Geology
GJBX-(81)-29

GJBX-29 '81

K/UR-29
Part 6

ORGDP

OAK
RIDGE
GASEOUS
DIFFUSION
PLANT

UNION
CARBIDE

HYDROGEOCHEMICAL AND STREAM SEDIMENT DETAILED GEOCHEMICAL SURVEY FOR TRANS-PECOS, TEXAS

GEOLOGY

STILLWELL MOUNTAINS PROJECT AREA

T. R. Butz, M. E. Wagner, J. G. Grimes,
C. S. Bard, R. N. Helgerson, and P. M. Pritz
Uranium Resource Evaluation Project

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

October 31, 1980

OPERATED BY
UNION CARBIDE CORPORATION
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

A computer readable magnetic tape containing measurement, analysis, and location data may be purchased from the GJOIS Project, UCC-ND Computer Applications Dept., 4500 North Building, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, Tennessee 37830.

Date of Issue: October 31, 1980
Report Number: K/UR-29
Part 6

Subject Category: UC-51, Nuclear Raw Materials

HYDROGEOCHEMICAL AND STREAM SEDIMENT DETAILED GEOCHEMICAL SURVEY FOR TRANS-PECOS, TEXAS

STILLWELL MOUNTAINS PROJECT AREA

T. R. Butz, M. E. Wagner, J. G. Grimes, C. S. Bard, R. N. Helgerson, and P. M. Pritz

Uranium Resource Evaluation Project

Union Carbide Corporation, Nuclear Division
Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee

Prepared for the U. S. Department of Energy
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado
under U. S. Government Contract W-7405 eng 26

Uranium Resource Evaluation Project
J. W. Arendt, Project Manager
T. R. Butz, Assistant Project Manager

Geology and Geochemistry
T. R. Butz, Project Geologist/Geochemist
P. M. Pritz, Field Geology Program Director
M. E. Wagner, Field Geology Supvervisor

J. H. French, S. A. Roberts, C. J. Stannard,
C. S. Lide, and D. J. Tieman, Field Geologists

Analytical Chemistry, Detailed Survey Geochemistry, and Report Preparation
J. D. Joyner, Data Management and Information Processing
R. N. Helgerson, Analytical Chemistry
J. G. Grimes and C. S. Bard, Detailed Geochemical Reporting

Uranium Resource Evaluation Project
Oak Ridge Gaseous Diffusion Plant
P. O. Box P, Mail Stop 246
Oak Ridge, Tennessee 37830
Telephone: (615) 574-8882
FTS 624-8882

CONTENTS

	Page
ABSTRACT	9
INTRODUCTION	11
Location and Physiography	12
Climate	12
Related Studies	12
GEOLOGY	18
Stratigraphy	18
Structure	21
Hydrology	23
Uranium Occurrences	23
SAMPLE COLLECTION	23
Chronology of the Survey	23
Field Procedures	23
Contamination	24
CHEMICAL ANALYSIS	24
QUALITY CONTROL	26
Measurements Control	26
Principal Component Error Analysis	26
GEOCHEMICAL RESULTS	26
Geochemical Distributions in Groundwater	26
Summary of Groundwater Data	32
Geochemical Distributions in Stream Sediments	32
Uranium	32
Thorium	33
Related Variables	34
Summary of Stream Sediment Data	35
BIBLIOGRAPHY	37
APPENDIX A. GROUNDWATER	A-1
APPENDIX B. STREAM SEDIMENT	B-1
APPENDIX C. COMPUTER CODE LIST AND FIELD FORMS	C-1
APPENDIX D. MICROFICHE OF FIELD AND LABORATORY DATA	D-1

LIST OF TABLES

No.	Title	Page
1	Detection Limits of Variables Determined in Water and Sediment Samples	25
2	Summary of Measurements Control Results Obtained With Groundwater Samples From the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas.	27
3	Summary of Measurements Control Results Obtained With Stream Sediment Samples from the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas.	28
4	Distribution of Samples by Geologic Unit From the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	31

LIST OF FIGURES

No.	Title	Page
1	Index Map Showing the Map Boundaries of the Still-Well Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	13
2	Generalized Geologic Map of Texas with Location of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	15
3	Generalized Geologic Map of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas.	17
4	Generalized Structure Map of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas.	19
5	Producing Horizon Map for Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	29

LIST OF PLATES

(In Back Pocket)

No.	Title
1	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Groundwater Sample Location Map
2	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Concentration Map, Groundwater, Uranium
3	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Concentration Map, Groundwater, Specific Conductance
4	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Stream Sediment Sample Location Map
5	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Symbol Plot, Stream Sediment, Uranium
6	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Symbol Plot, Stream Sediment, Thorium
7	Generalized Geologic Map of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas
8	Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Radiometric Sample Location Map

ABSTRACT

Results of the Stillwell Mountains project area of the detailed geochemical survey for Trans-Pecos, Texas are reported. Field and laboratory data are presented for 10 groundwater and 228 stream sediment samples. Statistical and areal distributions of uranium and possible uranium-related variables are given. A generalized geologic map of the project area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed.

Two groundwater samples from the western section of the project area have the highest uranium values (17.35 and 6.80 ppb). These samples display relatively high concentrations of variables commonly found associated with sulfide mineralization (silver, copper, molybdenum, and selenium). The specific conductance values measured for these two samples represent the second highest and the third lowest values in the project area. The producing horizons of these two samples are inferred to be in or below the Buda Limestone. The two samples occur in a rifted area with stratigraphically Lower Santa Elena Limestone and Tertiary intrusives exposed along the uplifted blocks.

Stream sediment samples containing significant amounts of soluble uranium (≧1.90 ppm) represent two major areas: along the Rio Grande (trending NE-SW) from Sierra Larga to Big Canyon, and between the Sierra del Carmen Range and Stillwell Mountain (trending NW-SE). Arsenic, beryllium, lithium, molybdenum, selenium, and vanadium are associated with high uranium values in both of the areas. The areas with high uranium values are characterized by extensive Tertiary faulting and folding and Tertiary intrusives.

STILLWELL MOUNTAINS PROJECT AREA

INTRODUCTION

The National Uranium Resource Evaluation (NURE) Program was established by the U. S. Atomic Energy Commission, now the U. S. Department of Energy (DOE), in the spring of 1973 to assess uranium resources and to identify favorable areas for detailed uranium exploration throughout the United States. The principal objectives of the NURE Program are: (1) to provide a comprehensive in-depth assessment of the nation's uranium resources for national energy planning, and (2) to identify areas favorable for uranium resources. A NURE Program report covering uranium resource assessment in 116 National Topographic Map Series (NTMS) 1° x 2° quadrangles, which contain 100% of the currently estimated uranium resources, is targeted for 1980. The complete resource assessment of the 272 highest-priority quadrangles is scheduled for completion in 1985, and the first comprehensive assessment report of the entire United States is scheduled for completion in 1988. This program, which is being administered by DOE, is expected to increase the activity of commercial exploration for uranium in the United States.

The NURE Program consists of five parts:

1. Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Program,
2. Aerial Radiometric and Magnetic Survey,
3. Surface Geologic Investigations,
4. Drilling for Geologic Information, and
5. Geophysical Technology Development.

The objective of the HSSR Program is to provide information to be used in accomplishing the overall NURE Program objectives. This is accomplished by a reconnaissance of surface water, groundwater, stream sediment, and lake sediment. The survey is being conducted by three Government-owned laboratories. Union Carbide Corporation, Nuclear Division (UCC-ND), under contract with DOE, is conducting its survey in 154 NTMS 1° x 2° quadrangles which cover approximately 2,500,000 km^2 (1,000,000 mi^2) of the central United States. This area includes most of the states of Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Minnesota, Wisconsin, Michigan, Indiana, Illinois, and Iowa, as well as parts of Arkansas, Missouri, New Mexico, and Ohio.

