1623
CLINTON	11	1.7	6.7	2.07	3.95	1.22	3.23	6782	1577
EAGLE PASS	12	1.2	7.9	1.06	6.39	0.86	7.42	0	1292
LOVELOCK	4	2.4	10.6	2.51	4.43	1.05	4.22	36	1234
SOCORRO	4	1.9	8.9	1.97	4.58	1.01	4.54	85655 -	1140
CLIFTON	4	3.0	11.9	2.75	4.03	0.93	4.33	0	956
GREENVILLE	15	2.7	11.2	1.00	4.18	0.37	11.21	225	895
WILLIAMSPORT	14	1.2	4.6	0.59	3.72	0.48	7.81	458	839 -
HARTFORD	14	1.9	6.5	1.24	3.44	0.66	5.25	2432	818
FT. STOCKTON	4	1.6	6.8	1.68	4.35	1.08	4.04	4250	816
CHARLOTTE	15	2.3	10.3	0.95	4.52	0.42	10.84	15048	631
PRESIDIO	4	1.9	7.8	2.11	4.04	1.09	3.70	576	627 -
EMORY PEAK	4	1.9	7.6	2.07	3.99	1.08	3.69	10188	621
NOGALES	4	4.0	15.5	3.61	3.84	0.89	4.29	2676	612
ATHENS	15	2.0	8.8	0.74	4.33	0.36	11.95	1190	564
LAWTON	11	1.7	7.7	1.57	4.47	0.91	4.93	26150	488
ELK CITY	5	1.5	7.9	1.89	5.28	1.27	4.16	1026	464
PORTLAND	14	2.2	7.6	1.38	3.52	0.64	5.54	8094	453
CEDAR CITY	4	1.6	11.6	1.55	7.18	0.96	7.46	3820	413
BROWNFIELD	9	1.2	4.9	1.07	4.10	0.90	4.56	5815	356
LLANO	9	1.2	4.9	1.01	4.19	0.86	4.89	36	296
SALT LAKE CITY	5	1.6	5.9	1.21	3.56	0.73	4.86	0	293
BOISE	3	2.5	7.6	1.77	3.01	0.70	4.28	19472	274
LUBBOCK	9	1.5	7.0	1.58	4.78	1.08	4.42	3565	261
DUBOIS	5	1.8	6.6	1.15	3.71	0.65	5.70	6383	258
BAKER	3	1.4	5.5	1.29	3.93	0.91	4.29	0	233
TUCUMCARI	9	1.7	6.8	1.56	4.11	0.94	4.37	3490	219
AMARILLO	9	1.7	7.0	1.81	4.22	1.09	3.87	34782	217
SIOUX CITY	9	2.1	8.1	1.60	3.79	0.74	5.09	0	203
BELOIT	9	2.8	11.5	1.93	4.12	0.69	5.96	0	199
LINCOLN	9	2.1	9.4	1.42	4.41	0.67	6.61	0	198
CLOVIS	9	1.8	7.8	1.63	4.48	0.93	4.81	3984	195
FREMONT	9	1.9	8.1	1.42	4.35	0.76	5.73	0	187
ASHTON	5	2.4	8.6	1.49	3.53	0.61	5.78	1013	182
ALLIANCE	9	1.8	7.6	1.72	4.11	0.93	4.40	1452	180
ABILENE	11	1.7	6.9	0.91	3.97	0.52	7.59	0	174
BROKEN BOW	9	2.1	8.5	1.79	4.10	0.86	4.74	0	159
GRAND ISLAND	9	2.7	11.0	2.01	4.07	0.74	5.47	0	154
GREAT BEND	9	2.6	10.8	2.02	4.08	0.76	5.35	0	146
WICHITA FALLS	11	1.8	8.5	1.28	4.72	0.71	6.64	67929-	137
LA JUNTA	9	2.7	11.0	2.09	4.07	0.77	5.26	0	135
OKLAHOMA CITY	11	1.4	6.9	0.98	4.83	0.68	7.09	0	127
FLORENCE	13	1.3	5.3	0.12	4.16	0.09	44.00	18	127
BOZEMAN	5	2.0	7.7	1.59	3.83	0.79	4.86	75985-	126
DILLON	5	2.1	7.3	1.61	3.48	0.77	4.54	43232	124
HAILEY	5	2.3	11.0	2.13	4.67	0.91	5.15	6813	120
HUTCHINSON	11	1.9	8.2	1.15	4.29	0.60	7.17	311	111

Table 3-9 (Contd)

QUAD	PROV	U	TH	K	THU	KU	THK	UINV	UINVP
SEGUIN	12	1.3	5.7	0.61	4.26	0.46	9.36	33326	110
ENID	11	2.0	8.8	1.30	4.32	0.64	6.75	0	109
WICHITA	11	2.2	9.3	1.48	4.31	0.69	6.30	0	105
DODGE CITY	9	2.4	10.1	2.28	4.12	0.93	4.43	0	94
CHALLIS	5	2.4	10.5	2.12	4.42	0.39	4.94	15836	91
DEL RIO	9	1.1	4.6	0.43	4.28	0.40	10.65	0	91
AUSTIN	12	1.6	6.1	0.67	3.92	0.43	9.18	31964	90
PRATT	9	2.1	8.5	2.25	3.98	1.05	3.78	0	82
AUGUSTA	13	1.7	7.2	0.17	4.31	0.10	42.12	6915	73
LAMAR	9	2.9	12.4	2.79	4.25	0.96	4.44	915	69
MANHATTAN	11	2.4	10.0	1.40	4.07	0.57	7.13	379	66
JOPLIN	11	2.2	9.3	0.87	4.20	0.39	10.67	0	56
HOUSTON	12	1.4	5.9	0.50	4.06	0.34	11.76	3670	37
IRON RIVER	10	1.2	3.3	1.12	2.73	0.93	2.93	0	30
ASHLAND	10	1.2	3.5	1.06	2.91	0.89	3.26	0	27
SAN ANTONIO	12	1.0	6.0	0.59	5.81	0.57	10.24	204	24
RICE LAKE	10	1.3	4.2	1.05	3.36	0.83	4.03	417	9
IRON MOUNTAIN	10	1.4	5.9	0.50	4.06	0.34	11.76	0	0

Similar stepwise multiple linear regressions were done for regionally adjusted* data for the same 193-quadrangle data set with UINVL as the dependent variable. The objective was to investigate the possible advantage of province adjustment in partially correcting for soil moisture and vegetation absorption of gamma rays and geochemical effects that vary from province to province. Another regression was performed on the data after having corrected for these effects by applying a correction factor related to a moisture index (IM) developed earlier (Texas Instruments, 1980). Based on the maximum R^2 values obtained with UINVL as a dependent variable, it was concluded that province adjustment was the most satisfactory data treatment; however, as indicated above, it is not good enough for quantitative prediction.

3) Summary of Conclusions

In spite of these somewhat disappointing results, several useful conclusions have been reached through this exercise. In summary, they are:

- The three radioelements U, Th, and K are well correlated with one another, as they should be.

variables	corr. coeff.
U and Th	0.68
U and K	0.66
Th and K	0.76

- UINVL and RESVL are well correlated with uranium, thorium and potassium (Table 3-6), providing support for the uraniferous (or more accurately, radioelement) province concept, and an exponential rather than linear relationship exists between uranium, thorium, and potassium, and UINV.
- Province adjustment of the radioelement data is slightly superior to region adjustment and correction of regional gamma-ray absorption and geochemical weathering effects by correction factors based on the moisture index (IM), as described in Texas Instruments (1980).

The most important conclusion is that no combination of whole-quadrangle average radiometric parameters has been found that can be used effectively to quantitatively relate the radiation measurements to uranium inventory.

*Regional adjustment is done by dividing each quadrangle average by the corresponding average for the whole conterminous United States.

There is too much noise unaccounted for in the equations tested thus far. A major cause of this is thought to be the simultaneous presence of uranium-enriched and uranium-depleted areas in the same quadrangle, with a resulting cancellation of their effects on the radiometric averages. Figure 3-14 shows a gradient-distribution curve for whole-quadrangle average UET values. The highlighted (high UINV) quadrangles are seen to be somewhat bunched at low values (primarily uranium source-rock types) or at high values (primarily uranium host-rock types) or scattered at intermediate values. Those scattered in the middle were found to have both high and low UET samples present in each that were indeed cancelling each other in the overall average UET. This has led to the conclusion that parameters related to the variance of UET in each quadrangle should be a better measure of uranium favorability than the whole-quadrangle averages of the variable (see paragraph III.B.1.b).

b. Outcrop UET Parameters

1) Gradient-Distribution Curves

Ninety-seven representative uranium-producing and barren quadrangles were selected to test the relationship between UET* variation in each quadrangle and the quadrangle's uranium inventory (UINV). The uranium excess over thorium was investigated on a local "outcrop" basis along each flight line. The "outcrop" data set used to prepare the outcrop, radiometric-lithology, and source/host rock maps (Texas Instruments, 1980) was reprocessed to give a gradient distribution curve of the "outcrop" UET* values for each quadrangle. Each "outcrop" consists of up to 25 individual, contiguous, 1-second records in a given geologic formation. Characteristically, each quadrangle contains several hundred to several thousand "outcrops."

The gradient-distribution curve (GDC) provides a more rapid, convenient, and accurate method of defining anomalous outcrops than do the standard statistical approaches. Figure 3-15 is a typical GDC for +UET values illustrating the well-defined breaks in slope (thresholds T_0, T_1, and T_2) that separate anomalous groups from the normal distribution of background values.

*UET = AU - ATh, where the data are adjusted by dividing each outcrop value for U or Th by the average for that element over the whole quadrangle.

Experience shows that nearly all GDCs of large data sets display at least three thresholds or breaks, dividing the anomalies into three classes of 1) major, 2) medium, and 3) minor magnitude. The number, intensity, and variance of these anomalies are measures of the degree of uranium enrichment in each quadrangle.

Figure 3-16 shows the negative end of the UET GDC, which is also divided into groups of anomalous uranium-depleted outcrops by thresholds T_0', T_1', and T_2'. The degree of uranium depletion can be measured in terms of the number, intensity, and variance of these anomalies.

Figure 3-17 illustrates the types of measurements made on the UET gradient distribution curves for the 97 quadrangles. They are:

PT — Positive threshold (T_1 on the GDC)

MPGT — Mean of Positive values Greater than Threshold (PT)

SPGT — Standard deviation of Positive values Greater than Threshold

MPLT — Mean of Positive values Less than Threshold (PT)

SPLT — Standard deviation of Positive values Less than Threshold

NH — Number of anomalous uranium-enriched outcrops (possible uranium host rocks)

NS — Number of anomalous uranium-depleted outcrops (possible uranium source rocks)

NOC — Total number of outcrops

NT — Negative threshold (T_1' on the GDC)

MNGT — Mean of Negative values Greater than Threshold (NT)

SNGT — Standard deviation of Negative values Greater than Threshold

MNLT — Mean of Negative values Less than Threshold (NT)

SNLT — Standard deviation of Negative values Less than Threshold.

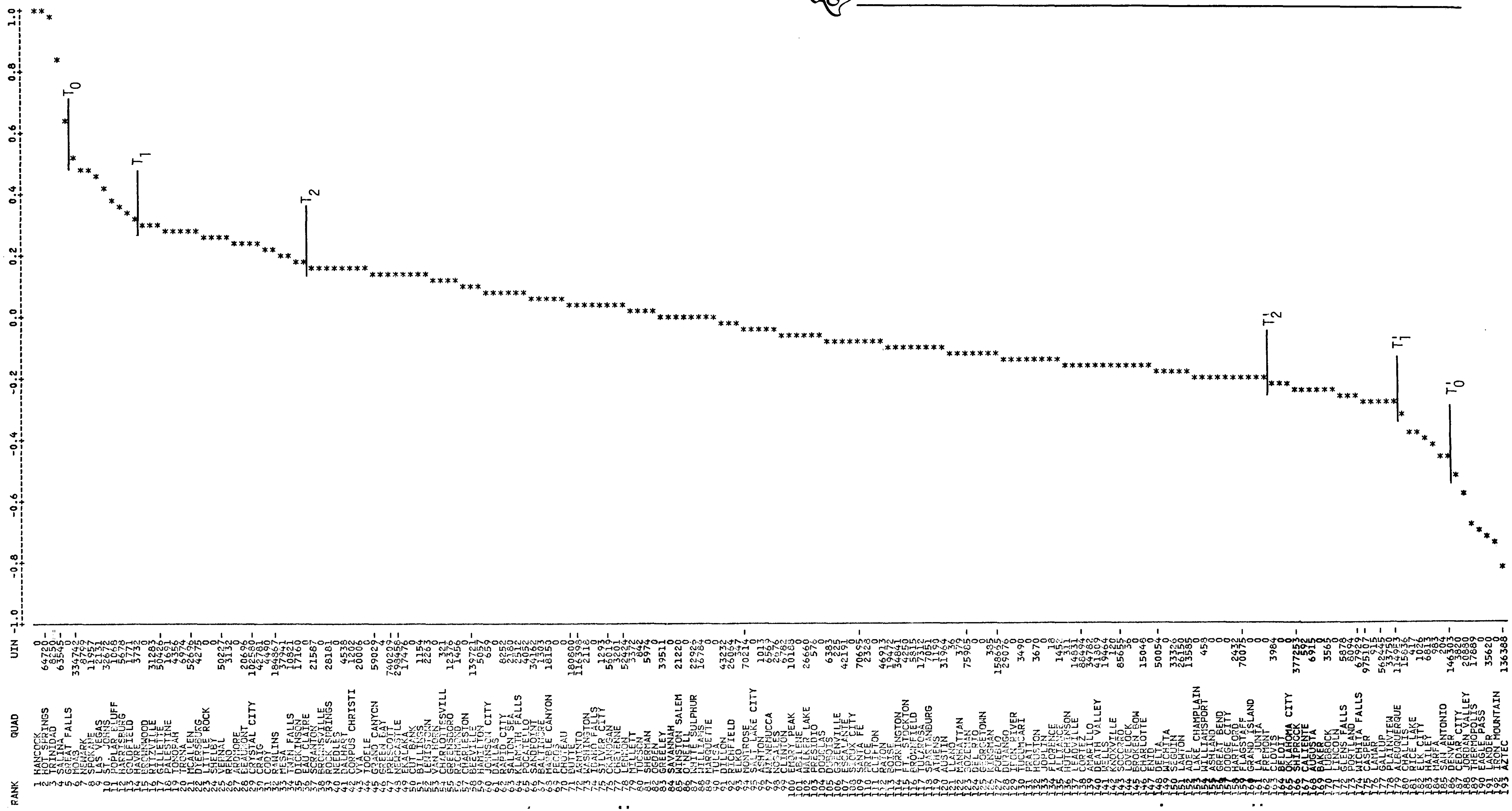


Figure 3-14. Gradient Distribution of Quadrangles Organized by Decreasing Values of UET

1	4817.00
2	4633.00
3	4156.00
4	3843.00
5	1654.00
6	2202.00
7	1436.00
8	2471.00
9	5215.00
10	3144.00
11	2535.00
12	3028.00
13	2537.00
14	1090.00
15	2884.00
16	3468.00
17	3170.00
18	2176.00
19	4159.00
20	5504.00
21	5169.00
22	3237.00
23	2465.00
24	663.00
25	3655.00
26	2707.00
27	4707.00
28	4978.00
29	4635.00
30	4324.00
31	1228.00
32	3194.00
33	3741.00
34	1127.00
35	814.00
36	4733.00
37	4290.00
38	2849.00
39	2419.00
40	5195.00
41	4143.00
42	742.00
43	3092.00
44	2745.00
45	5142.00
46	2461.00
47	3168.00
48	2832.00
49	2563.00
50	2771.00
51	5079.00
52	4577.00
53	5779.00
54	2560.00
55	3324.00
56	2445.00
57	636.00
58	4662.00
59	4792.00
60	5526.00
61	5493.00
62	3405.00
63	3520.00
64	1645.00
65	4208.00
66	4560.00
67	3577.00
68	2826.00
69	1937.00
70	822.00
71	340.00
72	366.00
73	523.00
74	5105.00
75	5157.00
76	3546.00
77	1142.00
78	2211.00
79	4603.00
80	3650.00
81	3525.00
82	5001.00
83	3273.00

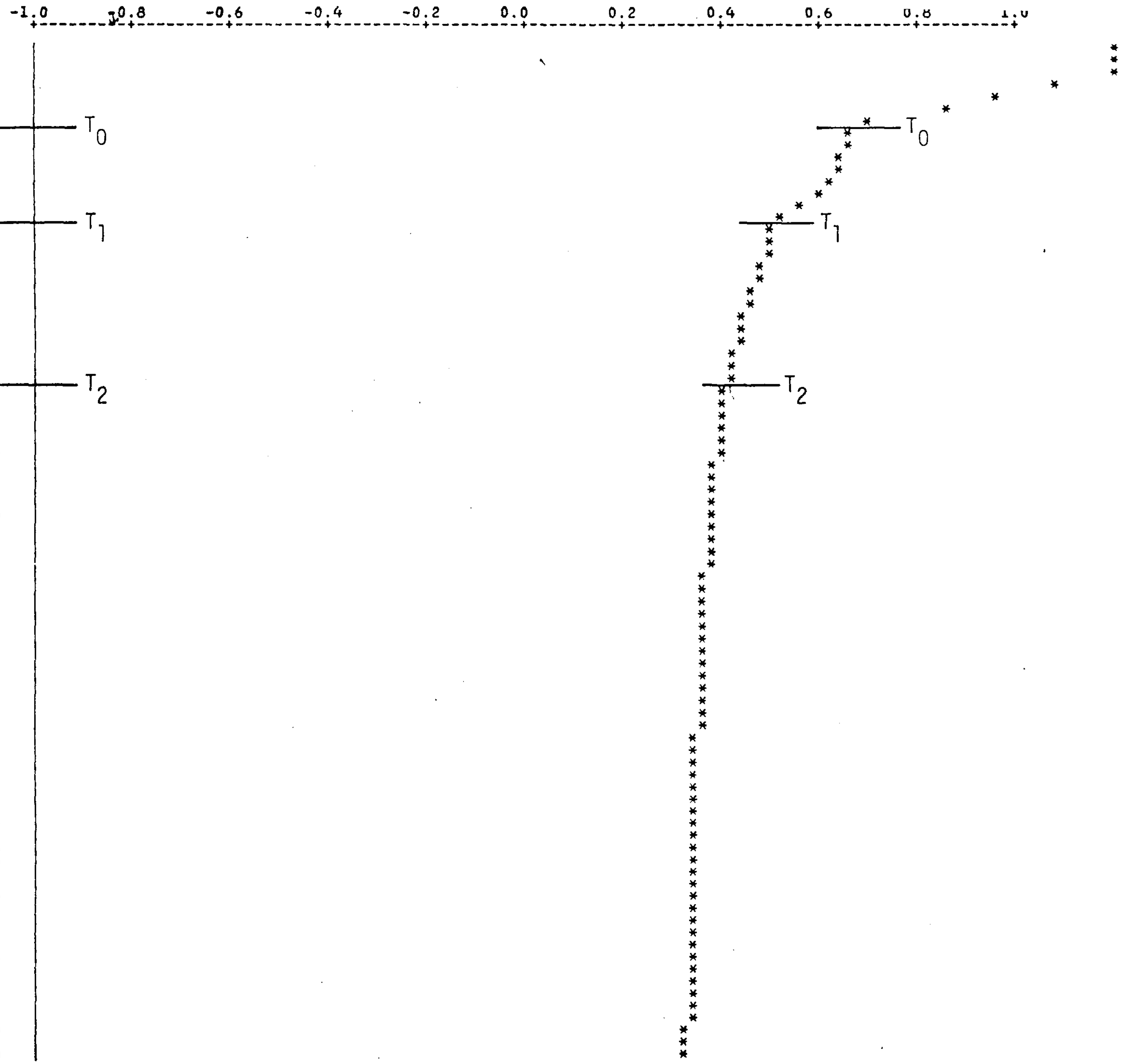


Figure 3-15. Gradient Distribution of Outcrops Organized by Decreasing Values of UET for a Typical Quadrangle

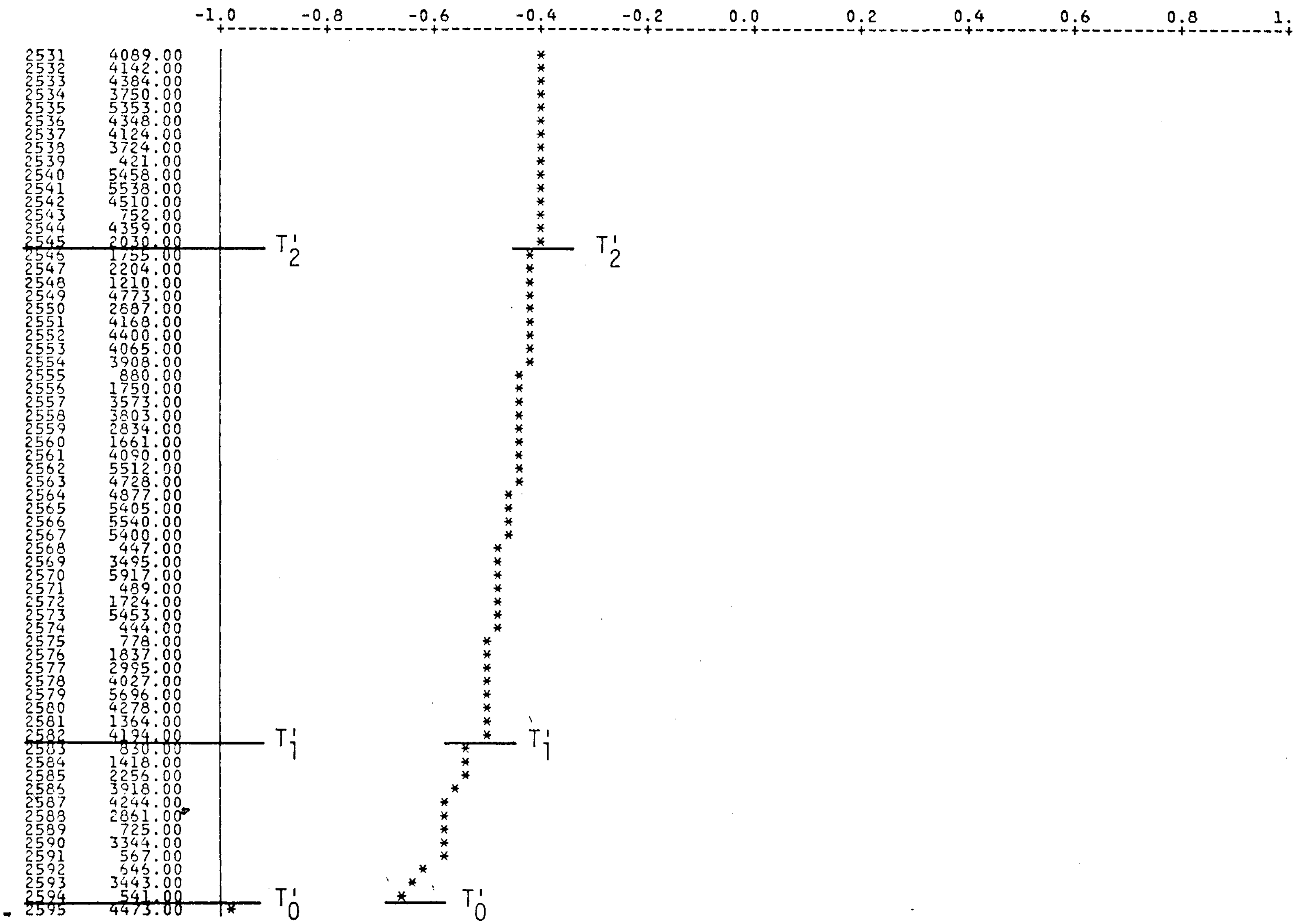


Figure 3-16. Gradient Distribution of Outcrops Organized by Decreasing Values of UET for a Typical Quadrangle

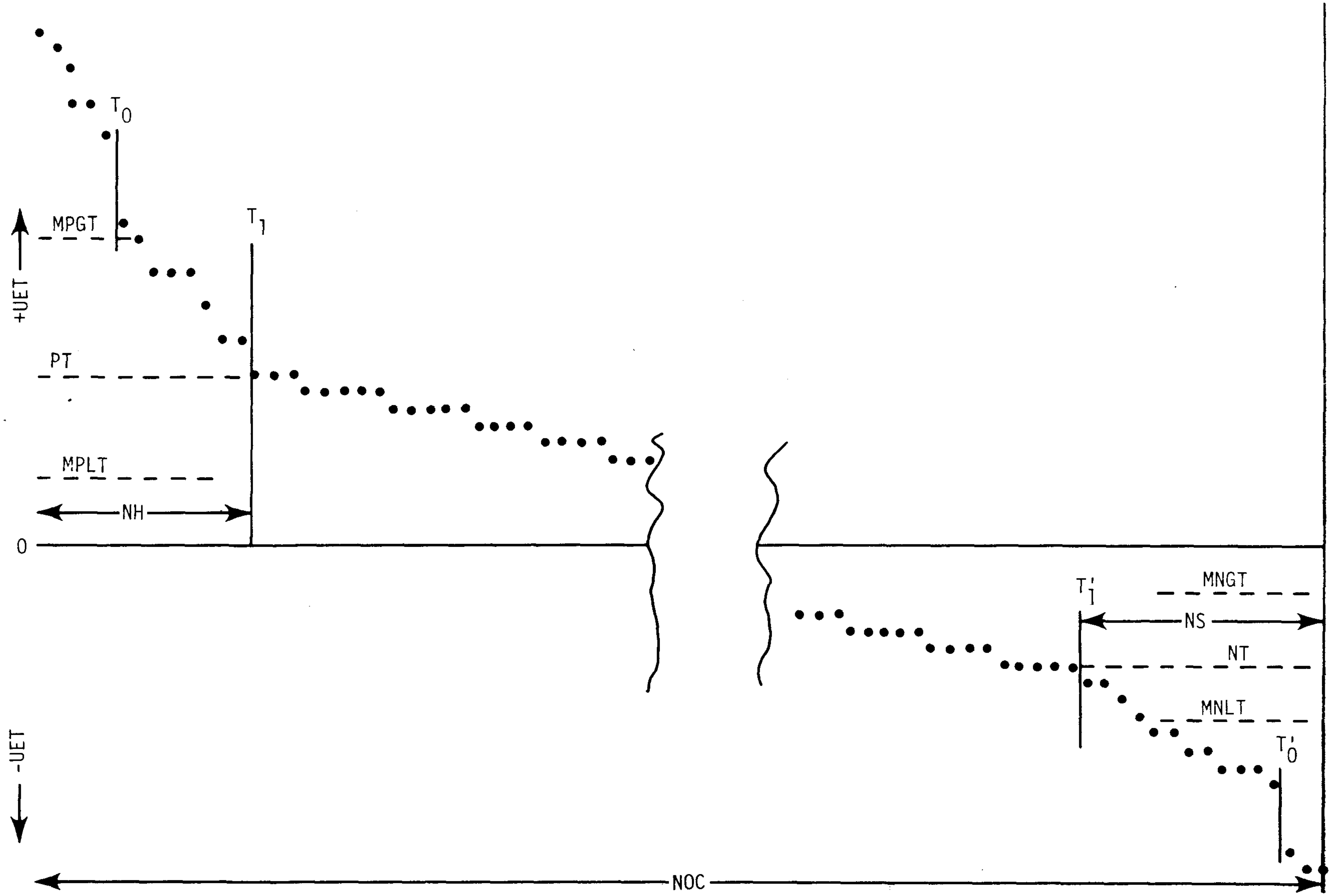


Figure 3-17. Outcrop UET Gradient Distribution Curve Parameters

Table 3-10 summarizes these data for the 97 test quadrangles and also lists latitude (LAT) and longitude (LONG) of the center of the quadrangle and the quadrangle uranium inventory (UINV), which is the total of past production, reserves and potential resources above 0.01 percent U_3O_8 expressed in tons of U_3O_8.

2. Prediction of Uranium Inventory

Through a process of successive experiments, all the GDC parameters and many mathematical combinations of them were entered as independent variables in stepwise multiple linear regressions with UINV as the dependent variable. The following six-variable model was chosen as the best one to predict UINV:

$$UINV = -446.2\ N + 936\ P + 2895\ A + 7516\ B - 0.1855\ H + 27.98\ M$$

where

$$N = (SPGT)\ (NH)\ (NS)$$
$$P = (SPGT + MPGT)\ (NH)^2\ (NS)^2/10{,}000$$
$$A = (SPGT)\ (NH)$$
$$B = (SPGT)\ (NS)$$
$$H = (NH)^2\ (NS)^2$$
$$M = (NH + NS)^2$$

The equation was constrained to pass through zero.

For this relationship, $R^2 = 0.73$, indicating that 73 percent of the variance in UINV is accounted for by these combinations of MPGT, SPGT, NH, and NS. Table 3-11 gives the predicted UINV values under predicted inventory for each quadrangle based on the UET anomalous values. The prediction is seen to be excellent for Albuquerque, Casper, and Moab and quite reasonable for the rest of the 27 quadrangles highlighted next to the UINVP column. These all agree with the DOE estimate of UINV within a factor of two. Quadrangles with major UINV (>50,000 tons of U_3O_8) are highlighted beside the UINV column, illustrating the grouping of the more productive quadrangles near the top of the list.

Table 3-10. Some Parameters for Quadrangles in the Conterminous United States

QUAD	LAT	LONG	UINV	NOC	NH	NS	MPGT	SPGT	MPLT	SPLT	MNGT	SNGT	MNLT	SNLT
ALBUQUERQUE	35.500	107.000	1149127	5740	84	40	2.1960	5.0120	0.2063	0.1561	-0.2934	0.2897	-1.1706	0.0862
ASHTON	44.500	111.000	1013	3445	31	10	0.9020	0.1030	0.1759	0.1467	-1.1801	0.1541	-1.2240	0.3318
AUGUSTA	33.500	81.000	6915	1678	15	16	1.0670	0.2844	0.1431	0.1262	-0.1507	0.1290	-0.9128	0.2587
BAKER	44.500	117.000	0	3696	23	19	0.9348	0.1372	0.1985	0.1570	-0.1933	0.1488	-0.8863	0.1310
BEEVILLE	28.583	97.250	139721	3742	44	23	0.6517	0.2735	0.1611	0.1089	-0.1927	0.1537	-0.8468	0.1241
BROWNSVILLE	26.500	97.667	0	1251	37	25	0.4686	0.0989	0.1383	0.0903	-0.1727	0.1263	-0.8754	0.2479
BUTTE	46.500	113.000	180800	3961	33	23	0.8386	0.6412	0.1687	0.1150	-0.2257	0.2184	-1.2070	0.1914
CASPER	42.500	107.000	975107	4390	32	66	2.9450	2.4630	0.2768	0.2273	-0.3081	0.2580	-1.6600	0.3597
CHALLIS	44.500	115.000	15836	6591	38	8	1.3550	0.5859	0.2209	0.1855	-0.2323	0.2054	-1.4070	0.1550
CHEYENNE	41.500	105.000	3201	3419	18	43	1.3330	0.3130	0.2133	0.1792	-0.1988	0.1603	-1.2000	0.3053
CLINTON	35.500	99.000	6782	2595	18	13	0.8593	0.4772	0.1413	0.0986	-0.1540	0.1147	-0.6031	0.1204
CODY	44.500	109.000	4490	5571	29	18	1.7090	0.3050	0.3226	0.2722	-0.3316	0.2589	-1.7270	0.2156
CORPUS CHRISTI	27.500	97.667	1202	1291	7	11	0.7006	0.1587	0.1947	0.1286	-0.2339	0.1578	-0.7668	0.1522
CORTEZ	37.500	109.000	88494	6915	54	21	2.2240	1.6290	0.2880	0.2578	-0.2542	0.1856	-1.2330	0.2201
CRAIG	40.500	107.000	42781	3868	9	11	1.4900	0.2982	0.2094	0.1951	-0.2470	0.2121	-1.0756	0.0375
CRYSTAL CITY	28.500	101.000	102580	4263	13	4	2.5080	2.5950	0.1257	0.1170	-0.1288	0.1025	-0.7350	0.0339
DEATH VALLEY	36.500	117.000	41809	11679	46	44	2.2710	3.1020	0.2079	0.1746	-0.2228	0.2089	-1.6070	0.6322
DELTA	39.500	113.000	50054	5791	49	32	2.6619	4.2920	0.2513	0.1873	-0.3287	0.3416	-2.5043	0.7768
DENVER	39.500	105.000	146303	7276	13	18	1.5360	0.8807	0.2181	0.1732	-0.2681	0.2760	-2.3110	0.5095
DICKINSON	46.500	103.000	17160	2862	19	14	1.1600	0.2358	0.2285	0.2031	-0.1723	0.1097	-0.5978	0.0822
DUBOIS	44.500	113.000	6383	5156	22	18	1.5900	0.3939	0.3134	0.2609	-0.2826	0.2177	-1.9160	1.1460
DYERSBURG	36.500	89.000	4275	3442	11	15	0.8542	0.2022	0.1435	0.1190	-0.1250	0.0948	-0.6532	0.1366
EAU CLAIRE	44.500	91.000	0	2947	16	36	2.1860	0.3462	0.3934	0.3618	-0.3519	0.2588	-1.2640	0.1718
EKALAKA	45.500	105.000	17476	4990	38	16	1.0460	0.3052	0.1512	0.1314	-0.1333	0.1006	-0.6591	0.0804
ELKO	40.500	115.000	347	5219	12	39	1.2210	0.1618	0.2655	0.1996	-0.2963	0.2423	-1.7490	0.5223
EMORY PEAK	29.500	103.000	10188	2740	6	30	1.8920	0.3645	0.3573	0.2367	-0.3965	0.2927	-2.1520	0.4399
ENID	36.500	97.000	0	3622	32	48	1.1203	0.1959	0.1718	0.1619	-0.1480	0.1110	-0.6246	0.1128
FLAGSTAFF	35.500	111.000	70075	4418	61	18	1.6250	1.0110	0.2678	0.2077	-0.3582	0.2633	-1.4420	0.2002
GALLUP	35.500	109.000	562445	5976	34	22	1.7404	0.3958	0.2568	0.1832	-0.4277	0.3210	-1.6250	0.1972
GILLETTE	44.500	105.000	50426	3535	41	13	0.9576	0.2811	0.1707	0.1402	-0.1523	0.1114	-0.9692	0.2908
GLENS FALLS	43.500	73.000	5878	804	24	28	0.8499	0.1777	0.2000	0.1523	-0.1950	0.1434	-0.7543	0.1419
GRAND CANYON	36.500	113.000	59029	3192	15	25	1.0050	0.0873	0.2070	0.1582	-0.2312	0.1864	-1.2680	0.3840
GREELEY	40.500	105.000	39511	8356	33	8	1.3420	0.3926	0.2151	0.1575	-0.3105	0.3312	-2.8820	0.4625
GREEN BAY	44.500	89.000	4	2858	39	28	1.5300	0.2919	0.3574	0.2856	-0.3331	0.2366	-1.4300	0.3163
GREENSBORO	36.500	79.000	12376	2962	31	23	1.0140	0.1861	0.2090	0.1418	-0.3271	0.3039	-2.9240	1.3390
HAMILTON	46.500	115.000	5057	3566	35	20	1.3410	0.3655	0.2423	0.1995	-0.2491	0.2077	-1.2490	0.1899
HOT SPRINGS	43.500	103.000	64720	3200	28	11	1.3360	0.4022	0.1914	0.1756	-0.2704	0.2183	-0.8810	0.0661
HUTCHINSON	38.500	97.000	311	3263	8	9	0.9155	0.4062	0.1798	0.1430	-0.1489	0.1018	-0.6042	0.0748
IRON RIVER	46.417	89.000	0	2561	27	15	2.0480	0.9312	0.3026	0.2398	-0.2868	0.2213	-1.3820	0.2149
JOPLIN	37.500	95.000	0	2997	53	17	0.8932	0.2735	0.1263	0.1113	-0.1234	0.0908	-0.5762	0.0702
KINGMAN	35.500	115.000	385	8045	17	23	2.8240	0.9949	0.2353	0.1927	-0.2754	0.2483	-1.7820	0.2293
KLAMATH FALLS	42.500	121.000	2512	5213	25	15	1.2710	0.2857	0.1970	0.1657	-0.1964	0.1664	-1.2700	0.3051
LAMAR	38.500	103.000	915	2312	15	9	0.9159	0.2374	0.1418	0.1287	-0.1304	0.1027	-0.6454	0.0434
LANDER	42.500	109.000	35620	4335	17	52	1.4990	0.3346	0.2601	0.1983	-0.3498	0.3231	-0.1963	0.5849
LAREDO	27.500	99.000	280075	2530	13	10	0.9321	0.2966	0.1403	0.1162	-0.1520	0.1180	-0.7086	0.1397
LAS VEGAS	36.500	115.000	2131	5437	23	35	2.2840	1.1450	0.3851	0.2899	-0.5600	0.5088	-2.6560	0.6729
LAWTON	34.500	99.000	26150	2604	5	3	0.5301	0.0586	0.1360	0.0960	-0.1359	0.0983	-1.2097	1.2010
LEADVILLE	39.500	107.000	14831	6194	47	98	1.5160	0.3688	0.3016	0.2395	-0.2982	0.2678	-2.4260	0.9726
LEMMON	45.500	103.000	52424	3564	8	23	2.7490	1.3550	0.2000	0.1915	-0.1700	0.1357	-0.8048	0.1020
LUBBOCK	33.500	101.000	3565	2427	14	5	1.6630	0.8524	0.1786	0.1798	-0.1740	0.1295	-0.6941	0.0334
MANHATTAN	39.500	97.000	379	3588	12	22	0.7720	0.1025	0.1589	0.1368	-0.1331	0.0949	-0.5248	0.0882
MARFA	30.500	104.500	983	2782	11	30	0.9060	0.2446	0.2144	0.1515	-0.2204	0.1828	-1.0950	0.1897
MCALLEN	26.583	98.467	52696	1413	21	27	0.5581	0.1726	0.1382	0.1004	-0.1438	0.1030	-0.5475	0.1129
MCDERMITT	41.500	117.000	3484	4923	15	8	0.7358	0.0926	0.1391	0.1129	-0.1494	0.1267	-0.8712	0.0920
MESA	33.500	111.000	37941	4134	19	57	1.2860	0.3727	0.2310	0.1838	-0.2416	0.2366	-1.6760	0.3528
MILLETT	39.500	117.000	3372	4835	22	24	0.9409	0.2007	0.1898	0.1477	-0.2018	0.1749	-1.6610	0.6139
MOAB	38.500	109.000	334742	5995	34	18	7.3800	9.9160	0.2580	0.2447	-0.2884	0.2193	-1.0200	0.1015
NEWARK	40.500	75.000	8799	4659	16	21	1.4560	0.3082	0.2647	0.2165	-0.2551	0.1997	-1.1050	0.1602
NEWCASTLE	43.500	105.000	298458	3011	55	12	1.3940	1.9930	0.1606	0.1387	-0.1503	0.0971	-0.5071	0.0742
NOGALES	31.750	110.833	2676	1763	9	17	0.9280	0.1824	0.1597	0.1289	-0.1744	0.1529	-0.8916	0.1002
OGDEN	41.500	111.000	0	5507	78	90	1.3390	0.9239	0.2332	0.1809	-0.2149	0.1679	-1.5210	0.6909
OKANOGAN	48.500	119.000	56019	4375	14	26	1.4140	0.6285	0.1913	0.1614	-0.2012	0.1593	-1.0440	0.2165
OKLAHOMA CITY	35.500	97.000	0	2703	7	3	0.6530	0.0925	0.1303	0.1009	-0.1365	0.1047	-0.5904	0.0320
PALESTINE	31.500	95.000	1691	4828	12	29	0.7130	0.1160	0.1736	0.1184	-0.2328	0.2256	-1.7350	0.3493
PECOS	31.500	103.000	0	4884	22	17	1.4220	0.4638	0.2702	0.2170	-0.2554	0.2077	-1.2770	0.1635
PLAINVIEW	34.500	101.000	33750	2482	16	19	0.8548	0.2863	0.1482	0.1215	-0.1449	0.1071	-0.5354	0.0810
POCATELLO	42.500	113.000	4052	3508	15	23	2.0130	1.3300	0.1513	0.1233	-0.1563	0.1300	-1.1940	0.4346
POPLAR BLUFF	36.500	91.000	1068	2778	20	8	0.7028	0.2660	0.1473	0.1034	-0.1696	0.1190	-0.6547	0.0711