As a part of the HSSR Program, detailed geochemical surveys were initiated in the fall of 1978 to supply comprehensive detailed geochemical data from specific areas. These surveys are designed to characterize the hydrogeochemistry, stream sediment geochemistry, and/or radiometric patterns of known or potential uranium occurrences. The information can be used to interpret data from the 1° x 2° NTMS quadrangle basic data surveys.

This report on the Stillwell Mountains project area represents the sixth volume of geochemical data which describe seven select areas in the Trans-Pecos region, Texas (see Figure 1 for the location and names of the last three of the seven project areas).

LOCATION AND PHYSIOGRAPHY

The Stillwell Mountains project area of the Trans-Pecos detailed geochemical survey covers a surface area of approximately 5,983 km^2 (2,311 mi^2) and is outlined on the generalized geologic map of Texas (Figure 2). It is located within the Emory Peak 1° x 2° NTMS Quadrangle, and solely within Brewster County. The area of detailed sampling includes approximately 1,199 km^2 (463 mi^2). A generalized geologic map and stratigraphic column listing URE geologic codes used are given in Figure 3 and Plate 7.

The Stillwell Mountains project area borders the northeastern boundary of Big Bend National Park. To the north of the project area is the Marathon Basin; to the west, the Santiago Mountains; and to the east, the Rio Grande. The area is the eastern-most extension of the Mexican Highland section of the Basin and Range Province within the United States. The project area is located on the northeast end of the doubly plunging Serrania del Burro Mountains of Mexico. It is characterized by Late Oligocene fault block mountain ranges and adjacent alluvium-filled graben structures extending to the Rio Grande. Major topographic highs include the Sierra del Carmen Range to the southwest, the Black Gap basaltic ridge in the center and, to the north, the Dove and Black Mountains.

CLIMATE

The climate of the Trans-Pecos region of Texas is classified as arid, subtropical. Vegetation coverage is sparse due to the extremely high evapotranspiration rate relative to rainfall. The normal annual precipitation for the eastern Trans-Pecos area is 30 cm (12 in.). The normal average temperature is 18°C (64°F).

September is the peak season for rain, with precipitation occurring as short-lived, intense afternoon thundershowers. The intensity of rainfall and lack of vegetation makes flash-floods common in the region (National Oceanic and Atmospheric Administration, 1974).

RELATED STUDIES

The geology and structural development of the Stillwell Mountains project area are discussed by Wilson (1951), Shambaugh (1951), and St. John (1965). Prior to NURE activity in the Stillwell Mountains region, four anomalously radioactive locations were described within the project boundaries (Southern Interstate Nuclear Board, 1969). However, uranium-related investigations have largely been limited to those of the NURE

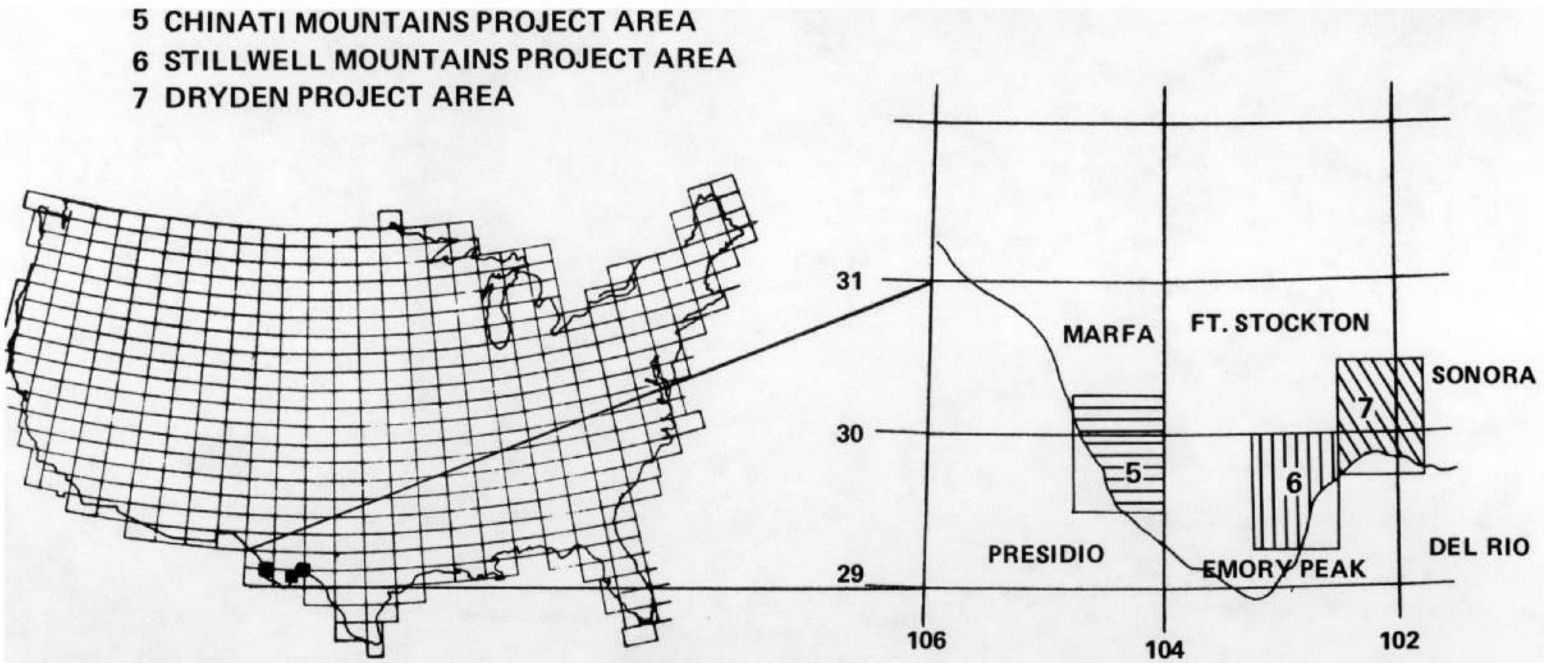


Figure 1

INDEX MAP SHOWING THE MAP BOUNDARIES OF THE STILLWELL MOUNTAINS PROJECT AREA (6), TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