Table 3-10 (Contd)

QUAD	LAT	LONG	UINV	NOC	NH	NS	MPGT	SPGT	MPLT	SPLT	MNGT	SNGT	MNLT	SNLT
PORTLAND	43.500	71.500	8094	763	21	13	0.7491	0.1627	0.1988	0.1480	-0.2009	0.1504	-0.7052	0.0655
PRATT	37.500	99.000	0	2172	36	13	0.5850	0.1954	0.1228	0.0881	-0.1393	0.1057	-0.6085	0.0654
PRESCOTT	34.500	113.000	740209	8049	13	44	3.0370	1.1360	0.2517	0.1891	-0.3432	0.3954	-4.1260	1.8430
PRESIDIO	29.750	104.250	576	927	28	9	0.5121	0.0899	0.1621	0.1025	-0.1855	0.1456	-0.7104	0.0983
PRICE	39.500	111.000	2328	5837	48	43	1.3970	0.3017	0.2320	0.1887	-0.2557	0.2008	-1.0960	0.2086
RAPID CITY	44.500	103.000	8252	4936	36	10	1.1500	0.2175	0.2262	0.1812	-0.2669	0.2284	-1.1960	0.3849
RAWLINS	41.500	107.000	184867	4587	28	33	3.7010	3.9760	0.1916	0.1883	-0.2614	0.3040	-1.9680	0.2766
RICE LAKE	45.500	91.000	417	2807	26	17	1.3440	0.1592	0.3159	0.2493	-0.2785	0.2019	-1.0770	0.1823
RICHFIELD	38.500	113.000	26064	5595	32	37	1.0470	0.9390	0.1697	0.1302	-0.2152	0.1946	-1.2390	0.1651
RITZVILLE	47.500	119.000	31283	5595	32	37	2.3280	2.1120	0.2272	0.1968	-0.2022	0.1463	-0.9366	0.2137
ROCK SPRINGS	41.500	109.000	28181	2926	21	21	1.1000	0.3359	0.1730	0.1478	-0.1574	0.1155	-0.8313	0.1939
SALINA	38.500	111.000	63545	5714	16	35	2.4840	1.2820	0.3190	0.2566	-0.4051	0.3437	-2.2460	0.5549
SANDPOINT	48.500	117.000	34162	5395	14	10	1.5660	0.1592	0.2303	0.2054	-0.2137	0.1730	-1.3000	0.2187
SCRANTON	41.500	75.000	21587	4913	12	20	1.2210	0.1293	0.2552	0.2018	-0.2303	0.1676	-1.2490	0.7960
SEGUIN	29.500	97.000	33326	3119	8	10	0.8146	0.2042	0.1479	0.1171	-0.1582	0.1332	-0.7897	0.1577
SHERMAN	33.500	97.000	5974	2995	12	8	1.5610	0.1229	0.2959	0.2702	-0.2547	0.1933	-1.2220	0.1354
SHIPROCK	36.500	109.000	377253	4998	17	16	2.0780	1.6880	0.2671	0.2191	-0.3869	0.2830	-1.4750	0.3384
SOCORRO	34.500	109.000	85655	5244	14	35	1.2700	0.5367	0.2527	0.1864	-0.2706	0.2284	-1.2620	0.3140
SPARTANBURG	34.5	81	7051	2440	23	33	0.6793	0.1481	0.1546	0.1134	-0.1937	0.1812	-1.0980	0.2489
SPOKANE	47.5	117	11957	4667	30	16	3.8560	7.6390	0.1986	0.1606	-0.1916	0.1348	-0.8063	0.1383
ST. CLOUD	45.5	95	0	2670	33	14	1.3910	0.2358	0.2549	0.2299	-0.2356	0.1706	-0.9082	0.1127
TOPRINGTON	42.5	105	34841	3249	19	42	1.1120	0.2092	0.2653	0.1837	-0.3806	0.3745	-1.9730	0.3311
VERNAL	40.5	109	50227	6019	34	13	2.1790	3.6890	0.2221	0.1920	-0.2368	0.2237	-1.5640	0.5070
VYA	41.5	119	20006	4656	14	40	1.1360	0.3331	0.1428	0.1212	-0.1369	0.1220	-0.9585	0.2027
WALKER LAKE	38.5	119	26660	4406	7	17	0.8375	0.2334	0.1444	0.1100	-0.1554	0.1247	-0.8084	0.1328
WELLS	41.5	115	19464	5661	30	27	1.2160	0.5004	0.2336	0.1667	-0.2913	0.2400	-1.5690	0.3563
WICHITA	37.5	97	0	3214	10	13	0.7370	0.1275	0.1368	0.1117	-0.1325	0.1069	-0.7102	0.1545
WICHITA FALLS	33.5	99	67929	2729	10	6	0.6392	0.2548	0.1155	0.0856	-0.1194	0.0861	-0.4338	0.0360
WILLIAMS	35.5	113	16784	8395	7	15	1.4840	0.0649	0.3326	0.2375	-0.4227	0.4387	-4.4024	0.8906

N=97

Table 3-11. List of Uranium Inventory for Quadrangles in the Conterminous United States Sorted by Decreasing Predicted Uranium Inventory

QUADRANGLE	LATITUDE	LONGITUDE	URANIUM INVENTORY	PREDICTED INVENTORY	RESIDUAL INVENTORY
ALBUQUERQUE	35.500	107.000	1149127-	1164684-	15557
CASPER	42.500	107.000	975107-	828268-	-146839 *
PRESCOTT	34.500	113.000	740209-	286546	-453663 *
RAWLINS	41.500	107.000	184867-	228546-	43679
MOAB	38.500	109.000	334742-	222436-	-112306 *
SPOKANE	47.500	117.000	11957	210461	198504 ←
SALINA	38.500	111.000	63545-	201474	137929 ←
LEMMON	45.500	103.000	52424-	188000	135576 ←
DEATH VALLEY	36.500	117.000	41809	164663	122854 ←
LAS VEGAS	36.500	115.000	2131	148123	145992 ←
POCATELLO	42.500	113.000	4052	138521	134469 ←
LANDER	42.500	109.000	35620	137675	102055 ←
VERNAL	40.500	109.000	50227-	128932	78705 ←
MESA	33.500	111.000	37941	126266	88325 ←
CRYSTAL CITY	28.500	101.000	102580-	124350-	21770
SHIPROCK	36.500	109.000	377253-	124046	-253207 *
RITZVILLE	47.500	119.000	31283	123076	91793 ←
KINGMAN	35.500	115.000	385	118453	118068 ←
EAU CLAIRE	44.500	91.000	0	113504	113504 ←
SOCORRO	34.500	109.000	85655-	108861-	23206
VYA	41.500	119.000	20006	96976	76970 ←
EMORY PEAK	29.500	103.000	10188	96348	86160 ←
CHEYENNE	41.500	105.000	3201	94688	91487 ←
NEWCASTLE	43.500	105.000	298458-	93117	-205341 *
OKANOGAN	48.500	119.000	56019-	91750-	35731
DENVER	39.500	105.000	146303-	89468-	-56835 *
ELKO	40.500	115.000	347	79775	79428 ←
CHALLIS	44.500	115.000	15836	79076	63240 ←
IRON RIVER	46.417	89.000	0	74182	74182 ←
CORTEZ	37.500	109.000	88494-	70215-	-18279
FLAGSTAFF	35.500	111.000	70075-	68513-	-1562
GALLUP	35.500	109.000	562445-	68164	-494281 *
TORRINGTON	42.500	105.000	34841	67827-	32986
MARFA	30.500	104.500	963	65499	64516 ←
GREELEY	40.500	105.000	39511	60299-	20788
GREEN BAY	44.500	89.000	4	59960	59956 ←
CODY	44.500	109.000	4490	58476	53986 ←
RAPID CITY	44.500	103.000	8252	55845	47593
GILLETTE	44.500	105.000	50426-	55830-	5404
DUBOIS	44.500	113.000	6383	53590	47207
ST. CLOUD	45.500	95.000	0	53461	53461 ←
NEWARK	40.500	75.000	8799	52731	43932
PECOS	31.500	103.000	0	52716	52716 ←
HOT SPRINGS	43.500	103.000	64720-	50986-	-13734
LUBBOCK	33.500	101.000	3565	50306	46741
HAMILTON	46.500	115.000	5057	49857	44800
EKALAKA	45.500	105.000	17476	47274	29798
ROCK SPRINGS	41.500	109.000	28181	46776-	18595
PALESTINE	31.500	95.000	1691	45279	43588
CLINTON	35.500	99.000	6782	45258	38476
KLAMATH FALLS	42.500	121.000	2512	44267	41755
RICE LAKE	45.500	91.000	417	43923	43506
PLAINVIEW	34.500	101.000	33750	42584-	8834
JOPLIN	37.500	95.000	0	42165	42165
PRATT	37.500	99.000	0	41220	41220
ASHTON	44.500	111.000	1013	40996	39983
AUGUSTA	33.500	81.000	6915	39592	32677
MILLETT	39.500	117.000	3372	39001	35629
WELLS	41.500	115.000	19464	38796-	19332
GRAND CANYON	36.500	113.000	59029-	38658-	-20371
WALKER LAKE	38.500	119.000	26660	37072-	10412
DICKINSON	46.500	103.000	17160	36392	19232
SCRANTON	41.500	75.000	21587	35335-	13748
BAKER	44.500	117.000	0	35083	35083
GREENSBORO	36.500	79.000	12376	34085	21709
MANHATTAN	39.500	97.000	379	33564	33185
PRESIDIO	29.750	104.250	576	33371	32795
NOGALES	31.750	110.833	2676	32615	29939
POPLAR BLUFF	36.500	91.000	1068	31919	30851
GLENS FALLS	43.500	73.000	5878	31810	25932
HUTCHINSON	38.500	97.000	311	31603	31292
DYERSBURG	36.500	89.000	4275	30909	26634
PORTLAND	43.500	71.500	8094	30858	22764
CRAIG	40.500	107.000	42781	30268-	-12513
LAREDO	27.500	99.000	280075-	29864	-250211 *
MCALLEN	26.583	98.467	52696-	28690-	-24006
OGDEN	41.500	111.000	0	26966	26966
LAMAR	38.500	103.000	915	26774	25859
SANDPOINT	48.500	117.000	34162	24122-	-10040
SPARTANBURG	34.500	81.000	7051	21965	14914
WICHITA	37.500	97.000	0	21790	21790
SEGUIN	29.500	97.000	33326	21279-	-12047
CORPUS CHRISTI	27.500	97.667	1202	19329	18127
WICHITA FALLS	33.500	99.000	67929-	18843	-49086

Table 3-11 (Contd)

QUADRANGLE	LATITUDE	LONGITUDE	URANIUM INVENTORY	PREDICTED INVENTORY	RESIDUAL INVENTORY
WILLIAMS	35.500	113.000	16784	18689 -	1905
MCDERMITT	41.500	117.000	3484	17880	14396
SHERMAN	33.500	97.000	5974	17332	11358
BUTTE	46.500	113.000	180800 -	15661	-165139 *
OKLAHOMA CITY	35.500	97.000	0	5841	5841
LAWTON	34.500	99.000	26150	3539	-22611
ENID	36.500	97.000	0	0 -	0
RICHFIELD	38.500	113.000	26064	0	-26064
BEEVILLE	28.583	97.250	139721 -	0	-139721 *
BROWNSVILLE	26.500	97.667	0	0 -	0
PRICE	39.500	111.000	2328	0	-2328
DELTA	39.500	113.000	50054 -	0	-50054 *
LEADVILLE	39.500	107.000	14831	0	-14831
TOTAL			7047286	8055777	1008491

* DOE inventory > predicted inventory

+ Predicted inventory > DOE inventory

- on uranium inventory for values >50,000 tons of U_3O_8

- on predicted inventory for values that agree with DOE uranium inventory within 2X

Table 3-11 also shows the residual inventory, which is equal to the predicted inventory minus the uranium inventory as estimated by DOE. That column is marked to indicate all differences greater than 50,000 tons of U_3O_8; the asterisk denotes DOE estimate greater than predicted value, and the arrow signifies a predicted value greater than the DOE estimate. The totals in the table suggest that in general the DOE estimates may be somewhat conservative compared with those predicted from the aerial gamma-ray spectrometer data.

2. Stream Sediment Geochemical Data

a. Description of Geochemical Parameters

Texas Instruments "variable premise" approach to the evaluation of uranium in stream sediment samples has made use of several new indices that reduce uranium variance owing to irrelevant environmental factors such as placering, geochemically inert matrix dilution, and rare earth mineral influence. These indices are described in Texas Instruments (1980).

The relative influence of these factors varies from one area to another, so one would expect the indices that best characterize the uranium distribution also to vary from quadrangle to quadrangle. However, the results of much experimentation in attempting to characterize the uranium potential of whole quadrangles in terms of the stream sediment geochemical variables strongly indicated that only two of the indices, UET* and UHP** and their interrelationship, are best suited to this task. These functions correlate well with measures of whole-quadrangle uranium production and/or reserves, and the relationships are readily explainable in terms of the known geology and geochemistry of uranium. (It is interesting to note that the generally similar quantity UET derived from the aerial radiometric data also was found to be well correlated with measures of uranium resources [paragraph III.B.1].)

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*UET is mean-adjusted uranium (as measured by UHP) excess over mean-adjusted thorium (as measured by ThHP).
ThHP is thorium normalized for heavy mineral and rare earth element variance.

**UHP is uranium normalized for heavy mineral and rare earth element variance.

Direct measurement of uranium in stream sediment does not necessarily relate to potentially economic uranium. In general, stream sediments contain enough inert matrix or heavy mineral-, pegmatite-, or rare earth-associated uranium to "drown out" the signal of the more mobile uranium usually associated with ore deposits.

The UHP transformation compensates for these effects by measuring uranium relative to a datum of elements that moves up and down in proportion to heavy mineral, pegmatite, or rare earth influence in a sample or a region. The supposition is that the more of these minerals there are in a sample, the more spurious uranium signal is present. UHP simultaneously normalizes uranium for dilution by inert matrix, such as quartz, or for enrichments by noneconomic, uranium-bearing minerals such as monazite.

The entity UET further refines the UHP function by segregating anomalous UHP samples in which uranium is abnormally abundant relative to thorium. UET sets aside quite a different suite of anomalous samples than is done by the simpler uranium-to-thorium ratio, which reflects merely the ratio of the two without discrimination of provenance.

The effectiveness of the UHP and UET indices as uranium indicators is illustrated by comparing correlations between several stream sediment parameters and three measures of mineable uranium potential: UINV, RESV, and PROD. UINV, uranium inventory,* and RESV, preproduction inventory,** are the same quantities used to evaluate the aerial radiometric data (paragraph III.B.1). PROD was an early approximate estimate of quadrangle uranium production used in preliminary evaluations of the whole-quadrangle ARR and HSSR data. The development of those figures is explained in Appendix I. UINVL, RESVL, and PRODL are respectively $\log_{10}$ of UINV, RESV, and PROD. The geochemical variables involved in this study are as follows (see also Texas Instruments, 1980):

---

*UINV (uranium inventory) is production plus reserves plus potential resources to 0.01 percent U_3O_8, expressed in tons of U_3O_8.

**RESV (preproduction inventory) is production plus reserves, in tons of U_3O_8.

U is quadrangle mean of laboratory-analyzed uranium.

U/Th is quadrangle mean of laboratory-analyzed uranium divided by mean of laboratory-analyzed thorium.

ANU is anomalous uranium index = MUGT + SUGT, where MUGT is mean uranium greater than threshold (from uranium gradient distribution curve for each quadrangle).

SUGT is standard deviation of uranium values greater than threshold.

SU is threshold standardized uranium for each quadrangle =

$$\frac{\text{MUGT} + \text{SUGT} - \text{Threshold U}}{\text{Threshold U} - \text{MULT}}$$

where MULT is mean of uranium values less than threshold

The following entities computed for each sample are used in generating whole quadrangle geochemical parameters:

UHP is laboratory-analyzed uranium divided by the mean of a suite of heavy-mineral, rare earth and pegmatitic elements custom-selected for each quadrangle with anomalous outliers eliminated.

ThHP is laboratory-analyzed thorium divided by the mean of the UHP suite of heavy-mineral, rare earth, and pegmatitic elements with anomalous outliers eliminated.

AUHP is UHP divided by the mean UHP for the quadrangle.

AThHP is ThHP divided by the mean ThHP for the quadrangle.

UET is (AUHP - AThHP) times quadrangle mean UHP.

Whole-quadrangle geochemical parameters are as follows:

$$\text{RUET} = \frac{\text{M(UET)GT} + \text{S(UET)GT}}{\text{M(UET)LT}}$$ (Computed for +UET samples only)

where

M(UET)GT is quadrangle mean of UET values greater than threshold.

S(UET)GT is standard deviation of UET values greater than threshold.

M(UET)LT is quadrangle mean of UET values less than threshold.

These measurements are taken from the UET gradient distribution curve for each quadrangle and constitute a measure of the degree of uranium enrichment over thorium in the quadrangle.

$$\text{SUHP} = \frac{\text{M(UHP)GT} + \text{S(UHP)GT} - \text{TUHP}}{\text{TUHP} - \text{M(UHP)LT}}$$

where

M(UHP)GT is quadrangle mean of UHP values greater than threshold.

S(UHP)GT is standard deviation of UHP values greater than threshold.

M(UHP)LT is quadrangle mean of UHP values less than threshold.

TUHP is threshold on UHP gradient distribution curve.

These quantities are derived from the UHP gradient distribution curve for each quadrangle, and SUHP constitutes a threshold standardized measure of anomalous UHP values in the quadrangle.