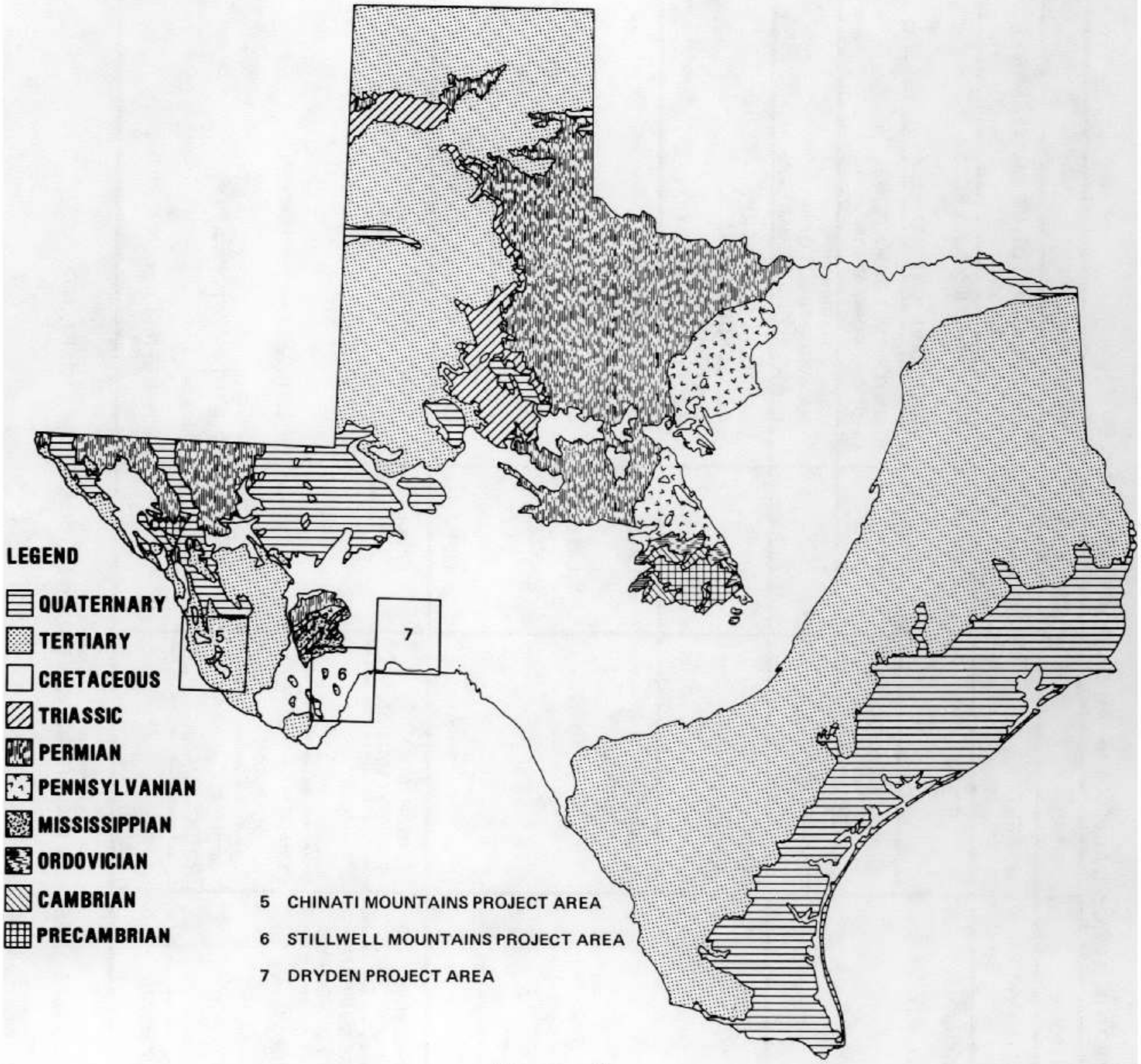


Figure 2

GENERALIZED GEOLOGIC MAP OF TEXAS
WITH LOCATION OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS
(AFTER KING, ET AL, 1974)

STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY

ERA	SYSTEM	SERIES	MAP CODE	GEOLOGIC UNIT
CENOZOIC	QUATERNARY	RECENT	QD	ALLUVIUM AND OTHER QUATERNARY DEPOSITS
	TERTIARY		TEV	EXTRUSIVE IGNEOUS ROCKS
			TI	INTRUSIVE IGNEOUS ROCKS
		OLIGOCENE/EOCENE	TECH	SOUTH RIM FORMATION CHISOS FORMATION
		EOCENE	TLSR	CANOE FORMATION HANNOLD HILL FORMATION BLACK PEAKS FORMATION
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS	UKSE	JAVELINA FORMATION AGUJA FORMATION PEN FORMATION BOQUILLAS FORMATION
		LOWER CRETACEOUS	LKLB	BUDA LIMESTONE DEL RIO CLAY
			LKSE	SANTA ELENA LIMESTONE
			LKSP	SUE PEAKS FORMATION DEL CARMEN LIMESTONE TELEPHONE CANYON FORMATION (UNDIVIDED)
			LKT	GLEN ROSE FORMATION
PALEOZOIC	PENNSYLVANIAN	LOWER PENNSYLVANIAN	CPUD	TESNUS FORMATION
	MISSISSIPPIAN AND DEVONIAN			CABALLOS NOVACULITE
	ORDOVICIAN	UPPER ORDOVICIAN		MARAVILLAS FORMATION
		MIDDLE ORDOVICIAN		FORT PENN FORMATION
	CAMBRIAN	UPPER CAMBRIAN		DAGGER FLATT SANDSTONE

SOURCE OF GEOLOGY:
1. BARNES, V. E.; GEOLOGIC ATLAS OF TEXAS, EMORY PEAK-PRESIDIO SHEET (PRELIMINARY SHEET, 1977).

LEGEND FOR FIGURE 3

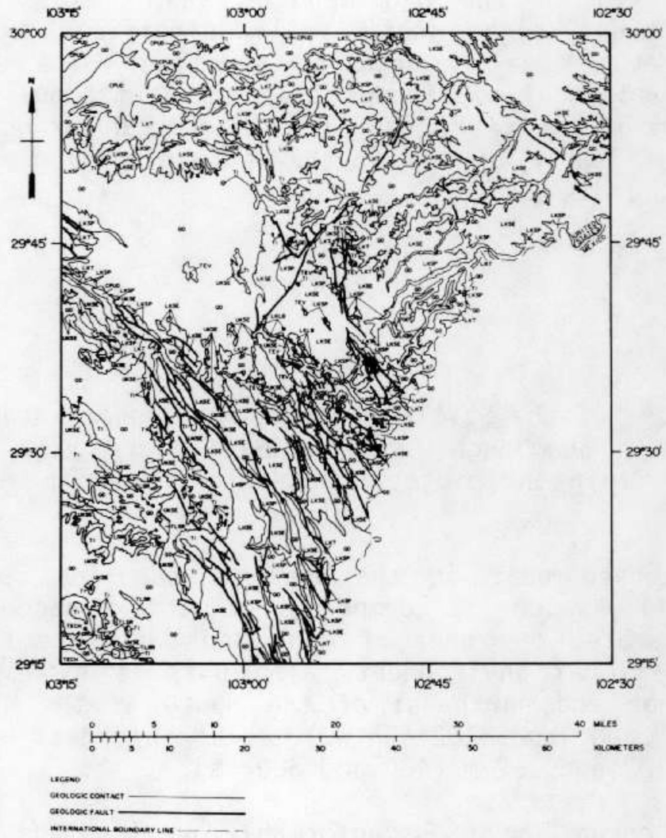


Figure 3

GENERALIZED GEOLOGIC MAP
OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

program. UCC-ND personnel observed and reported on geochemical patterns indicative of uranium mineralization from samples collected in the Emory Peak 1° x 2° NTMS Quadrangle (Uranium Resource Evaluation Project, 1978). In an airborne gamma-ray and magnetic reconnaissance survey, conducted by LKB Resources, Inc., 12,114 line km (7,529 line mi) were flown during 1978 in the Big Bend area of Texas. Four preferred anomalies and twenty-eight statistically significant eU anomalies were recognized in the area of detailed sampling. The uranium spectral channel displayed local amplitudes over the Cretaceous sediments in the eastern portion of the Emory Peak 1° x 2° NTMS Quadrangle exceeding the responses over volcanic terrain in the western portion of the quadrangle (LKB Resources, Inc., 1979).

GEOLOGY

STRATIGRAPHY

Unit descriptions of the Stillwell Mountains project area are taken from St. John (1965), Shambaugh (1951), and Sellards, et al (1932). The exposed units within the project boundaries range in age from Cambrian to Quaternary.

The oldest exposed unit in the area of sampling is the Glen Rose Formation (LKT), which is composed of thick bedded, fine-grained limestones separated by zones of marl and sandstone and represents a littoral depositional environment. The unit is exposed in the Sierra del Carmen Range and northeast of the mouth of the Maravillas Canyon (lat. 29°34' N. and long. 102°47' W.). Unit thickness has been measured to be between 122 and 152 m (400 and 500 ft).

The Telephone Canyon Formation conformably overlies the Glen Rose Formation. It is exposed on the northeastern scarp of Maravillas Creek and represents a transgressive neritic to littoral environment. This unit is a nodular, marly yellow to gray limestone with a thickness of approximately 21 m (70 ft). The Del Carmen Limestone conformably overlies the Telephone Canyon Formation. It is exposed at the crest of the Dove Mountain Anticline (lat. 29°44' N. and long. 102°56' W.) (Figure 4) and northeast of Maravillas Creek (lat. 29°34' N. and long. 102°50' W.) with an approximate thickness of 137 m (450 ft). This limestone is biomicritic with bioherms representing a neritic environment with shallow reefs. The Sue Peaks Formation conformably overlies the Del Carmen Limestone. The section measures 21 to 27 m (70 to 90 ft) at Stairway Mountain (lat. 29°32' N. and long. 102°57' W.). This micritic to biomicritic unit represents a shallow neritic environment with a clastic sediment source. The Telephone Canyon Formation, Del Carmen Limestone, and Sue Peaks Formation are combined on the geologic map (Figure 3 and Plate 7) and shown as LKSP.

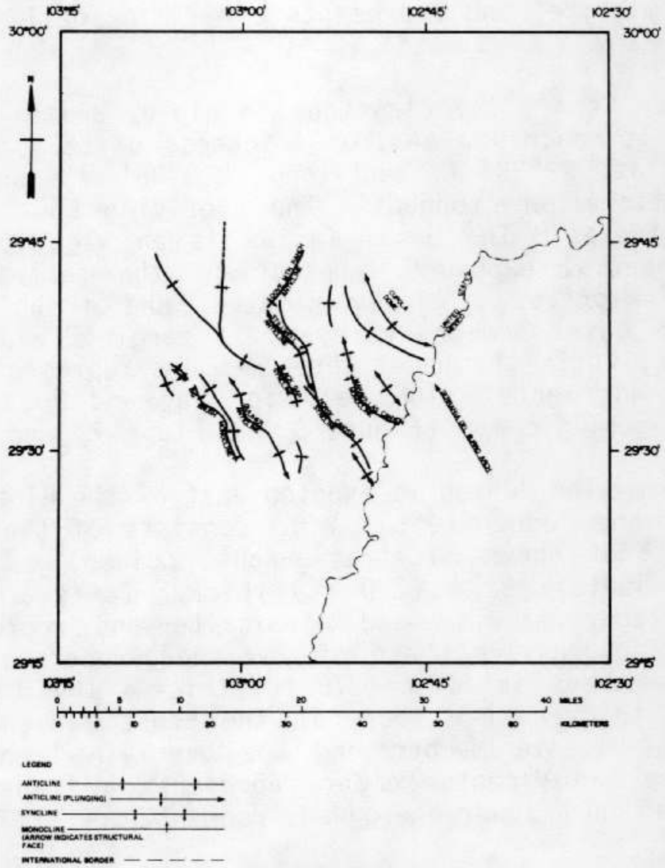


Figure 4

GENERALIZED STRUCTURE MAP
OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS
(ADAPTED FROM ST. JOHN, 1965 AND BARNES, 1977)

The Santa Elena Limestone (LKSE) is the most widely exposed unit of the project area, capping the Sierra Del Carmen Range (lat. 29°30' N. and long. 102°58' W.) and covering the northern section of the area sampled. It attains a maximum thickness of 290 m (950 ft). The Santa Elena Limestone (LKSE) is biomicritic with rudistid bioherms and beds of biosparite and micrite, and represents a neritic-shallow reef environment.

The Del Rio Clay is a silty claystone to clayey siltstone with gypsum accumulations. It reaches a maximum thickness of 56 m (185 ft) in Big Brushy Canyon (lat. 29°35' N. and long. 103°03' W.) and represents a littoral depositional environment. The overlying Buda Limestone consists of four facies. The basal facies is an algal biosparite with evidence of subaerial exposure. Upsection, the facies consist of a massive gray biomicrite, a clayey micrite, and a sublithic, nodular biomicrite. The basal member represents a marginal basin facies in a high energy zone, while the upper three members represent lower energy, deeper water environments. The Del Rio Clay and Buda Limestone are combined on the geologic map (Figure 3 and Plate 7) and shown as LKLB.

The Boquillas Formation, which is exposed east of the Black Gap Syncline (lat. 29°34' N. and long. 102°57' W.), consists of the Ernst and San Vicente Members (not shown on stratigraphic column). The basal Ernst Member is approximately 82 m (270 ft) thick. It is a silty, thin to medium-bedded flaggy micrite and biomicrite and represents a slow regressive or transgressive phase of low energy-nearshore deposition. The San Vicente Member is 82 m (270 ft) thick. The micritic beds of this member are thicker than those in the Ernst Member. The contact between the San Vicente Member and the overlying Pen Formation is gradational. The San Vicente Member represents a transgressive phase with deeper water and a lower energy environment.

The Pen Formation is the youngest Cretaceous marine unit exposed in the area sampled. This calcareous, gypsiferous clay has been protected from erosion by the overlying basalt cap. Its maximum thickness is 15 m (50 ft) when measured west of the Black Gap Syncline (Figure 4). It represents a regressive sequence with shallow water evaporitic conditions indicated by its gypsum content. The Boquillas and Pen Formations are combined on the geologic map with the Aguja and Javelina Formations (Figure 3 and Plate 7) and are shown as UKSE. The Aguja and Javelina Formations do not occur within the area sampled.

Tertiary extrusives (TEV) occur predominantly in the central graben-structure of the project area, between the Sierra del Carmen Range and Cupola Mountain (lat.29°40' N. and long. 102°51' W.). The major extrusive is a fine-grained, porphyritic basalt. A thickness of 137 m (450 ft) is exposed east of Stillwell Mountain (lat. 29°37' N. and long. 102°58' W.). Two units are identifiable in outcrop, the lower being dark gray and weathering smooth while the upper unit weathers into reddish brown angular blocks. The units exhibit flow structure and have plagioclase, augite, olivine, and iddingsite as principal mineral components. Although age dates have not been determined, the flows are considered to be Middle to Late Eocene in age, suggesting extrusion prior to major faulting and folding of the region.

The major intrusive unit (TI) of the area is an analcime gabbro exposed along the flanks of Stillwell Mountain, in Big Brushy Canyon, and west of Black Gap (lat. 29°33' N. and long. 102°56' W.). Reaching a maximum exposed thickness of 34 m (112 ft), it has intruded into the Ernst Member of the Boquillas Formation. The intrusive is a fine- to medium-grained holocrystalline, nonporphyritic unit composed predominantly of plagioclase. Mineralogical compositions of both the extrusives and intrusives are alike and may be considered to be of the same source. They are alkalic in nature and differences in composition can be explained by pre-intrusive differentiation (St. John, 1965).

The bolson fill of the Stillwell Mountains project area is considered to range from Tertiary to Quaternary in age. Age is determined by quantity and composition of igneous rocks in the sand, pebble, and cobble fractions of the interbedded gravels within the deposits. The silty clay and interbedded gravel extend into Mexico and were later cut by the Rio Grande. Bolson material is combined with alluvium and other Quaternary deposits on the geologic map (Figure 3 and Plate 7) and shown as QD.

STRUCTURE

The Stillwell Mountains project area is located within the Paleozoic Ouachita mobile foldbelt, southwest of the Marathon structural salient. Several major foldbelt structural features have subsurface expression within or near the project boundaries. The Luling Front extends arcuately through the central portion of the project area separating the highly sheared interior facies zone from rocks of the frontal zone. The front is marked by overthrusting of interior zone rocks over frontal facies units. No data could be found on the frontal zone rocks in the area, however, the interior zone rocks can be described from well log data from Bud Roark Well No. 1 (lat. 29°52' N. and long. 102°29' W.) and from outcrop studies at Sierra del Carmen in Coahuila, Mexico (lat. 29°11' N. and long. 102°50' W.). The rocks are believed to be of Cambrian to Ordovician (pre-Tesnus) age. They consist of weakly metamorphosed units similar to the Marathon Limestone of the Marathon Basin area (Flawn, et al, 1961 and St. John, 1965).

The Early Paleozoic Era was marked by the accumulation of fine-grained, limey, cherty, clastic sediments in the Ouachita Geosyncline. Periodic tectonic uplift and subsequent erosion of deposits within the geosyncline limited the total thickness of Early Paleozoic strata. Uplift of the hinterland, Llanoris, south of the geosyncline, precipitated the influx of clastic material from the activated area into the deepening trough (Flawn, et al, 1961). Continued geosyncline mobilization shifted the axis of deposition northward. Earlier Paleozoic sediments were brought to the surface, eroded and incorporated in newly deposited sediments closer to the craton margin. Crustal movement continued, advancing to the northwest in the form of compressional folds which broke into thrust sheets (King, 1935). Folding and overthrusting of geosynclinal deposits by the end of the Paleozoic Era moved the axis of deposition further north. The deposition of thick Permian (Wolfcamp) sediments signaled the end of the orogenic or deformational episode of the western section of the Ouachita system (King, 1935). The deformed Paleozoic sediments were then eroded to a flattened surface with later gentle Permo-Triassic folding. This area later underwent vertical tectonism during the Oligocene Laramide Orogeny (St. John, 1965).