In summary, RUET and SUHP are measures of the mean magnitude of the anomalous samples by these two indices relative to their backgrounds. This device has the effect of eliminating the influence of regional background variance in uranium and thorium. SUHP measures the amount of uranium theoretically not associated with heavy minerals, rare earths, or pegmatites. RUET measures the degree to which uranium is anomalous relative to thorium when each is normalized for heavy-mineral, rare earth, and pegmatite influence. A third parameter, HOST, measures the abundance of uranium as expressed by RUET relative to the abundance of uranium as expressed by SUHP.

$$\text{HOST} = \text{ARUET} - \text{ASUHP}$$

where

ARUET is RUET divided by the mean of RUET for the whole data set of quadrangles.

ASUHP is SUHP divided by the mean of SUHP for the whole data set of quadrangles.

The entity HOST can be used to sort quadrangles into two groups, those with positive values and those with negative values. Positive HOST indicates a condition in which uranium is higher with respect to thorium than it is with respect to the rare earth-pegmatite elements. Negative HOST denotes the opposite condition. This distinction may be fundamental in many quadrangles, perhaps marking a difference in the geochemical mode of the anomalous uranium. It is noted that when the RUET data set containing all quadrangles is divided into positive and negative HOST groups, most of the "misfit" quadrangles fall in the negative HOST group (see paragraph III.B.2.b).

b. Correlation Matrix

Table 3-12 shows the correlation of the measures of uranium potential against several stream sediment variables for all the quadrangles. Correlation coefficients that are valid at greater than the 90 percent level are highlighted. RUET shows the best correlation with the measures of uranium potential, especially PRODL. Parameters involving laboratory-analyzed uranium and thorium (not corrected for environmental influences) all correlate less well than RUET. The difference is obvious when one compares gradient distributions of these variables and examines the relative positions of the high-UINV and high-PROD quadrangles. Figure 3-18 shows the GDC for RUET, and Table 3-13 shows the corresponding data listing. The obvious segregation of the high-UINV quadrangles at high RUET values may be contrasted with the lack of segregation seen in Figure 3-19, the gradient distribution by decreasing U, and in Figure 3-20, the SU gradient distribution curve. The RUET curve shows that some quadrangles of seemingly low-to-moderate potential such as Millett, Ashland, and Harrisburg are grouped with the major producers Casper, Moab, and Albuquerque. Additionally, some medium producers — Lemmon, Hot Springs, Escalante, Dickinson, Flagstaff, and Beeville — have unaccountably low RUET values. All these apparent misfits fall in the negative HOST group, leaving the positive HOST group much improved in the correlation between RUET and production measures.

Table 3-12. Correlation Matrix for All Quadrangles

	U	U/Th	ANU	SU	RUET	SUHP	HOST
PROD	-0.03 23% 95	0.04 28% 93	0.06 42% 94	0.09 63% 94	0.41 99.99% 95	0.16 88% 95	0.27 99% 95
PRODL	0.01 5% 95	-0.01 4% 93	0.14 84% 94	0.12 76% 94	0.49 99.99% 95	0.20 95% 95	0.31 99% 95
UINV	0.04 31% 95	-0.06 41% 93	0.09 63% 94	-0.01 5% 94	0.23 98% 95	0.04 30% 95	0.21 96% 95
UINVL	0.17 91% 95	-0.17 89% 93	0.20 95% 94	-0.16 89% 94	0.14 83% 95	-0.06 47% 95	0.24 99% 95
RESV	0.05 22% 39	-0.22 81% 37	0.06 27% 38	0.05 23% 38	0.29 93% 39	0.10 46% 39	0.27 91% 39
RESVL	0.17 69% 39	-0.27 90% 37	0.19 75% 38	0.17 69% 38	0.39 99% 39	0.23 85% 39	0.25 88% 39

Key:

0.17	Correlation coefficient (underlined if valid at >90% level)
91	Level of validity in percent
95	No. of observations

Tables 3-14 and 3-15 show the correlation matrices for these two groups. In the positive HOST group, both RUET and SUHP correlate well with the measures of uranium potential, and it appears that the relationships are more nearly exponential than linear in that PRODL, UINVL, and RESVL show slightly higher correlation coefficients than do PROD, UINV, and RESV. This is similar to the results obtained in the aerial radiometric data study. Figures 3-21 and 3-22 are gradient distribution curves for RUET and SUHP for positive HOST quadrangles, and they both demonstrate the excellent segregation of the high UINV and PROD quadrangles. These types of gradient distributions provide a good qualitative separation of the more productive quadrangles and suggest that Billings, Ritzville, Walker Lake, Spokane, Lamar, La Junta, and Rock Springs quadrangles may have more promise than is indicated by the DOE UINV values. The data also suggest that UINV may be somewhat high for Prescott, Wichita Falls, Amarillo, Beaumont, and Seguin.

RANK	QUAD	UINV
1	BILLINGS	1154
2	MILLETT	3372
3	CORTEZ	88494
4	ARMINTO	116398
5	MOAB	334742
6	ASHLAND	0
7	RITZVILLE	31283
8	ALBUQUERQUE	1149127
9	CASPER	975107
10	WALKER LAKE	26660
11	HARRISBURG	5678
12	SPOKANE	11957
13	CHALLIS	15836
14	LOVELOCK	36
15	LAMAR	915
16	LA JUNTA	0
17	TONOPAH	4356
18	PUEBLO	158665
19	ROCK SPRINGS	28181
20	SALINA	63545
21	OKANOGAN	56019
22	CRAIG	42781
23	MONTROSE	70214
24	RICE LAKE	417
25	POCATELLO	4052
26	DILLON	43232
27	KLAMATH FALLS	2512
28	IRON RIVER	0
29	SANDPOINT	34162
30	GRAND CANYON	59029
31	BUTTE	180600
32	LANDER	35620
33	NEW ULM	1231
34	ST. CLOUD	0
35	TORRINGTON	34841
36	GILLETTE	50426
37	PORTLAND	8094
38	MESA	37941
39	WELLS	19464
40	RENO	3132
41	LEMMON	52424
42	HOT SPRINGS	64720
43	KINGMAN	385
44	WINNEMUCCA	6569
45	DELTA	50054
46	RICHFIELD	26064
47	PLAINVIEW	33750
48	ENID	0
49	AUSTIN	31964
50	SALTON SEA	2180
51	MCDERMITT	3484
52	LAWTON	26150
53	PRICE	2328
54	ESCALANTE	42191
55	ATHENS	1190
56	PRESCOTT	740209
57	WICHITA	0
58	DEATH VALLEY	41809
59	MCALLEN	52696
60	WILLIAMS	16784
61	SAN ANTONIO	2049
62	EMORY PEAK	10188
63	JOPLIN	0
64	RAPID CITY	8252
65	SCRANTON	21587
66	BROWNSVILLE	0
67	POPLAR BLUFF	1068
68	MARFA	983
69	LLANO	36
70	ELKO	347
71	GLENS FALLS	5878
72	DICKINSON	17160
73	TRONA	6974
74	AUGUSTA	6915