The Mesozoic structural development of the Stillwell Mountains project area is outlined in detail by St. John (1965). Post Permian uplift and erosion of Paleozoic strata were followed by deposition of Cretaceous marine units. The Stillwell Mountains region is considered to be part of the West Texas Platform at its junction with the Coahuila Peninsula of northern Mexico. The Coahuila Series of the Lower Cretaceous was either eroded or never deposited in the Stillwell Mountains area (Lonsdale, et al, 1955). Encroachment and inundation of the Tamaulipas and Coahuila Peninsulas by the Mexican geosynclinal sea led to the deposition of the Lower Cretaceous (Comanchean) Glen Rose Limestone.

Doming of the Marathon Salient occurred during the deposition of the Del Carmen and Santa Elena units and is demonstrated by their northward thinning from Black Gap towards Glass Mountain (lat. 30°30' N. and long. 103°00' W.). Minor folding and faulting occurred during Del Rio deposition and is indicated by substantial differences in unit lithology and thickness. Continued doming of the Marathon area led to the regression of the Mesozoic sea, subaerial erosion, and subsequent deposition of 'dirty' carbonate Upper Cretaceous (Gulfian) units (i.e., Boquillas Formation).

The Late Cretaceous-Early Tertiary Laramide Orogeny resulted in the uplift of the Sierra del Carmen Range and the formation of the Dove Mountain Anticline (lat. 29°44' N. and long. 102°45' W.) (Figure 4). Decollement from the Sierra del Carmen Range created northeast folding. The Stillwell Anticline (lat. 29°38' N. and long. 102° 57' W.) (Figure 4) is one such decollement feature.

The Late Eocene-Early Tertiary volcanic activity inundated the Stillwell Mountains area with basaltic lava flows. Remobilization of Paleozoic thrust sheets caused compressional stress accumulation in the Cretaceous limestones and Tertiary extrusives and resulted in conjugate shear sets. With the release of compression, vertical down-drop of basement rocks and overlying sediments occurred along shear sets creating Basin and Range-type topography.

Erosion of coarse clastics from topographically high normal fault blocks formed the bolson-fill deposits of Late Tertiary and Quaternary age.

HYDROLOGY

The hydrology of the Stillwell Mountains project area is poorly understood due to structurally induced groundwater controls. However, those few wells that do exist furnish water from the fractured limestones of the Lower Cretaceous (Trinity and Comanchean) units. Wells range in depth from 90 to 305 m (300 to 1,000 ft). A few shallow wells produce from alluvium, however the water is of a poor quality with high concentrations of dissolved solids and mineral species.

URANIUM OCCURRENCES

Investigations conducted by the U.S. Atomic Energy Comission have delineated one site of uranium mineralization. The Stillwell Ranch prospect (lat. 29°38' N. and long. 102°57' W.) has carnotite in narrow fractures in deformed Cretaceous limestones (Southern Interstate Nuclear Board, 1969 and Shambaugh, 1951). Radiometric readings on outcrops exceeded background threefold (Reeves, et al, 1978).

Additional readings of anomalous radioactivity were detailed by LKB Resources, Inc., (1979). These anomalies occurred at or near the Lower-Upper Cretaceous (Comanchean-Gulfian) contact, presumably from the basal marly-shaly interbeds of the Boquillas Formation. A few of the statistically significant anomalies occur within the Santa Elena Limestone, presumably due to uranium from contact between the Santa Elena Limestone and intrusive-extrusive igneous units or from mineralization in solution cavities.

SAMPLE COLLECTION

CHRONOLOGY OF THE SURVEY

Sampling in the Stillwell Mountains project area began in January 1980 and was completed in February 1980. Laboratory analysis and compilation and verification of all field and laboratory data were completed in May 1980. The final field and laboratory data base used to prepare the statistical and areal distribution of uranium and other related variables for this report was completed in June 1980.

FIELD PROCEDURES

A total of 10 groundwater and 228 stream sediment samples was collected during detailed sampling of the Stillwell Mountains project area. Well water and springwater samples are reported as groundwater. Sample locations for groundwater and stream sediment sites are shown on Plates 1 and 4, respectively. Radiometric sample locations are shown on Plate 8. Sampling density for groundwater in the Stillwell Mountains project area was less than optimal due to the sparse population and because the major portion of the project area is within the Black Gap Wildlife Refuge.

Detailed information regarding techniques in sample collection, recording site data, field equipment, and field measurements can be found in the following reports: "Hydrogeochemical and Stream Sediment Reconnaissance Procedures for the Uranium Resource Evaluation Project" (Arendt, et al, December 1979); "Procedures Manual for Groundwater Reconnaissance Sampling" (Uranium Resource Evaluation Project, March 1978); and "Procedures Manual for Stream Sediment Reconnaissance Sampling" (Uranium Resource Evaluation Project, May 1978). Field observations were recorded on the field form shown in Table C-2 and are included on microfiche in Appendix D.

BGS-1SL Scintrex Scintillation Counters were used to obtain the radiometric data in this area. These readings were used in directing sampling toward geologic units with positive anomalous radioactivity.

CONTAMINATION

Precautions were taken to avoid collecting contaminated samples. Wells which were affected by chlorination, water-softening, or filtering devices were not sampled unless a sample could be taken before the water passed through such devices. Any well that had not been pumped recently was allowed to run as long as possible to flush the system. Any wells that were thought to be contaminated were noted as such on the field forms.

Sediment samples were collected upstream from road crossings and railroad tracks, except where this was not feasible.

CHEMICAL ANALYSIS

All samples collected were returned to the URE Project laboratory in Oak Ridge, Tennessee for preparation and analysis. The elements determined and the analytical techniques used along with the appropriate detection limits are given in Table 1. These detection limits are considered the best average during normal operation; however, some variables have values reported below these limits. All water samples were received in 250-ml polyethylene bottles and were filtered through 0.45-μm cellulose acetate paper. Stream sediment samples were dried overnight at 85°C and sieved to collect the <150-μm fraction. Part of the sediment sample was dissolved in 10 ml of 1:1 nitric-hydrofluoric acid. The analytical procedures which were used have been described by Cagle (1977) and Arendt, et al (December 1979). All observed data from all samples are included on microfiche in Appendix D.