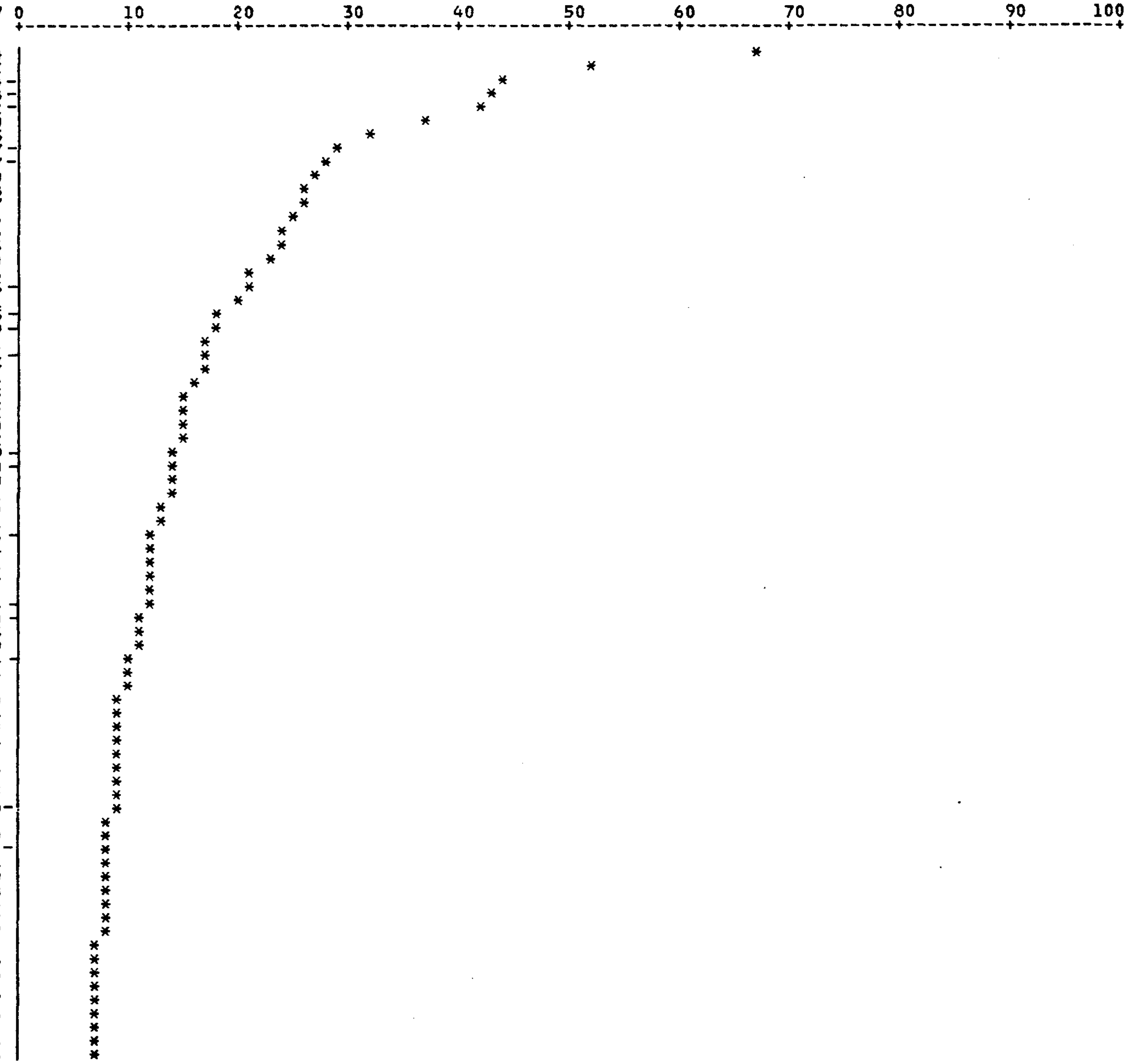

Figure 3-18. Gradient Distribution Curve for All Quadrangles by Decreasing RUET

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RANK       QUAD            UINV 0         10        20        30        40        50        60        70        80        90        100
                                +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+
  75 CLINTON               6782 |      *
  76 LAS VEGAS             2131 |      *
  77 SHERMAN               5974 |     *
  78 FLAGSTAFF            70075-|     *
  79 EAU CLAIRE               0 |     *
  80 OKLAHOMA CITY            0 |     *
  81 PRESIDIO               576 |    *
  82 GREENSBORO           12376 |    *
  83 WICHITA FALLS        67929-|    *
  84 AMARILLO             34782 |    *
  85 GREEN BAY                4 |    *
  86 SPARTANBURG           7051 |    *
  87 DYERSBURG             4275 |    *
  88 BEAUMONT             20696 |    *
  89 MANHATTAN              379 |    *
  90 PALESTINE             1691 |    *
  91 SEGUIN               33326 |   *
  92 PRATT                    0 |   *
  93 HUTCHINSON             311 |   *
  94 BEEVILLE            139721-|   *
  95 CORPUS CHRISTI        1202 |  *
```

Figure 3-18 (Contd)

Table 3-13. Gradient Distribution Listing for All Quadrangles by Decreasing RUET

RANK	QUAD	PROD	UINV	U	UTH	ANU	SU	RUET	SUHP	HOST
1	BILLINGS	250.0	1154	4.5	0.47	83.0	13.17	67.5	5.3	3.3
2	MILLETT	50.0	3372	5.8	0.39	94.0	12.38	52.1	21.1	-1.9
3	CORTEZ	16000.0	88494	3.1	0.44	25.2	6.78	44.7	8.5	0.9
4	ARMINTO	800.0	116398	3.5	0.39	47.9	9.90	43.3	8.2	0.9
5	MOAB	42000.0	334742	3.1	0.50	36.9	6.87	42.7	7.3	1.0
6	ASHLAND	0.0	0	2.4	0.61	33.6	29.52	37.3	19.7	-2.6
7	RITZVILLE	5000.0	31283	2.6	0.29	29.3	11.71	32.6	5.7	0.8
8	ALBUQUERQUE	20050.0	1149127	3.5	0.32	14.9	2.31	29.8	4.4	0.9
9	CASPER	25000.0	975107	6.1	0.25	70.5	5.67	28.9	5.4	0.6
10	WALKER LAKE	51.0	26660	5.4	0.39	32.1	4.83	27.8	6.9	0.1
11	HARRISBURG	0.1	5678	3.5	0.35	16.6	6.08	26.8	7.5	-0.1
12	SPOKANE	50.0	11957	5.3	0.32	59.2	3.68	26.4	4.8	0.6
13	CHALLIS	50.0	15836	6.9	0.39	76.5	5.29	25.4	7.2	-0.1
14	LOVELOCK	0.1	36	4.4	0.45	42.2	6.01	24.2	8.0	-0.4
15	LAMAR	0.0	915	7.2	0.30	48.4	4.80	24.1	3.4	0.8
16	LA JUNTA	0.1	0	4.5	0.38	15.9	4.70	23.9	5.9	0.1
17	TONOPAH	0.1	4356	5.0	0.33	39.8	5.69	21.8	6.0	-0.1
18	PUEBLO	0.1	158665	7.1	0.33	64.2	4.19	21.2	3.3	0.6
19	ROCK SPRINGS	1.0	28181	3.6	0.29	15.1	3.21	20.2	4.2	0.3
20	SALINA	5000.0	63545	2.4	0.35	11.6	3.36	19.0	4.2	0.2
21	OKANOGAN	0.1	56019	4.9	0.39	30.5	2.98	18.4	3.5	0.4
22	CRAIG	500.0	42781	7.1	0.27	97.7	5.13	17.9	2.4	0.6
23	MONTROSE	0.1	70214	6.4	0.43	71.1	1.89	17.4	2.7	0.5
24	RICE LAKE	0.0	417	2.0	0.28	11.1	6.64	17.2	4.6	-0.0
25	POCATELLO	0.1	4052	2.5	0.22	7.5	1.86	16.1	7.7	-0.9
26	DILLON	0.1	43232	7.7	0.38	73.3	2.21	16.0	1.9	0.6
27	KLAMATH FALLS	500.0	2512	1.7	0.39	7.5	3.70	15.8	4.3	-0.0
28	IRON RIVER	0.1	0	2.4	0.57	15.6	8.49	15.5	9.2	-1.3
29	SANDPOINT	51.0	34162	15.2	0.52	185.3	3.24	15.2	4.8	-0.2
30	GRAND CANYON	5000.0	59029	2.4	0.30	6.5	2.64	14.8	2.8	0.3
31	BUTTE	50.0	180800	7.1	0.50	59.5	1.60	14.5	2.2	0.4
32	LANDER	51.0	35620	4.0	0.26	22.5	2.17	14.2	2.8	0.2
33	NEW ULM	0.0	1231	3.0	0.39	11.0	3.69	14.1	4.1	-0.1
34	ST. CLOUD	0.0	0	2.8	0.62	14.2	5.14	13.9	4.8	-0.3
35	TORRINGTON	2050.0	34841	5.3	0.28	25.8	1.94	13.4	2.6	0.2
36	GILLETTE	5000.0	50426	3.5	0.40	15.2	2.51	12.9	2.6	0.2
37	PORTLAND	0.0	8094	7.2	0.27	35.3	2.30	12.7	3.9	-0.1
38	MESA	50.0	37941	4.7	0.25	19.3	3.52	12.5	3.3	-0.0
39	WELLS	50.0	19464	4.4	0.32	26.1	2.11	12.4	3.5	-0.1
40	RENO	25.0	3132	3.7	0.35	11.0	2.24	12.1	2.3	0.2
41	LEMMON	500.0	52424	3.3	0.57	23.1	6.98	12.0	6.4	-0.9
42	HOT SPRINGS	5000.0	64720	3.9	0.46	12.3	3.13	11.8	4.5	-0.4
43	KINGMAN	0.1	385	3.0	0.22	22.4	3.06	11.3	2.9	0.0
44	WINNEMUCCA	0.0	6569	4.0	0.34	11.4	2.04	11.1	3.8	-0.2
45	DELTA	500.0	50054	2.6	0.27	11.4	1.36	10.8	2.0	0.2
46	RICHFIELD	600.0	26064	3.2	0.26	15.0	2.46	10.6	2.8	0.0
47	PLAINVIEW	0.1	33750	2.5	0.29	8.3	4.12	10.3	3.5	-0.2
48	ENID	0.1	0	2.9	0.35	10.0	4.65	9.7	1.8	0.2
49	AUSTIN	0.0	31964	2.8	0.38	13.5	6.81	9.6	2.2	0.1
50	SALTON SEA	50.0	2180	3.3	0.28	19.4	3.87	9.5	1.6	0.2
51	MCDERMITT	0.1	3484	3.6	0.36	11.4	3.95	9.5	2.4	0.0
52	LAWTON	1.0	26150	2.7	0.31	13.3	7.51	9.4	1.9	0.2
53	PRICE	50.0	2328	2.5	0.37	7.8	2.86	9.3	2.2	0.1
54	ESCALANTE	550.0	42191	2.2	0.35	10.8	3.46	9.3	5.0	-0.7
55	ATHENS	0.0	1190	14.6	0.17	106.7	1.72	9.2	2.6	-0.0
56	PRESCOTT	50.0	740209	3.9	0.34	32.8	3.68	9.2	2.4	0.0
57	WICHITA	0.0	0	3.2	0.37	6.6	1.57	8.8	3.3	-0.3
58	DEATH VALLEY	1.0	41809	4.1	0.28	13.3	3.19	8.7	1.6	0.2
59	MCALLEN	0.1	52696	2.3	0.41	7.9	10.79	8.6	4.8	-0.7
60	WILLIAMS	0.1	16784	3.6	0.31	23.7	1.66	8.6	12.6	-2.7
61	SAN ANTONIO	0.0	2049	1.9	0.19	5.9	3.55	8.6	2.0	0.1
62	EMORY PEAK	0.1	10188	2.9	0.34	5.8	0.88	8.2	1.3	0.2
63	JOPLIN	0.0	0	3.6	0.52	7.8	1.74	8.1	3.8	-0.4
64	RAPID CITY	0.1	8252	2.9	0.40	7.3	1.41	8.0	2.5	-0.1
65	SCRANTON	0.1	21587	3.6	0.33	11.5	2.08	8.0	1.7	0.1
66	BROWNSVILLE	0.0	0	2.7	0.50			7.9	4.1	-0.5
67	POPLAR BLUFF	0.0	1068	2.6	0.39	7.9	1.97	7.8	1.9	0.0
68	MARFA	0.1	983	3.0	0.34	6.0	1.09	7.8	0.7	0.4
69	LLANO	0.1	36	1.9	0.13	4.5	2.54	7.7	1.9	0.0
70	ELKO	0.0	347	3.1	0.24	8.6	1.59	7.5	1.2	0.2
71	GLENS FALLS	0.1	5878	3.3	0.32	16.6	2.06	7.4	3.5	-0.4
72	DICKINSON	500.0	17160	3.1	0.50	8.1	3.28	7.4	2.7	-0.2
73	TRONA	0.1	6974	3.7	0.38	12.6	3.28	7.2	4.3	-0.6

Table 3-13 (Contd)

RANK	QUAD	PROD	UINV	U	UTH	ANU	SU	RUET	SUHP	HOST
74	AUGUSTA	0.0	6915	13.9	0.17	133.3	3.60	7.2	1.4	0.1
75	CLINTON	0.1	6782	2.3	0.36	4.9	1.37	7.1	1.2	0.2
76	LAS VEGAS	0.1	2131	2.1	0.38	18.0	6.21	7.0	4.8	-0.8
77	SHERMAN	0.1	5974	2.4	0.32	10.0	3.54	6.9	1.7	0.0
78	FLAGSTAFF	0.0	70075	2.5	0.42	7.2	3.70	6.5	4.4	-0.7
79	EAU CLAIRE	0.0	0	2.0	.	5.5	1.11	6.3	0.9	0.2
80	OKLAHOMA CITY	0.0	0	2.6	0.49	11.8	4.73	6.0	1.7	-0.0
81	PRESIDIO	0.0	576	3.4	0.28	5.5	1.97	6.0	1.5	0.0
82	GREENSBORO	0.0	12376	5.7	0.30	35.6	2.18	5.7	1.3	0.1
83	WICHITA FALLS	0.1	67929	2.4	0.28	4.2	0.97	5.7	1.0	0.1
84	AMARILLO	0.0	34782	2.3	0.36	8.7	1.73	5.7	0.9	0.2
85	GREEN BAY	0.0	4	2.3	.	8.2	1.82	5.6	1.1	0.1
86	SPARTANBURG	0.0	7051	11.1	0.26	103.9	2.46	5.3	1.3	0.0
87	DYERSBURG	0.0	4275	4.7	0.39	37.0	5.23	5.3	2.1	-0.2
88	BEAUMONT	0.0	20696	2.9	0.51	9.7	3.70	5.1	1.0	0.1
89	MANHATTAN	0.0	379	3.2	0.38	8.0	3.91	5.1	0.9	0.1
90	PALESTINE	0.0	1691	3.7	0.60	13.9	2.86	5.0	0.9	0.1
91	SEGUIN	0.1	33326	1.8	1.03	4.9	1.67	5.0	1.1	0.0
92	PRATT	0.0	0	3.4	0.30	11.9	3.62	4.9	0.8	0.1
93	HUTCHINSON	0.0	311	3.3	0.48	5.4	2.82	4.5	0.8	0.1
94	BEEVILLE	0.1	139721	1.9	0.35	5.2	1.88	4.5	1.6	-0.1
95	CORPUS CHRISTI	0.0	1202	2.0	0.37	3.4	2.01	3.6	2.0	-0.3

N=95

RANK	QUAD	UINV
1	SANDPOINT	34162
2	ATHENS	1190
3	AUGUSTA	6915
4	SPARTANBURG	7051
5	DILLON	43232
6	LAMAR	915
7	PORTLAND	8094
8	BUTTE	180800-
9	PUEBLO	158665-
10	CRAIG	42781
11	CHALLIS	15836
12	MONTROSE	70214-
13	CASPER	975107-
14	MILLETT	3372
15	GREENSBORO	12376
16	WALKER LAKE	26660
17	TORRINGTON	34841
18	SPOKANE	11957
19	TONOPAH	4356
20	OKANOGAN	56019-
21	DYERSBURG	4275
22	MESA	37941
23	LA JUNTA	0
24	BILLINGS	1154
25	WELLS	19464
26	LOVELOCK	36
27	DEATH VALLEY	41809
28	WINNEMUCCA	6569
29	LANDER	35620
30	PRESCOTT	740209-
31	HOT SPRINGS	64720-
32	TRONA	6974
33	PALESTINE	1691
34	RENO	3132
35	JOPLIN	0
36	ROCK SPRINGS	28181
37	SCRANTON	21587
38	MCDERMITT	3484
39	WILLIAMS	16784
40	ALBUQUERQUE	1149127-
41	GILLETTE	50426-
42	ARMINTO	116398-
43	HARRISBURG	5678
44	PRESIDIO	576
45	PRATT	0
46	GLENS FALLS	5878
47	SALTON SEA	2180
48	LEMMON	52424-
49	HUTCHINSON	311
50	WICHITA	0
51	RICHFIELD	26064
52	MANHATTAN	379
53	DICKINSON	17160
54	CORTEZ	88494-
55	ELKO	347
56	MOAB	334742-
57	NEW ULM	1231
58	KINGMAN	385
59	MARFA	983
60	EMORY PEAK	10188
61	BEAUMONT	20696
62	RAPID CITY	8252
63	ENID	0
64	ST. CLOUD	0
65	AUSTIN	31964
66	BROWNSVILLE	0
67	LAWTON	26150
68	DELTA	50054-
69	OKLAHOMA CITY	0
70	POPLAR BLUFF	1068
71	RITZVILLE	31283
72	FLAGSTAFF	70075-
73	PRICE	2328
74	POCATELLO	4052
75	PLAINVIEW	33750

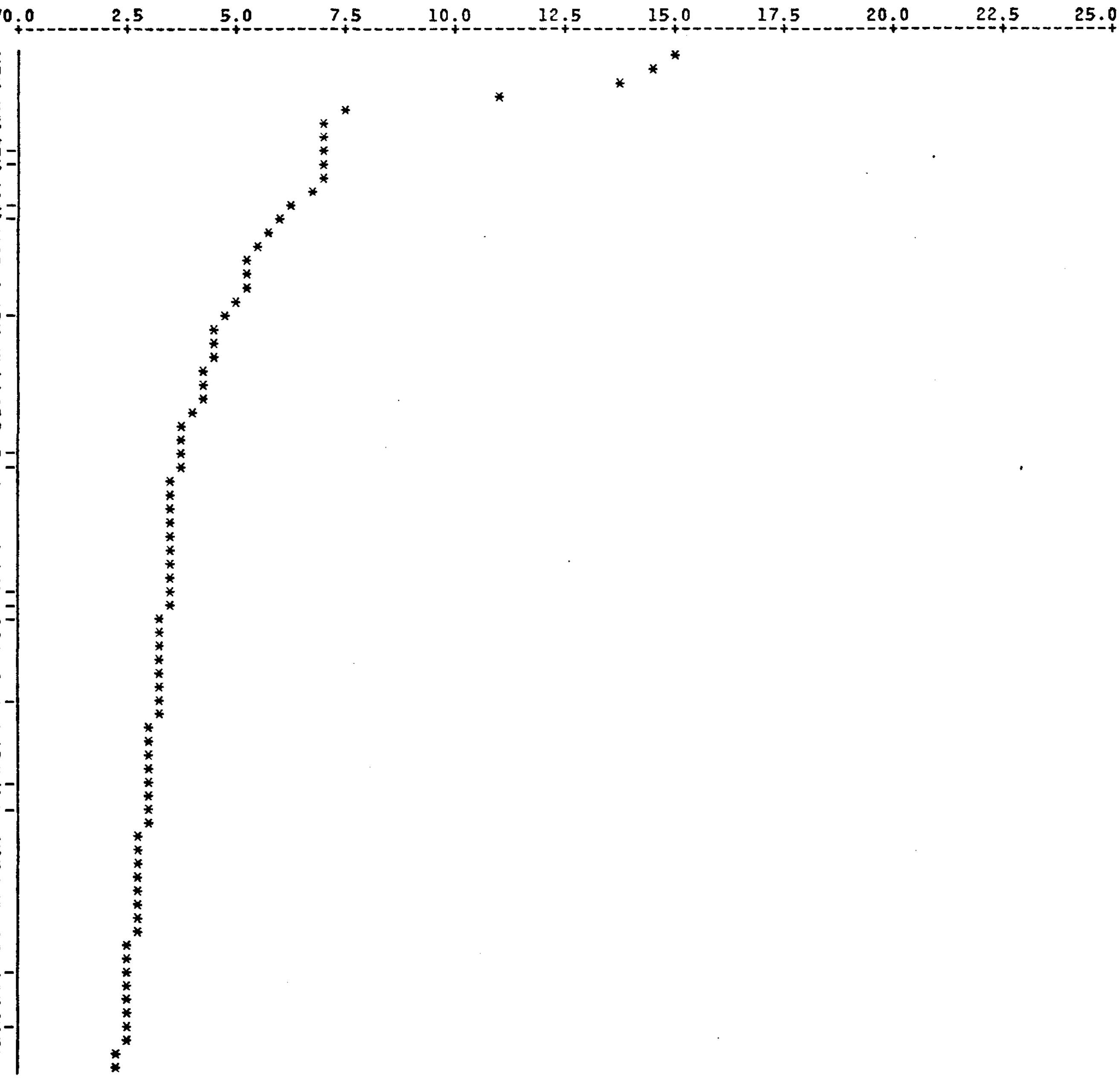

Figure 3-19. Gradient Distribution Curve for All Quadrangles by Decreasing U

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RANK        QUAD            UINV0.0      2.5       5.0       7.5      10.0      12.5      15.0      17.5      20.0      22.5      25.0
                                 +---------+---------+---------+---------+---------+---------+---------+---------+---------+---------+
  76 WICHITA FALLS         67929-|        *
  77 GRAND CANYON          59029-|        *
  78 IRON RIVER                0 |        *
  79 ASHLAND                   0 |        *
  80 SHERMAN                5974 |        *
  81 SALINA                63545-|        *
  82 GREEN BAY                 4 |        *
  83 AMARILLO              34782 |        *
  84 MCALLEN               52696-|        *
  85 CLINTON                6782 |        *
  86 ESCALANTE             42191 |       *
  87 LAS VEGAS              2131 |       *
  88 EAU CLAIRE                0 |       *
  89 RICE LAKE               417 |       *
  90 CORPUS CHRISTI         1202 |      *
  91 BEEVILLE             139721-|      *
  92 SAN ANTONIO            2049 |      *
  93 LLANO                    36 |      *
  94 SEGUIN                33326 |      *
  95 KLAMATH FALLS          2512 |     *
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Figure 3-19 (Contd)

RANK	QUAD	UINV
1	ASHLAND	0
2	BILLINGS	1154
3	MILLETT	3372
4	RITZVILLE	31283
5	MCALLEN	52696
6	ARMINTO	116398
7	IRON RIVER	0
8	LAWTON	26150
9	LEMMON	52424
10	MOAB	334742
11	AUSTIN	31964
12	CORTEZ	88494
13	RICE LAKE	417
14	LAS VEGAS	2131
15	HARRISBURG	5678
16	LOVELOCK	36
17	TONOPAH	4356
18	CASPER	975107
19	CHALLIS	15836
20	DYERSBURG	4275
21	ST. CLOUD	0
22	CRAIG	42781
23	WALKER LAKE	26660
24	LAMAR	915
25	OKLAHOMA CITY	0
26	LA JUNTA	0
27	ENID	0
28	PUEBLO	158665
29	PLAINVIEW	33750
30	MCDERMITT	3484
31	MANHATTAN	379
32	SALTON SEA	2180
33	BEAUMONT	20696
34	FLAGSTAFF	70075
35	KLAMATH FALLS	2512
36	NEW ULM	1231
37	PRESCOTT	740209
38	SPOKANE	11957
39	PRATT	0
40	AUGUSTA	6915
41	SAN ANTONIO	2049
42	SHERMAN	5974
43	MESA	37941
44	ESCALANTE	42191
45	SALINA	63545
46	TRONA	6974
47	DICKINSON	17160
48	SANDPOINT	34162
49	ROCK SPRINGS	28181
50	DEATH VALLEY	41809
51	HOT SPRINGS	64720
52	KINGMAN	385
53	OKANOGAN	56019
54	PRICE	2328
55	PALESTINE	1691
56	HUTCHINSON	311
57	GRAND CANYON	59029
58	LLANO	36
59	GILLETTE	50426
60	RICHFIELD	26064
61	SPARTANBURG	7051
62	ALBUQUERQUE	1149127
63	PORTLAND	8094
64	RENO	3132
65	DILLON	43232
66	GREENSBORO	12376
67	LANDER	35620
68	WELLS	19464
69	SCRANTON	21587
70	GLENS FALLS	5878
71	WINNEMUCCA	6569
72	CORPUS CHRISTI	1202
73	PRESIDIO	576
74	POPLAR BLUFF	1068
75	TORRINGTON	34841

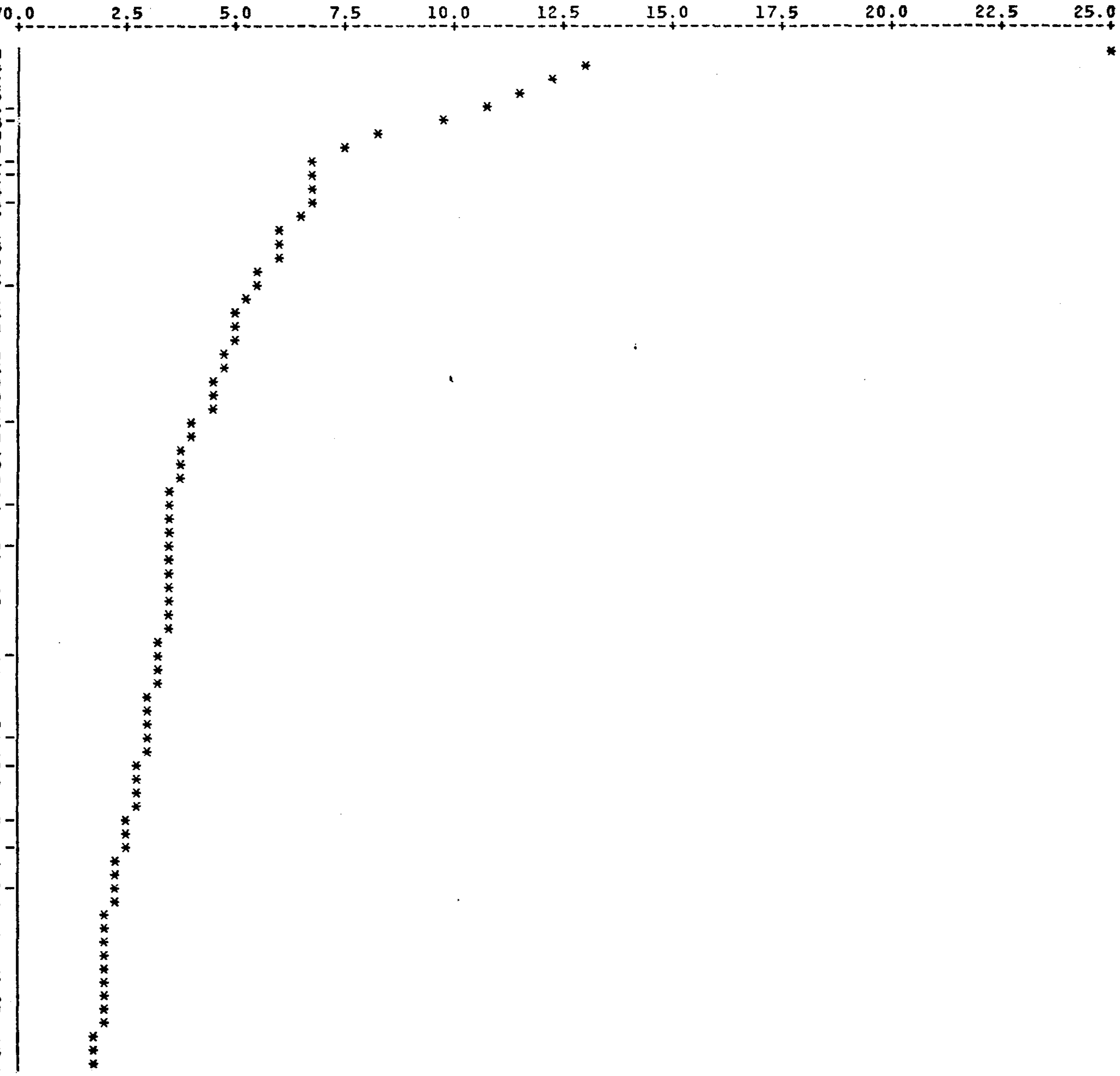

Figure 3-20. Gradient Distribution Curve for All Quadrangles by Decreasing SU

RANK	QUAD	UINV
76	MONTROSE	70214
77	BEEVILLE	139721
78	POCATELLO	4052
79	GREEN BAY	4
80	JOPLIN	0
81	AMARILLO	34782
82	ATHENS	1190
83	SEGUIN	33326
84	WILLIAMS	16784
85	BUTTE	180800
86	ELKO	347
87	WICHITA	0
88	RAPID CITY	8252
89	CLINTON	6782
90	DELTA	50054
91	EAU CLAIRE	0
92	MARFA	983
93	WICHITA FALLS	67929
94	EMORY PEAK	10188
95	BROWNSVILLE	0

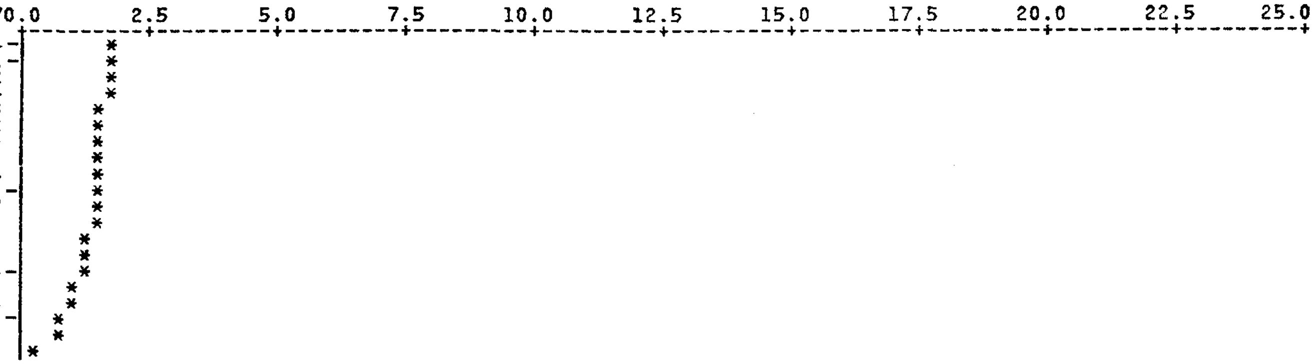

Figure 3-20 (Contd)

Table 3-14. Correlation Matrix for Quadrangles with Positive HOST Values

	U	U/Th	ANU	SU	RUET	SUHP	HOST
PROD	-0.04 25% 58	0.08 45% 56	0.09 51% 58	0.25 94% 58	0.49 99.99% 58	0.54 99.99% 58	0.31 98%
PRODL	-0.05 32% 58	-0.02 13% 56	0.14 72% 58	0.38 99% 58	0.62 99.99%	0.65 99.99%	0.41 99.9%
UINV	0.07 40% 58	-0.03 16% 56	0.14 72% 58	0.07 40% 58	0.28 97% 58	0.29 98% 58	0.19 84%
UINVL	0.19 85% 58	0.12 63% 56	0.28 97% 58	0.11 57% 58	0.28 97% 58	0.32 99% 58	0.17 79%
RESV	0.14 49%	-0.14 46%	0.14 48%	0.07 26%	0.29 83%	0.33 88%	0.18 60%
RESVL	0.40 95%	-0.09 31%	0.39 95%	0.26 80%	0.48 98%	0.65 99.9%	0.20 65%

Table 3-15. Correlation Matrix for Quadrangles with Negative HØST Values

	U	U/Th	ANU	SU	RUET	SUHP	HOST
PROD	-0.03 26% 37	0.14 60% 37	-0.09 39% 36	-0.07 32% 36	-0.04 19% 37	-0.05 23% 37	0.04 20% 37
PRODL	0.11 47% 37	0.16 66% 37	0.17 67% 36	-0.05 23% 36	0.14 59% 37	0.05 22% 37	0.06 27% 37
UINV	-0.07 32% 37	-0.01 6% 37	-0.07 34% 36	-0.12 53% 36	-0.25 87% 37	-0.19 75% 37	0.07 32% 37
UINVL	0.16 66% 37	-0.49 99% 37	0.11 50% 36	-0.32 95% 36	-0.12 53% 37	-0.17 68% 37	0.16 66% 37
RESV	-0.24 60% 15	-0.34 80% 15	-0.22 55% 14	-0.24 59% 14	-0.25 64% 15	-0.21 55% 15	0.09 25% 15
RESVL	0.04 12% 15	-0.20 52% 15	0.01 4% 14	-0.05 14% 14	0.02 5% 15	0.05 13% 15	-0.08 23% 15

RANK	QUAD	UINV
1	BILLINGS	1154
2	CORTEZ	88494
3	ARMINTO	116398
4	MOAB	334742
5	RITZVILLE	31283
6	ALBUQUERQUE	1149127
7	CASPER	975107
8	WALKER LAKE	26660
9	SPOKANE	11957
10	LAMAR	915
11	LA JUNTA	0
12	PUEBLO	158665
13	ROCK SPRINGS	28181
14	SALINA	63545
15	OKANOGAN	56019
16	CRAIG	42781
17	MONTROSE	70214
18	DILLON	43232
19	GRAND CANYON	59029
20	BUTTE	180800
21	LANDER	35620
22	TORRINGTON	34841
23	GILLETTE	50426
24	RENO	3132
25	KINGMAN	385
26	DELTA	50054
27	RICHFIELD	26064
28	ENID	0
29	AUSTIN	31964
30	SALTON SEA	2180
31	MCDERMITT	3484
32	LAWTON	26150
33	PRICE	2328
34	PRESCOTT	740209
35	DEATH VALLEY	41809
36	SAN ANTONIO	2049
37	EMORY PEAK	10188
38	SCRANTON	21587
39	POPLAR BLUFF	1068
40	MARFA	983
41	LLANO	36
42	ELKO	347
43	AUGUSTA	6915
44	CLINTON	6782
45	SHERMAN	5974
46	EAU CLAIRE	0
47	PRESIDIO	576
48	GREENSBORO	12376
49	WICHITA FALLS	67929
50	AMARILLO	34782
51	GREEN BAY	4
52	SPARTANBURG	7051
53	BEAUMONT	20696
54	MANHATTAN	379
55	PALESTINE	1691
56	SEGUIN	33326
57	PRATT	0
58	HUTCHINSON	311

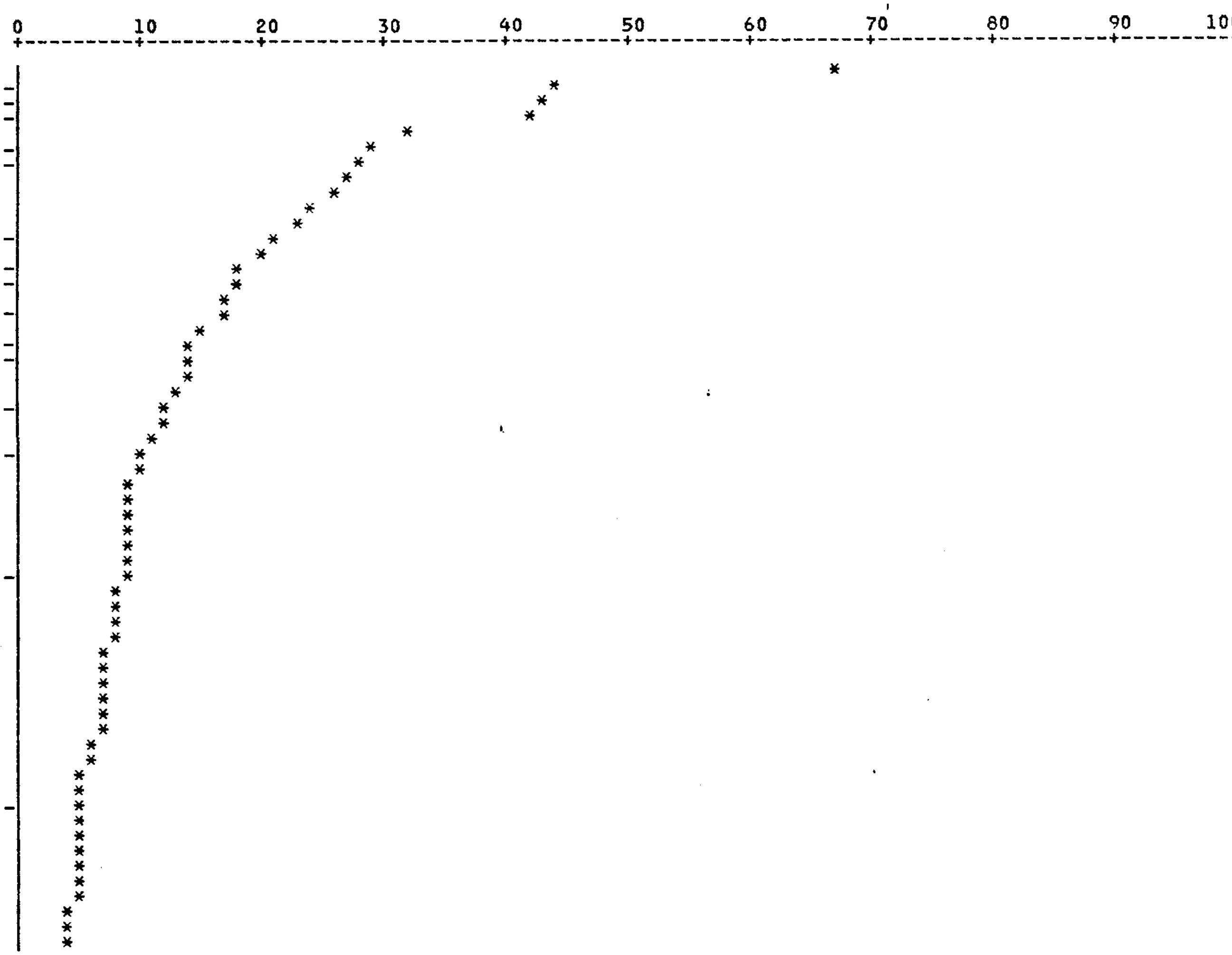

Figure 3-21. Gradient Distribution Curve for Positive HOST Quadrangles by Decreasing RUET

RANK	QUAD	UINV
1	CORTEZ	88494
2	ARMINTO	116398
3	MOAB	334742
4	WALKER LAKE	26660
5	LA JUNTA	0
6	RITZVILLE	31283
7	CASPER	975107
8	BILLINGS	1154
9	SPOKANE	11957
10	ALBUQUERQUE	1149127
11	ROCK SPRINGS	28181
12	SALINA	63545
13	OKANOGAN	56019
14	LAMAR	915
15	PUEBLO	158665
16	KINGMAN	385
17	LANDER	35620
18	GRAND CANYON	59029
19	RICHFIELD	26064
20	MONTROSE	70214
21	TORRINGTON	34841
22	GILLETTE	50426
23	PRESCOTT	740209
24	CRAIG	42781
25	MCDERMITT	3484
26	RENO	3132
27	PRICE	2328
28	AUSTIN	31964
29	BUTTE	180800
30	DELTA	50054
31	SAN ANTONIO	2049
32	DILLON	43232
33	POPLAR BLUFF	1068
34	LAWTON	26150
35	LLANO	36
36	ENID	0
37	SHERMAN	5974
38	SCRANTON	21587
39	SALTON SEA	2180
40	DEATH VALLEY	41809
41	PRESIDIO	576
42	AUGUSTA	6915
43	GREENSBORO	12376
44	EMORY PEAK	10188
45	SPARTANBURG	7051
46	ELKO	347
47	CLINTON	6782
48	SEGUIN	33326
49	GREEN BAY	4
50	WICHITA FALLS	67929
51	BEAUMONT	20696
52	EAU CLAIRE	0
53	AMARILLO	34782
54	MANHATTAN	379
55	PALESTINE	1691
56	HUTCHINSON	311
57	PRATT	0
58	MARFA	983

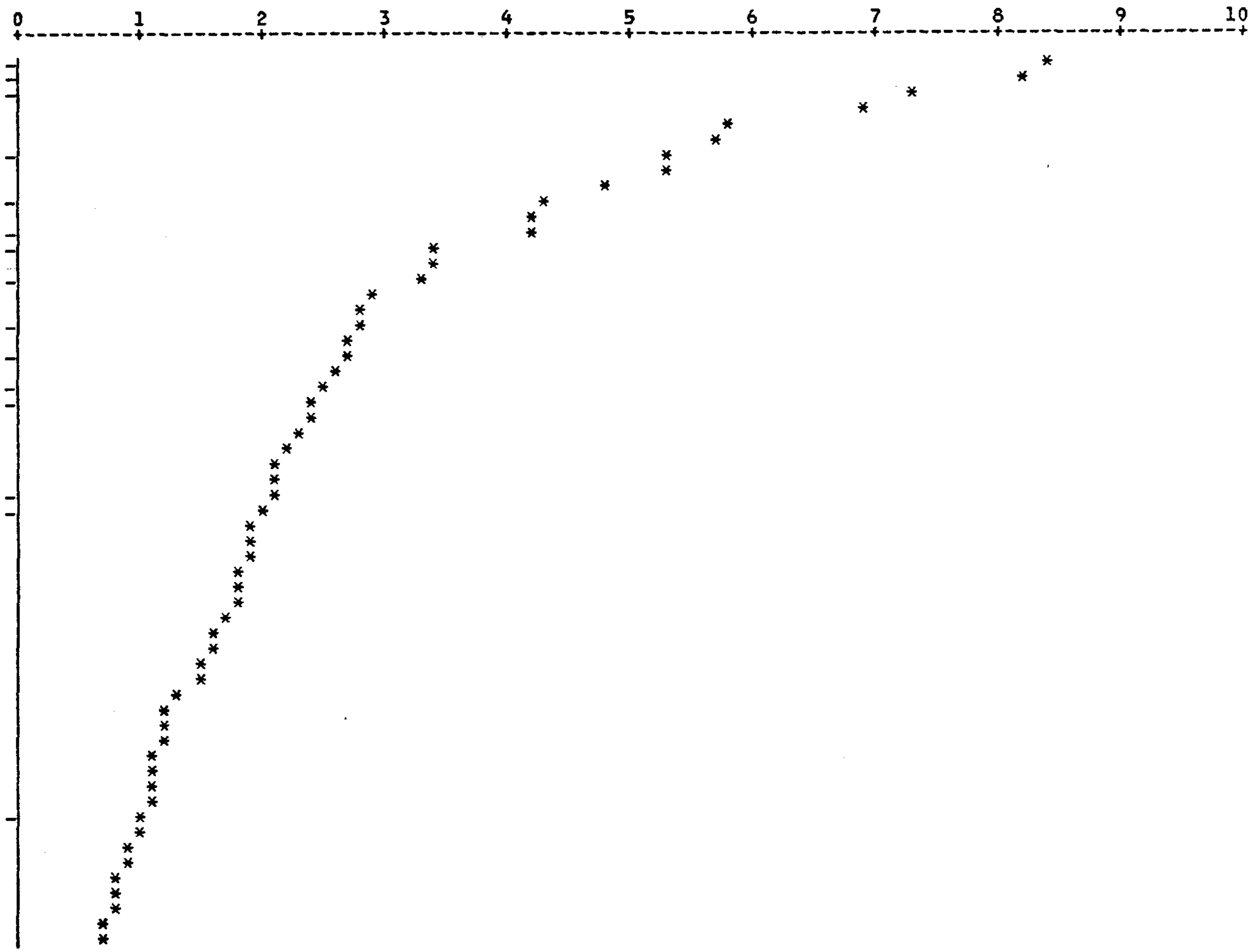

Figure 3-22. Gradient Distribution Curve for Positive HOST Quadrangles by Decreasing SUHP

Examination of the correlation matrix (Table 3-15) for negative HOST quadrangles shows the only reasonably good correlation is a negative one between U/Th and UINVL. Figure 3-23 illustrates the gradient distribution of U/Th for this group. At high U/Th values there is a mixture of a few of the higher UINV and most of the zero UINV quadrangles. In the log function the zeros predominate, and the effect of Beeville and a large number of intermediate UINV quadrangles at low U/Th values resulted in the negative correlation. Note that there is effectively no correlation between UINV and U/Th (see Table 3-15). It is concluded that none of the parameters tested so far is effective for even qualitative separations of the poor and more productive quadrangles in the negative HOST group.

It is interesting to note that most of the very productive quadrangles with major roll-front types of uranium deposits fall high on the list in the positive HOST group. This suggests that this type of geochemical pattern is fundamentally related to abnormally high RUET values as compared to SUHP.

Ashland quadrangle in Wisconsin has a negative HOST value but rates high in possible potential when judged by RUET alone (fifth on the RUET gradient distribution). It is driven into the negative HOST group by its even higher SUHP value. Other Wisconsin quadrangles, Iron River and Rice Lake, show high SUHP values with moderately high RUET values and fall in the negative HOST group. This appears to hint that given a sufficiently valid rationale for some non-roll-front kind of economic uranium mineralization in these quadrangles, their potential should be reviewed carefully.

A series of experimental, stepwise, multiple linear regressions have been performed with UINV and UINVL as dependent variables and all the better-correlated geochemical parameters as independent variables with little success. The maximum R^2 values attained were so low as to indicate that successful quantitative prediction of UINV was not practical by any of the tested variable combinations.

RANK	QUAD	UINV
1	ST. CLOUD	0
2	ASHLAND	0
3	LEMMON	52424-
4	IRON RIVER	0
5	SANDPOINT	34162
6	JOPLIN	0
7	BROWNSVILLE	0
8	DICKINSON	17160
9	OKLAHOMA CITY	0
10	HOT SPRINGS	64720-
11	LOVELOCK	36
12	FLAGSTAFF	70075-
13	MCALLEN	52696-
14	RAPID CITY	8252
15	KLAMATH FALLS	2512
16	DYERSBURG	4275
17	NEW ULM	1231
18	CHALLIS	15836
19	MILLETT	3372
20	TRONA	6974
21	LAS VEGAS	2131
22	WICHITA	0
23	CORPUS CHRISTI	1202
24	BEEVILLE	139721-
25	ESCALANTE	42191
26	HARRISBURG	5678
27	WINNEMUCCA	6569
28	TONOPAH	4356
29	WELLS	19464
30	GLENS FALLS	5878
31	WILLIAMS	16784
32	PLAINVIEW	33750
33	RICE LAKE	417
34	PORTLAND	8094
35	MESA	37941
36	POCATELLO	4052
37	ATHENS	1190

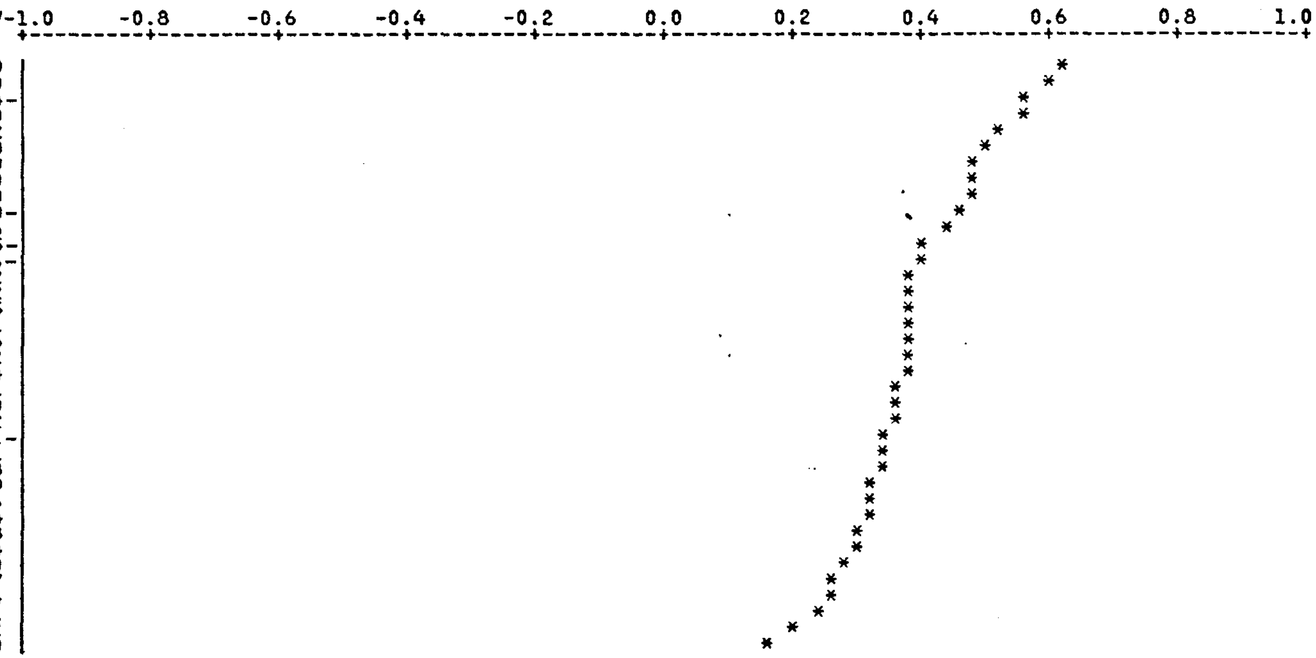

Figure 3-23. Gradient Distribution Curve for Negative HOST Quadrangles by Decreasing U/Th

c. Uranium Inventory Prediction

Based on the correlation matrices, it is concluded that geochemical entities RUET, SUHP, and HOST are related to the economic uranium potential of a quadrangle, though not closely enough to quantitatively predict UINV by a multivariable linear function as was done using the ARR data. An assumption was made that the most mined (and most extensively prospected) quadrangles have the most accurate preproduction inventory (RESV) and inventory (UINV) information. On this basis, the geochemical entities were used to establish the relative order of the quadrangles, and their UINV data were used to determine the shape of the average UINV gradient distribution for use in UINV prediction. The major producing quadrangles — Cortez, Arminto, Moab, Albuquerque, and Casper (termed the CAMAC quadrangles) — were chosen as UINV datums, with the average UINV equal to 532,774 tons of U_3O_8 (>0.01 percent U_3O_8) per quadrangle.

Several different models were tested to predict UINV for all the quadrangles based on RUET, SUHP, and HOST and their relationship to the CAMAC mean UINV. The most successful of these was derived using only those quadrangles with preproduction inventory (RESV) values. The following equation defines the order of the quadrangles on the gradient distribution (Table 3-16):

$$\text{RESVLP} = 393.5\ \text{ARUET} + 45.22\ \text{HOST} - 80.74\ \text{ARUET}^2$$

where

RESVLP = predicted $\log_{10}$ of RESV

Note: RESVP in Table 3-16 = predicted RESV (the antilogarithm of RESVLP).

ARUET = RUET divided by mean RUET for the data set

HOST = ARUET - ASUHP

ASUHP = SUHP divided by mean SUHP for the data set

R^2 = 0.87 for this relationship involving 41 quadrangles

Table 3-16 presents the quadrangles sorted by decreasing predicted RESV (RESVP) calculated according to the above equation. This data set was used in the following steps leading to a prediction of UINV values (UINVP):

(1) Sort data according to increasing RESVLP and compute mean UINV (MUINV) based on a 5-point moving average from low end to high end of gradient distribution. (This yields a gradient distribution of relative uranium inventory values (MUINV) wherein the DOE-specified inventory values (UINV) are adjusted to accommodate the order of priority established by the HSSR-defined index, RESVLP.)

Table 3-16. Gradient Distribution List of Quadrangles Sorted by Decreasing RESVP

RANK	QUAD	PROD	UINVP	UINV	RESVP	U	UTH	ANU	SU	RUET	SUHP	HOST
1	RITZVILLE	5000.0	737873	31283	132496	2.6	0.29	29.3	11.71	32.6	5.7	0.8
2	ALEUQUERQUE	20050.0	744904	1149127	126824	3.5	0.32	14.9	2.31	29.8	4.4	0.9
3	MOAB	42000.0	622787	334742	105339	3.1	0.50	36.9	6.87	42.7	7.3	1.0
4	CASPER	25000.0	532299	975107	84790	6.1	0.25	70.5	5.67	28.9	5.4	0.6
5	ARMINTO	800.0	421802	116398	79193	3.5	0.39	47.9	9.90	43.3	8.2	0.9
6	CORTEZ	16000.0	342077	88494	65151	3.1	0.44	25.2	6.78	44.7	8.5	0.9
7	SPOKANE	50.0	282557	11957	58091	5.3	0.32	59.2	3.68	26.4	4.8	0.6
8	LAMAR	0.0	237506	915	49044	7.2	0.30	48.4	4.80	24.1	3.4	0.8
9	WALKER LAKE	51.0	207815	26660	44900	5.4	0.39	32.1	4.83	27.8	6.9	0.1
10	HARRISBURG	0.1	182535	5678	31288	3.5	0.35	16.6	6.08	26.8	7.5	-0.1
11	CHALLIS	50.0	161663	15836	24421	6.9	0.39	76.5	5.29	25.4	7.2	-0.1
12	LA JUNTA	0.1	144997	0	23822	4.5	0.38	15.9	4.70	23.9	5.9	0.1
13	PUEBLO	0.1	131907	158665	21470	7.1	0.33	64.2	4.19	21.2	3.3	0.6
14	LOVELOCK	0.1	118463	36	14126	4.4	0.45	42.2	6.01	24.2	8.0	-0.4
15	TONOPAH	0.1	107903	4356	12365	5.0	0.33	39.8	5.69	21.8	6.0	-0.1
16	ROCK SPRINGS	1.0	99922	28181	12100	3.6	0.29	15.1	3.21	20.2	4.2	0.3
17	CRAIG	500.0	92852	42781	8538	7.1	0.27	97.7	5.13	17.9	2.4	0.6
18	SALINA	5000.0	86079	63545	7801	2.4	0.35	11.6	3.36	19.0	4.2	0.2
19	OKANOGAN	0.1	79395	56019	7658	4.9	0.39	30.5	2.98	18.4	3.5	0.4
20	MONTROSE	0.1	74816	70214	6421	6.4	0.43	71.1	1.89	17.4	2.7	0.5
21	DILLON	0.1	69777	43232	4571	7.7	0.38	73.3	2.21	16.0	1.9	0.6
22	ASHLAND	0.0	65366	0	3897	2.4	0.61	33.6	29.52	37.3	19.7	-2.6
23	RICE LAKE	0.0	61739	417	3652	2.0	0.28	11.1	6.64	17.2	4.6	-0.0
24	BUTTE	50.0	58495	180800	2264	7.1	0.50	59.5	1.60	14.5	2.2	0.4
25	KLAMATH FALLS	500.0	54380	2512	2222	1.7	0.39	7.5	3.70	15.8	4.3	-0.0
26	GRAND CANYON	5000.0	50672	59029	2160	2.4	0.30	6.5	2.64	14.8	2.8	0.3
27	LANDER	51.0	47151	35620	1662	4.0	0.26	22.5	2.17	14.2	2.8	0.2
28	SANDPOINT	51.0	43728	34162	1521	15.2	0.52	185.3	3.24	15.2	4.8	-0.2
29	TORRINGTON	2050.0	40325	34841	1202	5.3	0.28	25.8	1.94	13.4	2.6	0.2
30	NEW ULM	0.0	37031	1231	1106	3.0	0.39	11.0	3.69	14.1	4.1	-0.1
31	GILLETTE	5000.0	34227	50426	988	3.5	0.40	15.2	2.51	12.9	2.6	0.2
32	POCATELLO	0.1	31449	4052	971	2.5	0.22	7.5	1.86	16.1	7.7	-0.9
33	ST. CLOUD	0.0	28967	0	[illegible]	2.8	0.62	14.2	5.14	13.9	4.8	-0.3
34	RENO	25.0	26682	3132	717	3.7	0.35	11.0	2.24	12.1	2.3	0.2
35	MESA	50.0	24563	37941	652	4.7	0.25	19.3	3.52	12.5	3.3	-0.0
36	PORTLAND	0.0	22672	8094	620	7.2	0.27	35.3	2.30	12.7	3.9	-0.1
37	WELLS	50.0	20898	19464	585	4.4	0.32	26.1	2.11	12.4	3.5	-0.1
38	MILLETT	50.0	19441	3372	549	5.8	0.39	94.0	12.38	52.1	21.1	-1.9
39	IRON RIVER	0.1	18176	0	515	2.4	0.57	15.6	8.49	15.5	9.2	-1.3
40	DELTA	500.0	16998	50054	412	2.6	0.27	11.4	1.36	10.8	2.0	0.2
41	KINGMAN	0.1	15739	385	404	3.0	0.22	22.4	3.06	11.3	2.9	0.0
42	HOT SPRINGS	5000.0	14561	64720	337	3.9	0.46	12.3	3.13	11.8	4.5	-0.4
43	RICHFIELD	600.0	13425	26064	303	3.2	0.26	15.0	2.46	10.6	2.8	0.0
44	WINNEMUCCA	0.0	12387	6569	282	4.0	0.34	11.4	2.04	11.1	3.8	-0.2
45	ENID	0.1	11490	0	244	2.9	0.35	10.0	4.65	9.7	1.8	0.2
46	SALTON SEA	50.0	10723	2180	[illegible]	3.3	0.28	19.4	3.87	9.5	1.6	0.2
47	LEMMON	500.0	10013	52424	[illegible]	3.3	0.57	23.1	6.98	12.0	6.4	-0.9
48	AUSTIN	0.0	9226	31964	202	2.8	0.38	13.5	6.81	9.6	2.2	0.1
49	PLAINVIEW	0.1	10108	33750	202	2.5	0.29	8.3	4.12	10.3	3.5	-0.2
50	LAWTON	1.0	10910	26150	201	2.7	0.31	13.3	7.51	9.4	1.9	0.2
51	MCDERMITT	0.1	11562	3484	182	3.6	0.36	11.4	3.95	9.5	2.4	0.0