Table 1

DETECTION LIMITS OF VARIABLES DETERMINED IN WATER AND SEDIMENT SAMPLES

Variable	Method	Detection Limits Sediment (ppm)	Detection Limits Water (ppb)
U	Fluorometry	0.25	0.2
U-MS	Mass Spectrometry-Isotope Dilution	--	0.02
U-NT	Neutron Activation-Delayed Neutron Count	0.02	--
As	Atomic Absorption	0.1	0.5
Se	Atomic Absorption	0.1	0.2
Ag	Plasma Source Emission Spectrometry	2	2
Al	Plasma Source Emission Spectrometry	0.05[a]	10
B	Plasma Source Emission Spectrometry	10	4
Ba	Plasma Source Emission Spectrometry	2	2
Be	Plasma Source Emission Spectrometry	1	1
Ca	Plasma Source Emission Spectrometry	0.05[a]	0.1[b]
Ce	Plasma Source Emission Spectrometry	10	30
Co	Plasma Source Emission Spectrometry	4	2
Cr	Plasma Source Emission Spectrometry	1	4
Cu	Plasma Source Emission Spectrometry	2	2
Fe	Plasma Source Emission Spectrometry	0.05[a]	10
Hf	Plasma Source Emission Spectrometry	15	--
K	Plasma Source Emission Spectrometry	0.05[a]	0.1[b]
La	Plasma Source Emission Spectrometry	2	--
Li	Plasma Source Emission Spectrometry	1	2
Mg	Plasma Source Emission Spectrometry	0.05[a]	0.1[b]
Mn	Plasma Source Emission Spectrometry	4	2
Mo	Plasma Source Emission Spectrometry	4	4
Na	Plasma Source Emission Spectrometry	0.05[a]	0.1[b]
Nb	Plasma Source Emission Spectrometry	4	--
Ni	Plasma Source Emission Spectrometry	2	4
P	Plasma Source Emission Spectrometry	5	40
Pb	Plasma Source Emission Spectrometry	10	--
Sc	Plasma Source Emission Spectrometry	1	1
Si	Plasma Source Emission Spectrometry	--	0.1[b]
Sr	Plasma Source Emission Spectrometry	1	2
Th	Plasma Source Emission Spectrometry	2	--
Ti	Plasma Source Emission Spectrometry	10	2
V	Plasma Source Emission Spectrometry	2	4
Y	Plasma Source Emission Spectrometry	1	1
Zn	Plasma Source Emission Spectrometry	2	4
Zr	Plasma Source Emission Spectrometry	2	2
SO_4	Spectrophotometry	--	5[b]
Cl	Spectrophotometry	--	10[b]

[a]Detection limits expressed in percent.
[b]Detection limits expressed in ppm.

QUALITY CONTROL

MEASUREMENTS CONTROL

The procedures used to analyze URE Project samples require that calibration standards, check samples, and blanks be analyzed along with normal samples to ensure the validity of the reported results. A measurements control program provides information concerning precision and reliability of these measurements. On a daily basis, control samples of two water batches and three sediment batches are submitted anonymously along with routine samples. A statistical summary of results reported on control samples, which were analyzed along with the samples included in this survey, is given in Tables 2 and 3. Results of uranium analysis of water and sediment control samples obtained from the Ames Laboratory as part of the Multilaboratory Analytical Quality Control for the HSSR Program are reported by D'Silva, et al (1980).

PRINCIPAL COMPONENT ERROR ANALYSIS

A principal component analysis of data from groundwater and stream sediment samples was used to produce an ordered list of samples using the eigenvalue statistics as described by Kane, et al (1977), where the most extreme samples were listed first. Additional samples were identified if single-element measurements were outside a three standard deviation confidence interval around the mean. The laboratory and field data from the samples identified by this procedure were reviewed. Two groundwater samples (029319 and 029402) and three stream sediment samples (029317, 029342, and 029474) were submitted for reanalysis. The original results were compared to the results from reanalysis. Of the more than 150 individual analyses that were compared, the only results which were considered to be in error in the original analysis and thus require corrections were the sulfate and chloride values for Groundwater Sample 029402, U-FL value for Sediment Sample 029474, arsenic and selenium values for Sediment Sample 029317, and multielement values for Sediment Sample 029342. This low error rate for the samples indicates a high level of reliability for the laboratory measurements.

GEOCHEMICAL RESULTS

GEOCHEMICAL DISTRIBUTIONS IN GROUNDWATER

Sample locations for groundwater samples collected in the Stillwell Mountains project area of the Trans-Pecos detailed geochemical survey are shown on Plate 1. Areal concentration maps for uranium and specific conductance are presented on Plates 2 and 3, and Figures A-1b and A-2b, respectively. A map showing the units from which samples are produced is presented in Figure 5.

Table 2

SUMMARY OF MEASUREMENTS CONTROL RESULTS OBTAINED WITH GROUNDWATER SAMPLES FROM THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

		Batch L-4				Batch H-4			
Element	Method	No. of Samples	Mean (ppb)	Standard Deviation (ppb)	Coefficient of Variation	No. of Samples	Mean (ppb)	Standard Deviation (ppb)	Coefficient of Variation
U	FL[(a)]	17	0.75	0.351	0.47	11	10.87	0.897	0.08
AS	AA[(b)]	20	3.3	1.11	0.33	17	0.6	0.31	0.55
SE	AA	20	1.2	0.31	0.26	17	0.8	0.24	0.29
AL	PS[(c)]	13	92.0	20.2	0.22	18	330.0	25.0	0.08
B	PS	13	1,570.0	62.2	0.04	19	69.0	4.6	0.07
BA	PS	12	140.0	3.3	0.02	19	31.0	1.4	0.05
CA	PS	14	10,000.0	850.0	0.08	18	91,400.0	6,190.0	0.07
CO	PS	14	20.0	4.1	0.20	17	90.0	2.9	0.03
CR	PS	14	93.0	5.6	0.06	18	18.0	1.8	0.10
CU	PS	8	45.0	1.8	0.04	18	202.0	23.3	0.11
FE	PS	13	103.0	7.2	0.07	18	960.0	50.7	0.05
K	PS	14	1,800.0	229.0	0.13	17	19,490.0	937.0	0.05
LI	PS	14	16.0	1.1	0.07	18	100.0	5.6	0.06
MG	PS	14	9,200.0	420.0	0.05	18	67,900.0	2,710.0	0.04
MN	PS	14	20.0	2.3	0.11	16	96.0	4.1	0.04
MO	PS	13	24.0	10.1	0.41	13	11.0	6.3	0.57
NA	PS	14	1,600.0	150.0	0.10	18	43,800.0	2,120.0	0.05
NI	PS	13	195.0	10.7	0.05	18	37.0	6.2	0.16
P	PS	13	90.0	23.8	0.26	17	4,498.0	134.3	0.03
SC	PS	13	63.0	2.8	0.04	17	11.0	0.5	0.05
SI	PS	14	870.0	164.0	0.19	18	7,940.0	371.0	0.05
SR	PS	14	56.29	2.644	0.05	18	5,012.55	170.85	0.03
TI	PS	13	118.0	8.2	0.07	18	38.0	4.4	0.11
V	PS	12	9.0	1.5	0.15	18	41.0	3.5	0.08
Y	PS	14	9.0	1.4	0.14	18	45.0	2.4	0.05
ZN	PS	14	498.0	42.7	0.09	18	45.0	24.3	0.54

[(a)] Fluorometric analysis.
[(b)] Atomic absorption.
[(c)] Plasma source emission spectroscopy.

Table 3

SUMMARY OF MEASUREMENTS CONTROL RESULTS OBTAINED WITH STREAM SEDIMENT SAMPLES FROM THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