52	PRICE	50.0	12130	2328	178	2.5	0.37	7.8	2.86	9.3	2.2	0.1
53	PRESCOTT	50.0	12609	740209	156	3.9	0.34	32.8	3.68	9.2	2.4	0.0
54	DEATH VALLEY	1.0	[illegible]	41809	153	4.1	0.28	13.3	3.19	8.7	1.6	0.2
55	ATHENS	0.0	10817	1190	151	14.6	0.17	106.7	1.72	9.2	2.6	-0.0
56	SAN ANTONIO	0.0	9993	2049	124	1.9	0.19	5.9	3.55	8.6	2.0	0.1
57	BILLINGS	250.0	9222	1154	122	4.5	0.47	83.0	13.17	67.5	5.3	3.3
58	EMORY PEAK	0.1	8505	10188	122	2.9	0.34	5.8	0.88	8.2	1.3	0.2
59	MARFA	0.1	7819	983	114	3.0	0.34	6.0	1.09	7.8	0.7	0.4
60	SCRANTON	0.1	7181	21587	100	3.6	0.33	11.5	2.08	8.0	1.7	0.1
61	WICHITA	0.0	6612	0	97	3.2	0.37	6.6	1.57	8.8	3.3	-0.3
62	ELKO	0.0	6075	347	86	3.1	0.24	8.6	1.59	7.5	1.2	0.2
63	POPLAR BLUFF	0.0	5580	1068	82	2.6	0.39	7.9	1.97	7.8	1.9	0.0
64	RAPID CITY	0.1	5124	8252	80	2.9	0.40	7.3	1.41	8.0	2.5	-0.1
65	ESCALANTE	550.0	4746	42191	78	2.2	0.35	10.8	3.46	9.3	5.0	-0.7
66	LLANO	0.1	4351	36	77	1.9	0.13	4.5	2.54	7.7	1.9	0.0
67	CLINTON	0.1	3993	6782	69	2.3	0.36	4.9	1.37	7.1	1.2	0.2
68	AUGUSTA	0.0	3659	6915	67	13.9	0.17	133.3	3.60	7.2	1.4	0.1
69	MCALLEN	0.1	3337	52696	59	2.3	0.41	7.9	10.79	8.6	4.8	-0.7

Table 3-16 (Contd)

RANK	QUAD	PROD	UINVP	UINV	RESVP	U	UTH	ANU	SU	RUET	SUHP	HOST
70	JOPLIN	0.0	2994	0	57	3.6	0.52	7.8	1.74	8.1	3.8	-0.4
71	DICKINSON	500.0	2681	17160	53	3.1	0.50	8.1	3.28	7.4	2.7	-0.2
72	SHERMAN	0.1	2402	5974	50	2.4	0.32	10.0	3.54	6.9	1.7	0.0
73	BROWNSVILLE	0.0	2139	0	46	2.7	0.50	.	.	7.9	4.1	-0.5
74	EAU CLAIRE	0.0	1938	0	45	2.0	.	5.5	1.11	6.3	0.9	0.2
75	GLENS FALLS	0.1	1751	5378	43	3.3	0.32	16.6	2.06	7.4	3.5	-0.4
76	AMARILLO	0.0	1570	34782	31	2.3	0.36	8.7	1.73	5.7	0.9	0.2
77	PRESIDIO	0.0	1392	576	31	3.4	0.28	5.5	1.97	6.0	1.5	0.0
78	WICHITA FALLS	0.1	1228	67929	31	2.4	0.28	4.2	0.97	5.7	1.0	0.1
79	OKLAHOMA CITY	0.0	1050	0	30	2.6	0.49	11.8	4.73	6.0	1.7	-0.0
80	TRONA	0.1	891	6974	30	3.7	0.38	12.6	3.28	7.2	4.3	-0.6
81	GREENSBORO	0.0	745	12376	29	5.7	0.30	35.6	2.18	5.7	1.3	0.1
82	GREEN BAY	0.0	611	4	29	2.3	.	8.2	1.82	5.6	1.1	0.1
83	LAS VEGAS	0.1	497	2131	23	2.1	0.38	18.0	6.21	7.0	4.8	-0.8
84	SPARTANBURG	0.0	394	7051	22	11.1	0.26	103.9	2.46	5.3	1.3	0.0
85	MANHATTAN	0.0	321	379	21	3.2	0.38	8.0	3.91	5.1	0.9	0.1
86	PALESTINE	0.0	264	1691	21	3.7	0.60	13.9	2.86	5.0	0.9	0.1
87	BEAUMONT	0.0	213	20696	21	2.9	0.51	9.7	3.70	5.1	1.0	0.1
88	PRATT	0.0	166	0	20	3.4	0.30	11.9	3.62	4.9	0.8	0.1
89	FLAGSTAFF	0.0	145	70075	19	2.5	0.42	7.2	3.70	6.5	4.4	-0.7
90	SEGUIN	0.1	117	33326	18	1.8	1.03	4.9	1.67	5.0	1.1	0.0
91	DYERSBURG	0.0	89	4275	17	4.7	0.39	37.0	5.23	5.3	2.1	-0.2
92	HUTCHINSON	0.0	51	311	15	3.3	0.48	5.4	2.82	4.5	0.6	0.1
93	BEEVILLE	0.1	23	139721	12	1.9	0.35	5.2	1.88	4.5	1.6	-0.1
94	WILLIAMS	0.1	6	16784	6	3.6	0.31	23.7	1.66	8.6	12.6	-2.7
95	CORPUS CHRISTI	0.0	0	1202	5	2.0	0.37	3.4	2.01	3.6	2.0	-0.3

N=95

(2) Sort data according to decreasing RESVLP, and compute cumulative mean of MUINV (CUINV1) from high end to low end of distribution. Compute cumulative mean of RESVLP (CR1) from high end to low end of distribution. (This smooths the MUINV and RESVLP curves into a close mutual fit.)

(3) For each quadrangle, compute CUINV = CUINV1 - $\overline{\text{CUINV1}}$, where $\overline{\text{CUINV1}}$ is mean of all CUINV1 values. (This adjusts the CUINV1 curve to zero at its bottom end.)

(4) For each quadrangle, compute CR = CR1 - $\overline{\text{CR1}}$, where $\overline{\text{CR1}}$ is mean of all CR1 values. (This adjusts the CR1 curve to zero at its bottom end.)

(5) For each quadrangle, compute RUINV = CR x CUINV. (This merges the HSSR and DOE relative values.)

(6) Compute the constant CAMAC = mean RUINV of Cortez, Arminto, Moab, Albuquerque, and Casper quadrangles = 85,630,346.

(7) Compute the constant: average UINV for Cortez, Arminto, Moab, Albuquerque and Casper quadrangles = 532,774 tons U_3O_8 per quadrangle.

(8) For each quadrangle, compute UINVP

$$\text{UINVP} = \frac{532,774}{85,630,346} \times \text{RUINV}$$

In summary, this method of prediction begins with the assumption that preproduction inventory (RESV) figures provided by DOE for 41 of the 95 quadrangles are reliable and generally proportional to the overall economic uranium potential and that the RESV values are most correct for the CAMAC quadrangles. An equation is then established between RESV and the geochemical entities ARUET and HOST. Rank-ordering of the quadrangles is established by the RESVLP gradient distribution and is a function of the geochemical entities and the preproduction inventory.

The uranium inventory and preproduction inventory figures are then smoothed by the moving average and cumulative mean procedures (steps 1 and 2), and adjusted to zero at the low end by subtracting the last cumulative mean of each (steps 3 and 4). The smoothed and zero-adjusted preproduction inventory and total inventory figures are multiplied together to provide an entity (RUINV) that is related to UINV but is in effect weighted by the RESV-containing quadrangles.

The final step is to use the RUINV numbers for each quadrangle to calculate a predicted inventory (UINVP), by assuming RUINV to be directly proportional to UINVP using the average numbers for the five CAMAC quadrangles to establish the proportionality constant. UINVP is compared with the DOE-estimated UINV in Table 3-17, which also shows the residual or difference between them.

3. Comparison of ARR and HSSR Predictions

Table 3-18 summarizes quadrangles for which both the HSSR and ARR data indicate that the DOE estimate of UINV is too low. Ten of these are highlighted because they agree within a factor of two, and 20 more agree in sign but do not agree within a factor of two.

Table 3-19 shows quadrangles for which both the HSSR and ARR data indicate that the DOE estimate of UINV is too high. Thirteen agree within a factor of two, and six show a larger difference but agree in sign.

Table 3-20 shows those that disagree in sign, a total of 42 quadrangles; however, eleven of these are in essential agreement, in that they differ by less than 20,000 tons.

In summary, 34 quadrangles are in essential agreement as to their UINV prediction, and 26 more agree in the sign of the residual inventory. Thirty-one quadrangles differ in sign and disagree by more than 20,000 tons.

The data have been further analyzed to highlight quadrangles where both ARR and HSSR data indicate simultaneously that the DOE estimates of UINV are either too low or too high by a substantial (>50,000 tons) amount (Table 3-21). The potential resource estimates for these quadrangles may warrant reexamination.

A list of the quadrangles for which only the ARR data indicate that the DOE estimate of UINV is too small is in Table 3-22. Table 3-23 lists those for which the DOE estimate of UINV is too small based on the HSSR data only.

Table 3-24 lists quadrangles for which the DOE-estimated UINV is too large as judged by ARR data or HSSR data alone.

Table 3-17. Comparison of HSSR-Predicted and DOE-Estimated Uranium Inventories for Selected Quadrangles

QUADRANGLE	LATITUDE	LONGITUDE	URANIUM INVENTORY	PREDICTED INVENTORY	RESIDUAL INVENTORY
RITZVILLE	47.500	119.000	31283	737873	706590 ←
ALBUQUERQUE	35.500	107.000	1149127 -	744904 -	-404223 *
MOAB	38.500	109.000	334742	622787 -	288045 ←
CASPER	42.500	107.000	975107 -	532299 -	-442808
ARMINTO	43.500	107.000	116398 -	421802	305404 ←
CORTEZ	37.500	109.000	88494 -	342077	253583 ←
SPOKANE	47.500	117.000	11957	282557	270600 ←
LAMAR	38.500	103.000	915	237506	236591 ←
WALKER LAKE	38.500	119.000	26650	207815	181155 ←
HARRISBURG	40.500	77.000	5678	182535	176857 ←
CHALLIS	44.500	115.000	15836	161663	145827 ←
LA JUNTA	37.500	101.000	0	144997	144997 ←
PUEBLO	38.500	105.000	158665 -	131907 -	-26758
LOVELOCK	40.500	119.000	36	118463	118427 ←
TONOPAH	38.500	117.000	4356	107903	103547 ←
ROCK SPRINGS	41.500	109.000	28181	99922	71741 ←
CRAIG	40.500	107.000	42781	92852	50071 ←
SALINA	38.500	111.000	63545 -	86079 -	22534
OKANOGAN	48.500	119.000	56019 -	79395 -	23376
MONTROSE	38.500	107.000	70214 -	74816 -	4602
DILLON	45.500	113.000	43232	69777 -	26545
ASHLAND	46.500	91.000	0	65366	65366 ←
RICE LAKE	45.500	91.000	417	61739	61322 ←
BUTTE	46.500	113.000	180800 -	58495	-122305 *
KLAMATH FALLS	42.500	121.000	2512	54380	51868 ←
GRAND CANYON	36.500	113.000	59029 -	50672 -	-8357
LANDER	42.500	109.000	35620	47151 -	11531
SANDPOINT	48.500	117.000	34162	43728 -	9566
TORRINGTON	42.500	105.000	34841	40325 -	5484
NEW ULM	44.500	95.000	1231	37031	35800
GILLETTE	44.500	105.000	50426 -	34227 -	-16199
POCATELLO	42.500	113.000	4052	31449	27397
ST. CLOUD	45.500	95.000	0	28967	28967
RENO	39.500	119.000	3132	26682	23550
MESA	33.500	111.000	37941	24563 -	-13378
PORTLAND	43.500	71.500	8094	22672	14578
WELLS	41.500	115.000	19464	20898 -	1434
MILLETT	39.500	117.000	3372	19441	16069
IRON RIVER	46.417	89.000	0	18176	18176
DELTA	39.500	113.000	50054 -	16998 -	-33056
KINGMAN	35.500	115.000	385	15739	15354
HOT SPRINGS	43.500	103.000	64720 -	14561	-50159 *
RICHFIELD	38.500	113.000	26064	13425 -	-12639
WINNEMUCCA	40.500	117.000	6569	12387	5818
ENID	36.500	97.000	0	11490	11490
SALTON SEA	33.500	115.000	2180	10723	8543
LEMMON	45.500	103.000	52424 -	10013	-42411
AUSTIN	30.500	97.000	31964	9226	-22738
PLAINVIEW	34.500	101.000	33750	10108	-23642
LAWTON	34.500	99.000	26150	10910	-15240
MCDERMITT	41.500	117.000	3484	11562	8078
PRICE	39.500	111.000	2328	12130	9802
PRESCOTT	34.500	113.000	740209 -	12609	-727600 *
DEATH VALLEY	36.500	117.000	41809	11718	-30091
ATHENS	33.500	83.000	1190	10817	9627
SAN ANTONIO	29.500	99.000	2049	9993	7944
BILLINGS	45.500	109.000	1154	9222	8068
EMORY PEAK	29.500	103.000	10188	8505 -	-1683
MARFA	30.500	104.500	983	7819	6836
SCRANTON	41.500	75.000	21587	7181	-14406
WICHITA	37.500	97.000	0	6612	6612
ELKO	40.500	115.000	347	6075	5728
POPLAR BLUFF	36.500	91.000	1068	5580	4512
RAPID CITY	44.500	103.000	8252	5124 -	-3128
ESCALANTE	37.500	111.000	42191	4746	-37445
LLANO	30.500	99.000	36	4351	4315
CLINTON	35.500	99.000	6782	3993 -	-2789
AUGUSTA	33.500	81.000	6915	3659 -	-3256
MCALLEN	26.583	98.467	52696 -	3337	-49359

Table 3-17 (Contd)

QUADRANGLE	LATITUDE	LONGITUDE	URANIUM INVENTORY	PREDICTED INVENTORY	RESIDUAL INVENTORY
JOPLIN	37.500	95.000	0	2994	2994
DICKINSON	46.500	103.000	17160	2681	-14479
SHERMAN	33.500	97.000	5974	2402	-3572
BROWNSVILLE	26.500	97.667	0	2139	2139
EAU CLAIRE	44.500	91.000	0	1938	1938
GLENS FALLS	43.500	73.000	5876	1751	-4127
AMARILLO	35.500	101.000	34782	1570	-33212
PRESIDIO	29.750	104.250	576	1392	816
WICHITA FALLS	33.500	99.000	67929 -	1228	-66701 *
OKLAHOMA CITY	35.500	97.000	0	1050	1050
TRONA	35.500	117.000	6974	891	-6083
GREENSBORO	36.500	79.000	12376	745	-11631
GREEN BAY	44.500	89.000	4	611	607
LAS VEGAS	36.500	115.000	2131	497	-1634
SPARTANBURG	34.500	81.000	7051	394	-6657
MANHATTAN	39.500	97.000	379	321 -	-58
PALESTINE	31.500	95.000	1691	264	-1427
BEAUMONT	31.500	95.000	20696	213	-20483
PRATT	37.500	99.000	0	166	166
FLAGSTAFF	35.500	111.000	70075 -	145	-69930 *
SEGUIN	29.500	97.000	33326	117	-33209
DYERSBURG	36.500	89.000	4275	89	-4186
HUTCHINSON	38.500	97.000	311	51	-260
BEEVILLE	28.583	97.250	139721 -	23	-139698 *
WILLIAMS	35.500	113.000	16784	6	-16778
CORPUS CHRISTI	27.500	97.667	1202	0	-1202
TOTAL			5385142	6470181	1085039

Table 3-18. Quadrangles for Which ARR and HSSR Data Indicate DOE Estimate of UINV Is Too Low

QUAD	LAT	LONG	UINV	UINVH*	UINVG**	DIFH***	DIFG****
BROWNSVILLE	26.500	97.667	0	2139	0	2139	0
CHALLIS	44.500	115.000	15836	161663	79076	145827	63240
EAU CLAIRE	44.500	91.000	0	1938	113504	1938	113504
ELKO	40.500	115.000	347	6075	79775	5728	79428
ENID	36.500	97.000	0	11490	0	11490	0
GREEN BAY	44.500	89.000	4	611	59960	607	59956
IRON RIVER	46.417	89.000	0	18176	74182	18176	74182