		Batch Q-1				Batch R-3				Batch S-3			
Element	Method	No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation	No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation	No. of Samples	Mean (ppm)	Standard Deviation (ppm)	Coefficient of Variation
U	FL[a]	40	0.79	0.268	0.34	37	4.26	0.469	0.11	38	28.52	2.674	0.09
U	NT[b]	39	0.67	0.160	0.24	50	4.91	0.102	0.02	35	26.25	0.797	0.03
AS	AA[c]	17	1.8	0.25	0.14	27	3.6	0.64	0.18	19	26.4	3.11	0.12
SE	AA	12	0.5	0.31	0.57	28	0.2	0.43	2.02	20	1.4	0.62	0.45
AL	PS[d]	36	9,700.0	490.0	0.05	39	34,100.0	2,730.0	0.08	30	48,700.0	3,430.0	0.07
B	PS	38	7.0	3.5	0.46	34	20.0	7.1	0.34	30	61.0	10.3	0.17
BA	PS	38	130.0	14.6	0.11	39	454.0	51.0	0.11	32	314.0	31.1	0.10
BE	PS	37	<1.0			40	<1.0			32	2.0	4.0	1.74
CA	PS	38	1,200.0	100.0	0.08	40	3,100.0	300.0	0.10	31	16,900.0	80.0	0.06
CE	PS	37	19.08	3.677	0.19	39	68.82	7.196	0.10	29	55.59	4.968	0.09
CO	PS	38	4.0	2.7	0.59	40	10.0	2.2	0.20	31	33.0	3.1	0.09
CR	PS	38	14.0	2.1	0.14	39	28.0	3.2	0.11	32	65.0	6.6	0.10
CU	PS	35	3.0	0.8	0.22	38	20.0	1.5	0.07	30	69.0	2.9	0.04
FE	PS	37	9,700.0	390.0	0.04	40	18,000.0	1,070.0	0.06	30	40,800.0	2,070.0	0.05
K	PS	37	1,900.0	190.0	0.10	38	9,900.0	930.0	0.09	31	17,200.0	2,000.0	0.12
LI	PS	37	9.0	0.8	0.08	39	23.0	1.8	0.08	32	35.0	3.6	0.10
MG	PS	38	1,100.0	50.0	0.05	39	2,200.0	110.0	0.05	32	5,600.0	260.0	0.05
MN	PS	37	317.0	9.9	0.03	40	1,909.0	87.8	0.05	30	404.0	15.9	0.04
MO	PS	1	<4.0			40	2.0	0.9	0.41	29	43.0	3.7	0.08
NA	PS	1	<500.0			40	1,600.0	190.0	0.13	31	1,600.0	220.0	0.14
NB	PS	37	2.0	0.7	0.32	41	8.0	4.3	0.49	33	2.0	1.6	0.58
NI	PS	37	6.0	1.0	0.16	41	20.0	3.1	0.15	30	108.0	6.3	0.06
P	PS	36	70.0	6.0	0.09	35	2,149.0	217.3	0.10	28	1,441.0	83.8	0.06
PB	PS	28	5.0	3.0	0.50	27	38.0	5.6	0.14	28	21.0	3.6	0.16
SC	PS	38	1.0	0.5	0.31	41	5.0	0.8	0.15	32	10.0	0.8	0.08
SR	PS	36	19.17	1.320	0.07	39	55.33	4.054	0.07	32	85.56	6.133	0.07
TH	PS	38	2.0	1.7	0.74	41	8.0	2.8	0.34	33	8.0	2.5	0.30
TI	PS	38	572.0	54.8	0.10	39	3,321.0	369.9	0.11	32	2,123.0	174.9	0.08
V	PS	35	20.0	0.9	0.04	38	55.0	4.4	0.08	30	166.0	6.7	0.04
Y	PS	37	4.0	0.3	0.08	39	20.0	1.7	0.08	30	33.0	1.6	0.05
ZN	PS	36	13.0	2.1	0.16	35	93.0	7.5	0.08	29	185.0	12.0	0.06
ZR	PS	38	30.0	2.9	0.10	38	136.0	10.9	0.08	31	83.0	6.0	0.07
HF	PS	27	2.11	1.577	0.75	27	3.83	2.685	0.70	28	1.95	1.455	0.75
LA	PS	28	20.89	3.023	0.14	27	78.00	15.056	0.19	28	90.61	4.787	0.05

(a) Fluorometric analysis.
(b) Neutron activation delayed neutron count.
(c) Atomic absorption.
(d) Plasma source emission spectroscopy.

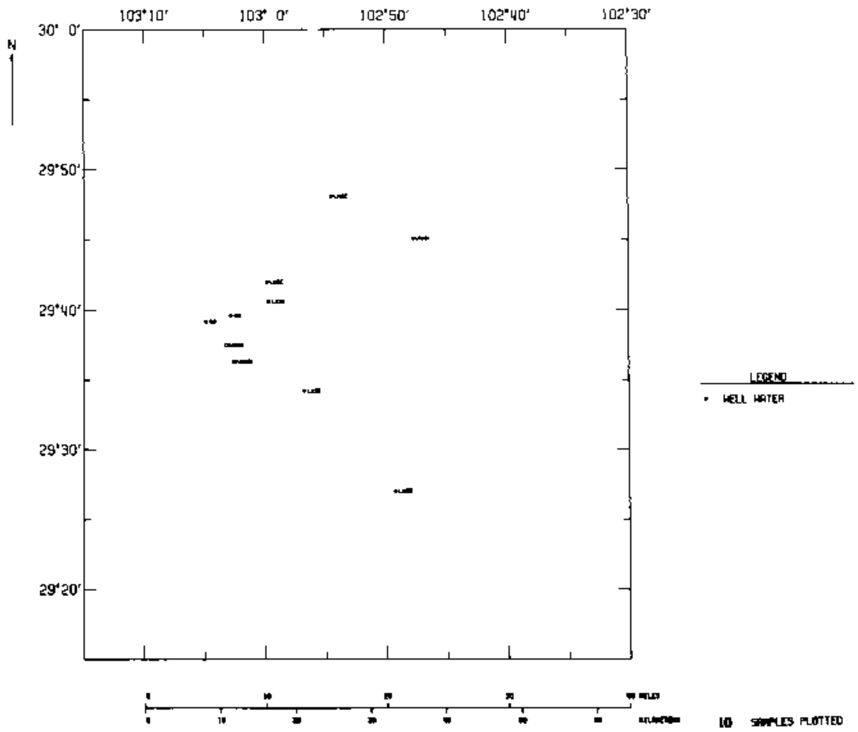


Figure 5

PRODUCING HORIZON MAP FOR GROUNDWATER
OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

The number of groundwater samples collected from each of the stratigraphic units is given in Table 4.

Observed data for the variables uranium, specific conductance, the 1,000·uranium:specific conductance ratio, silver, calcium, copper, molybdenum, selenium, strontium, the sodium:chloride ratio, and sulfate are listed in Table A-2. The figures in Appendix A present log frequency, lognormal probability, percentile, and areal concentration maps for these same variables and barium, potassium, and lithium.

The small number of groundwater samples has placed constraints on statistical manipulations; no correlation matrix or cluster analysis is presented. Discussion of groundwater geochemistry is given on a sample by sample basis, using the areal concentration maps as a guide to interpretation.

The two groundwater samples displaying the highest uranium values of the Stillwell Mountains project area are 029319 (Penner's Windmill; lat. 29°38' N. and long. 103°03' W.), and 029503 (Brushy Canyon Road Windmill; lat. 29°36' N. and long. 103°03' W.). Uranium concentrations for these two samples are 17.35 and 6.80 ppb, respectively. These samples display relatively high values for silver (Figure A-4b), calcium (Figure A-6b), copper (Figure A-7b), molybdenum (Figure A-10b), selenium (Figure A-11b), strontium (Figure A-12b), the sodium:chloride ratio (Figure A-13b), and sulfate (Figure A-14b). The areal concentration maps for barium (Figure A-5b), potassium (Figure A-8b), and lithium (Figure A-9b) indicate that concentrations of these elements in these two samples are relatively low. The variables silver, copper, molybdenum, and selenium are commonly found in nature as sulfides and may indicate base metal sulfide occurrences. The presence of elements commonly associated with sulfides and a high sulfate concentration may indicate favorable environmental conditions for potential uranium accumulations.

Specific conductance values of the high uranium Samples (029319 and 029503) are 1,057 and 831 μmhos/cm, respectively. These represent the second highest and third lowest specific conductance values of the Stillwell Mountains groundwater samples.

The producing horizons of these two high uranium samples have not been positively identified due to alluvial cover and structural features modifying normal stratigraphic succession. Both wells are within a rifted area, presumably with the Buda Limestone and Del Rio Clay (LKLB), beneath the alluvial cover. The Santa Elena Limestone (LKSE) is exposed on the raised fault blocks bounding the rift. Tertiary intrusives (TI) are also exposed along strike of the inferred faults bounding the downdropped area. Base metal joint fillings have been noted where the Santa

Table 4

DISTRIBUTION OF SAMPLES BY GEOLOGIC UNIT CODE
FROM THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

Geologic Unit Code[(a)]	No. of Groundwater Samples	No. of Sediment Samples	No. of Radiometric Samples
QD	2	53	11
TI	0	0	9
TEV	0	5	15
UKSE	0	10	18
LKLB	0	4	4
LKSE	5	124	67
LKSP	0	28	15
LKT	0	4	1
CPUD	0	0	0
UNKN	3	0	0
Total	10	228	140

[(a)]See Figure 3 for unit names.