JOPLIN	37.500	95.000	0	2994	42165	2994	42165
KINGMAN	35.500	115.000	385	15739	118453	15354	118068
KLAMATH FALLS	42.500	121.000	2512	54380	44267	51868	41755
LAMAR	38.500	103.000	915	237506	26774	236591	25859
LANDER	42.500	109.000	35620	47151	137675	11531	102055
MARFA	30.500	104.500	983	7819	65499	6836	64516
MCDERMITT	41.500	117.000	3484	11562	17880	8078	14396
MILLETT	39.500	117.000	3372	19441	39001	16069	35629
OKANOGAN	48.500	119.000	56019	79395	91750	23376	35731
OKLAHOMA CITY	35.500	97.000	0	1050	5841	1050	5841
POCATELLO	42.500	113.000	4052	31449	138521	27397	134469
POPLAR BLUFF	36.500	91.000	1068	5580	31919	4512	30851
PORTLAND	43.500	71.500	8094	22672	30858	14578	22764
PRATT	37.500	99.000	0	166	41220	166	41220
PRESIDIO	29.750	104.250	576	1392	33371	816	32795
RICE LAKE	45.500	91.000	417	61739	43923	61322	43506
RITZVILLE	47.500	119.000	31283	737873	123076	706590	91793
ROCK SPRINGS	41.500	109.000	28181	99922	46776	71741	18595
SALINA	38.500	111.000	63545	86079	201474	22534	137929
SPOKANE	47.500	117.000	11957	282557	210461	270600	198504
ST. CLOUD	45.500	95.000	0	28967	53461	28967	53461
TORRINGTON	42.500	105.000	34841	40325	67827	5484	32986
WALKER LAKE	38.500	119.000	26660	207815	37072	181155	10412
WELLS	41.500	115.000	19464	20898	38796	1434	19332
WICHITA	37.500	97.000	0	6612	21790	6612	21790

N=32

*UINVH = UINV predicted from HSSR data.
**UINVG = UINV predicted from ARR data.
***DIFH = UINVH - UINV.
****DIFG = UINVG - UINV.

Table 3-19. Quadrangles for Which ARR and HSSR Data Indicate DOE Estimate of UINV Is Too High

QUAD	LAT	LONG	UINV	UINVH	UINVG	DIFH	DIFG
BEEVILLE	28.583	97.250	139721	23	0	-139698	-139721
BUTTE	46.500	113.000	180800	58495	15661	-122305	-165139
CASPER	42.500	107.000	975107	532299	828268	-442808	-146839
DELTA	39.500	113.000	50054	16998	0	-33056	-50054
FLAGSTAFF	35.500	111.000	70075	145	68513	-69930	-1562
GRAND CANYON	36.500	113.000	59029	50672	38658	-8357	-20371
HOT SPRINGS	43.500	103.000	64720	14561	50986	-50159	-13734
LAWTON	34.500	99.000	26150	10910	3539	-15240	-22611
MCALLEN	26.583	98.467	52696	3337	28690	-49359	-24006
PRESCOTT	34.500	113.000	740209	12609	286546	-727600	-453663
RICHFIELD	38.500	113.000	26064	13425	0	-12639	-26064
SEGUIN	29.500	97.000	33326	117	21279	-33209	-12047
WICHITA FALLS	33.500	99.000	67929	1228	18843	-66701	-49086

N=13

Table 3-20. Quadrangles for Which ARR and HSSR Data Do Not Agree or for Which One Set of Data Is Missing

QUAD	LAT	LONG	UINV	UINVH	UINVG	DIFH	DIFG
ALBUQUERQUE	35.500	107.000	1149127	744904	1164684	-404223	15557
AMARILLO	35.500	101.000	34782	1570	.	-33212	.
ARMINTO	43.500	107.000	116398	421802	.	305404	.
ASHLAND	46.500	91.000	0	65366	.	65366	.
ASHTON	44.500	111.000	1013	.	40996	.	39983
ATHENS	33.500	83.000	1190	10817	.	9627	.
AUGUSTA	33.500	81.000	6915	3659	39592	-3256	32677
AUSTIN	30.500	97.000	31964	9226	.	-22738	.
BAKER	44.500	117.000	0	.	35083	.	35083
BEAUMONT	31.500	95.000	20696	213	.	-20483	.
BILLINGS	45.500	109.000	1154	9222	.	8068	.
CHEYENNE	41.500	105.000	3201	.	94688	.	91487
CLINTON	35.500	99.000	6782	3993	45258	-2789	38476
CODY	44.500	109.000	4490	.	58476	.	53986
CORPUS CHRISTI	27.500	97.667	1202	0	19329	-1202	18127
CORTEZ	37.500	109.000	88494	342077	70215	253583	-18279
CRAIG	40.500	107.000	42781	92852	30268	50071	-12513
CRYSTAL CITY	28.500	101.000	102580	.	124350	.	21770
DEATH VALLEY	36.500	117.000	41809	11718	164663	-30091	122854
DENVER	39.500	105.000	146303	.	89468	.	-56835
DICKINSON	46.500	103.000	17160	2681	36392	-14479	19232
DILLON	45.500	113.000	43232	69777	.	26545	.
DUBOIS	44.500	113.000	6383	.	53590	.	47207
DYERSBURG	36.500	89.000	4275	89	30909	-4186	26634
EKALAKA	45.500	105.000	17476	.	47274	.	29798
EMORY PEAK	29.500	103.000	10188	8505	96348	-1683	86160
ESCALANTE	37.500	111.000	42191	4746	.	-37445	.
GALLUP	35.500	109.000	562445	.	68164	.	-494281
GILLETTE	44.500	105.000	50426	34227	55830	-16199	5404
GLENS FALLS	43.500	73.000	5878	1751	31810	-4127	25932
GREELEY	40.500	105.000	39511	.	60299	.	20788
GREENSBORO	36.500	79.000	12376	745	34085	-11631	21709
HAMILTON	46.500	115.000	5057	.	49857	.	44800
HARRISBURG	40.500	77.000	5678	182535	.	176857	.
HUTCHINSON	38.500	97.000	311	51	31603	-260	31292
LA JUNTA	37.500	101.000	0	144997	.	144997	.
LAREDO	27.500	99.000	280075	.	29864	.	-250211
LAS VEGAS	36.500	115.000	2131	497	148123	-1634	145992
LEADVILLE	39.500	107.000	14831	.	0	.	-14831
LEMMON	45.500	103.000	52424	10013	188000	-42411	135576
LLANO	30.500	99.000	36	4351	.	4315	.
LOVELOCK	40.500	119.000	36	118463	.	118427	.
LUBBOCK	33.500	101.000	3565	.	50306	.	46741
MANHATTAN	39.500	97.000	379	321	33564	-58	33185
MESA	33.500	111.000	37941	24563	126266	-13378	88325
MOAB	38.500	109.000	334742	622787	222436	288045	-112306
MONTROSE	38.500	107.000	70214	74816	.	4602	.
NEW ULM	44.500	95.000	1231	37031	.	35800	.
NEWARK	40.500	75.000	8799	.	52731	.	43932
NEWCASTLE	43.500	105.000	298458	.	93117	.	-205341
NOGALES	31.750	110.833	2676	.	32615	.	29939
OGDEN	41.500	111.000	0	.	26966	.	26966
PALESTINE	31.500	95.000	1691	264	45279	-1427	43588
PECOS	31.500	103.000	0	.	52716	.	52716
PLAINVIEW	34.500	101.000	33750	10108	42584	-23642	8834
PRICE	39.500	111.000	2328	12130	0	9802	-2328
PUEBLO	38.500	105.000	158665	131907	.	-26758	.
RAPID CITY	44.500	103.000	8252	5124	55845	-3128	47593
RAWLINS	41.500	107.000	184867	.	228546	.	43679
RENO	39.500	119.000	3132	26682	.	23550	.
SALTON SEA	33.500	115.000	2180	10723	.	8543	.
SAN ANTONIO	29.500	99.000	2049	9993	.	7944	.
SANDPOINT	48.500	117.000	34162	43728	24122	9566	-10040
SCRANTON	41.500	75.000	21587	7181	35335	-14406	13748
SHERMAN	33.500	97.000	5974	2402	17332	-3572	11358
SHIPROCK	36.500	109.000	377253	.	124046	.	-253207
SOCORRO	34.500	109.000	85655	.	108861	.	23206
SPARTANBURG	34.500	81.000	7051	394	21965	-6657	14914
TONOPAH	38.500	117.000	4356	107903	.	103547	.
TRONA	35.500	117.000	6974	891	.	-6083	.
VERNAL	40.500	109.000	50227	.	128932	.	78705
VYA	41.500	119.000	20006	.	96976	.	76970
WILLIAMS	35.500	113.000	16784	6	18689	-16778	1905
WINNEMUCCA	40.500	117.000	6569	12387	.	5818	.

N=74

Table 3-21. Quadrangles for Which ARR and HSSR Data Indicate DOE UINV Estimates Are Too Large or Too Small by >50,000 Tons

Both ARR and HSSR Data Indicate DOE UINV Too Small by >50,000 Tons			Both ARR and HSSR Data Indicate DOE UINV Too Large by >50,000 Tons		
Quadrangle	HSSR Residual Inventory (tons)	ARR Residual Inventory (tons)	Quadrangle	HSSR Residual Inventory (tons)	ARR Residual Inventory (tons)
Challis	146,000	63,000	Beeville	-140,000	-140,000
Ritzville	707,000	92,000	Butte	-122,000	-165,000
Spokane	271,000	199,000	Casper	-443,000	-147,000
			Prescott	-727,000	-454,000

Table 3-22. Quadrangles for Which ARR Data Only Indicate DOE UINV Too Small by >50,000 Tons

Quadrangle	ARR Residual Inventory (tons)	HSSR Residual Inventory (tons)
Eau Claire	+114,000	+ 2,000
Elko	+ 79,000	+ 6,000
Green Bay	+ 60,000	+ 1,000
Iron River	+ 74,000	+18,000
Kingman	+118,000	+15,000
Lander	+102,000	+12,000
Marfa	+ 64,000	+ 7,000
Pocatello	+134,000	+27,000
Salina	+138,000	+23,000
St. Cloud	+ 53,000	+29,000
Cheyenne	+ 91,000	(no HSSR data)
Cody	+ 54,000	(no HSSR data)
Death Valley	+123,000	-30,000
Emory Peak	+ 86,000	+ 2,000
Las Vegas	+146,000	- 2,000
Lemmon	+136,000	-42,000
Mesa	+ 88,000	-13,000
Pecos	+ 52,000	(no HSSR data)
Vernal	+ 79,000	(no HSSR data)
Vya	+ 77,000	(no HSSR data)

Table 3-23. Quadrangles for Which HSSR Data Only Indicate DOE UINV Too Small by >50,000 Tons

Quadrangle	HSSR Residual Inventory (tons)	ARR Residual Inventory (tons)
Ashland	+ 65,000	(no ARR data)
Klamath Falls	+ 52,000	+ 42,000
La Junta	+145,000	(no ARR data)
Lamar	+237,000	+ 26,000
Rice Lake	+ 61,000	+ 44,000
Rock Springs	+ 71,000	+ 19,000
Walker Lake	+181,000	+ 10,000
Arminto	+305,000	(no ARR data)
Cortez	+254,000	- 18,000
Craig	+ 50,000	- 13,000
Harrisburg	+177,000	(no ARR data)
Lovelock	+118,000	(no ARR data)
Moab	+288,000	-112,000
Tonapah	+104,000	(no ARR data)

Table 3-24. Quadrangles for Which ARR or HSSR Data Only Indicate DOE UINV Too Large by >50,000 Tons

HSSR Data Only Indicate DOE UINV Too Large by >50,000 Tons

Quadrangle	HSSR Residual Inventory (tons)	ARR Residual Inventory (tons)
Flagstaff	- 70,000	- 2,000
Hot Springs	- 50,000	-14,000
Wichita Falls	- 67,000	-49,000
Albuquerque	-404,000	+16,000

ARR Data Only Indicate DOE UINV Too Large by >50,000 Tons

Quadrangle	ARR Residual Inventory (tons)	HSSR Residual Inventory (tons)
Delta	- 50,000	- 33,000
Denver	- 57,000	(no HSSR data)
Gallup	-494,000	(no HSSR data)
Laredo	-250,000	(no HSSR data)
Moab	-112,000	+288,000
Newcastle	-205,000	(no HSSR data)
Shiprock	-253,000	(no HSSR data)

4. Conclusions

It is concluded that patterns of uranium enrichment relative to thorium or related elements, as measured by aerial gamma-ray spectrometry (UET) and by stream sediment geochemistry (UET and UHP), reflect the presence of economic uraniferous provinces. The aerial radiometric data may be related at least semiquantitatively to uranium inventory by a multivariable linear equation and used to predict such inventories in relatively unexplored territory. Stream sediments data appear to be less closely related to uranium inventory but may be used for qualitative prediction to indicate quadrangles that appear not to fit the relationship between geochemical variables and uranium inventory. In the NURE program, this may be useful in pointing out quadrangles that warrant restudy by the quadrangle evaluators

SECTION IV

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APPENDIX I

QUADRANGLES WITH SIGNIFICANT URANIUM PRODUCTION
(adapted from DOE, 1979, and Butler, Finch, and Twenhofel, 1962)

APPENDIX I

QUADRANGLES WITH SIGNIFICANT URANIUM PRODUCTION
(adapted from DOE, 1979, and Butler, Finch, and Twenhofel, 1962)

Mining districts with current or past uranium production (1948-1978) were taken from DOE (1979, Fig. 2.2) and assigned to the appropriate 1:250,000-scale NTMS quadrangles by consulting Butler, Finch, and Twenhofel (1962). Production estimates in tons of U_3O_8 were adapted from the production ranges shown by DOE (1979) as follows:

Indicated Range	Assigned Production Value
less than 1 ton	1 ton
1-100 tons	50 tons
101-1000 tons	500 tons
1001-10,000 tons	5,000 tons
greater than 10,000 tons	10,000 tons

The assigned total production for each quadrangle and the number of producing properties are recorded in the following table. In addition, all quadrangles with reported uranium occurrences shown by Butler, Finch, and Twenhofel (1962) but not assigned 1 ton or more production based on DOE (1979) were all arbitrarily assigned 0.1 ton of U_3O_8 production.

Quadrangle	Tons of U_3O_8 Production	No. of Producing Properties
Sandpoint	51	3
Ritzville	5,000	3
Spokane	50	9
Butte	50	3
White Sulphur Springs	1	1
Dickinson	500	13
Lemmon	500	28
Billings	250	10
Cody	250	10
Challis	50	5
Bend	1	1
Klamath Falls	500	2
Gillette	5,000	27
Newcastle	3,300	63
Arminto	800	44
Hot Springs	5,000	102

Quadrangle	Tons of U_3O_8 Production	No. of Producing Properties
Lander	51	6
Rock Springs	1	5
Rawlins	500	5
Cheyenne	1	1
Vya	1	1
Wells	50	3
Casper	25,000	92
Chico	25	4
Reno	25	4
Millett	50	2
Delta	500	3
Vernal	5,000	22
Craig	500	28
Denver	4,000	32
Greeley	1,000	9
Walker Lake	51	4
Richfield	600	22
Salina	5,000	65
Moab	42,000	1,348
Torrington	2,050	18
Price	50	17
Escalante	550	172
Cortez	16,000	583
Shiprock	5,550	216
Flagstaff	500	99
Grand Canyon	5,000	2
Marble Canyon	50	12
St. Johns	50	21
Mesa	50	16
Prescott	50	1
Nogales	50	3
Salton Sea	50	3
Bakersfield	51	4
Death Valley	1	1
Gallup	5,500	32
Albuquerque	20,050	119
Aztec	3	6
Socorro	51	9
Silver City	1	1
Lubbock	50	7
Lawton	1	1
Crystal City	10,000	54
Laredo	500	3

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