Elena Limestone is in close proximity to the Tertiary intrusives in the area. The structural control and presence of intrusive sills may have significance in the presence of these geochemical anomalies.

Summary of Groundwater Data

Two groundwater samples (029319 and 029503) from the western portion of the project area exhibit the highest uranium values (17.35 and 6.80 ppb). These samples display a high concentration of elements commonly found in nature as sulfides (silver, copper, molybdenum, and selenium). Specific conductance values for these two samples represent the second highest and the third lowest values in the project area. The producing horizons of these two samples are inferred to be in or below the Buda Limestone (LKLB). The two samples occur in a rifted area with the stratigraphically lower Santa Elena Limestone (LKSE) exposed parallel to the uplifted blocks along with Tertiary intrusives (TI). The structural control and presence of intrusive sills may play a part in the presence of these hydrogeochemical anomalies.

GEOCHEMICAL DISTRIBUTIONS IN STREAM SEDIMENTS

Sample site locations from which stream sediment samples were collected in the Stillwell Mountains project area are shown on Plate 4. Areal distribution plots for hot-acid-soluble uranium, determined by fluorometric analysis and Thorium are presented on Plates 2 and 3 and Figures B-1b and B-4b, respectively.

Table 4 presents the number of sediment samples collected from the major groupings of stratigraphic units in the project area. Data for all sediment samples are included in Table B-3 and on microfiche in Appendix D.

Observed data for the variables, U, total uranium determined by neutron activation (U-NT), thorium, the thorium:U-NT ratio, arsenic, lithium, molybdenum, nickel, phosphorus, titanium, and vanadium are listed in Table B-3. The figures in Appendix B present log frequency, lognormal probability, percentile and areal distribution plots for these same variables (except titanium and vanadium) and the U:U-NT ratio, boron, beryllium, copper, iron, magnesium, manganese, sodium, selenium, and strontium.

Uranium

The areal distribution plot (Plate 5 and Figure B-1b) for soluble uranium indicates that concentrations ≧1.90 ppm generally occur in two major areas within the Stillwell Mountains project area: along the Rio Grande (trending northeast-southwest) from Sierra Larga (lat. 29°26' N. and long. 102°53' W.) to Big Canyon (lat. 29°43' N. and long. 102°45' W.); and between Stillwell Mountain (lat. 29°43' N. and long. 102°56' W.) and the Sierra del Carmen Range (lat. 29°32' N. and long. 103°00' W.).

The correlation matrix (Table B-2) indicates a significant positive correlation (a Pearson and Spearman correlation coefficient ≧0.17) between the natural log of U and the natural logs of U:U-NT ratio, U-NT, arsenic, lithium, strontium, vanadium, and zinc. In addition, the natural log of U has a significant positive Pearson correlation with the natural logs of aluminum and titanium.

The areal distribution plot (Plate 6 and Figure B-2b) for U-NT indicates that concentrations ≧2.30 ppm generally occur within the same two areas designated as having high soluble uranium values.

The percentile plot for U-NT (Figure B-2a) indicates that the Boquillas and Pen Formations (UKSE) have the highest concentrations of U-NT.

The correlation matrix (Table B-2) indicates a significant positive correlation (a Pearson and Spearman correlation coefficient ≧0.17) between the natural log of U-NT and the natural logs of U, arsenic, beryllium, lithium, strontium, vanadium, yttrium, and zinc. In addition, the natural log of U-NT has a signficant positive Spearman correlation with the natural logs of iron, manganese, and aluminum.

The U:U-NT ratio indicates the percentage of total uranium in sediments which is present in hot-acid-soluble form. A sample with a high U:U-NT ratio value and a high U-NT value may indicate anomalous accumulations of uranium in a hot-acid-soluble form. Low U:U-NT ratio values in samples with high U-NT values indicate that the uranium is probably present in relatively insoluble (resistate) minerals (i.e., zircon, allanite, pyrochlore, monazite, and xenotime (Levinson, 1980).

The areal distribution plot for the U:U-NT ratio (Figure B-3b) indicates that no trend of high or low values corresponds with the two designated areas of both high soluble and total uranium values.

The correlation matrix (Table B-2) indicates a significant positive correlation (Spearman correlation coefficient ≧0.17) between the natural log of the U:U-NT ratio and the natural logs of uranium and cobalt.

<u>Thorium</u>

The areal distribution plot for thorium (Plate 6 and Figure B-4b) indicates that no significant area of high thorium values is present within the Stillwell Mountains project area. Instead, single sample anomalies are scattered throughout the project area.

The correlation matrix (Table B-2) indicates a significant positive correlation (Pearson and Spearman correlation coefficient ≧0.17) between the natural log of thorium and the natural logs of the thorium:U-NT ratio and cerium. In addition, the natural log of thorium has a significant positive Spearman correlation with the natural log of yttrium.

Figure B-5b, the areal distribution plot for the thorium:U-NT ratio, can be used to delineate areas which have been relatively depleted or enriched in uranium with respect to thorium. Thorium:uranium ratio values for sedimentary rocks vary from 1.0 to 3.4 for carbonates and 4.9 for clays (Rogers and Adams, 1969). Assuming a normal thorium:uranium ratio between 2.0 and 3.0 for carbonates with clay partings, a low value ($\leq$1.80) may indicate uranium enrichment with respect to thorium. However, low values for the thorium:uranium ratios do not correspond to the two designated areas of high U and U-NT values.

The correlation matrix (Table B-2) indicates a significant positive Pearson and Spearman correlation between the natural log of the thorium: U-NT ratio and the natural logs of thorium and cerium. In addition, a significant positive Pearson correlation exists between the natural log of the thorium:U-NT ratio and the natural logs of scandium, chromium, and yttrium.

Related Variables

Variables associated with high uranium values in the two designated areas of the Stillwell Mountains project include arsenic (Figure B-6b), boron (Figure B-7b), beryllium (Figure B-8b), lithium (Figure B-11b), manganese (Figure B-13b), molybdenum (Figure B-14b), sodium (Figure B-15b), selenium (Figure B-18b), strontium (Figure B-19b), and vanadium (Figure B-21b). In addition, the northwestern section of the area with anomalous uranium values, between Stillwell Mountain and the Sierra del Carmen Range, exhibits relatively high concentrations of iron (Figure B-10b), magnesium (Figure B-12b), phosphorus (Figure B-17b), and titanium (Figure B-20b). Association of minor and trace elements such as arsenic, molybdenum, and selenium with uranium has been noted by many authors (Adler, 1974; Gabelman, 1977; Harshman, 1974; Krauskopf, 1967; Levinson, 1980; Mason, 1966; Perel'man, 1977; and Siegel, 1974).

Percentile plots in Appendix B indicate that the highest concentrations for the above-mentioned variables are from samples collected from the Boquillas and Pen Formations (UKSE).

The area of anomalous uranium values between Stillwell Mountain and the Sierra del Carmen Range is a graben structure with the Santa Elena Limestone (LKSE) exposed adjacent to younger units at the graben margin. The two major folds in the area are the Brushy Canyon Monocline and the Gulther Anticline (Figure 4). Tertiary faults abound in this area, many with Tertiary intrusive sills (TI) along the strike of the faults. A Tertiary agglomerate (one of the centers of volcanic activity) exists west of Stillwell Mountain. Most of the outcrop of the Pen Formation (UKSE) occurs within this area, along with the Black Gap basalt (TEV). In this area base metal accumulations as joint and fracture fillings within the Santa Elena Limestone (LKSE) occur where the Santa Elena Limestone is in close proximity to Tertiary intrusive sills (TI).

The second area with anomalous uranium values along the Rio Grande also coincides with major structural features. The Horse Canyon Syncline and the Maravillas Canyon Monocline (Figure 4) closely approximate the trend of major Tertiary faulting in the area. The largest fault system trends between the Rio Grande and Cupola Mountain Dome (lat. 29°40' N. and long. 102°51' W.). A Tertiary extrusive unit (TEV) is exposed at the peaks of the raised mountain blocks. Extensive vertical joints and overthrusting occur in the Santa Elena Limestone (LKSE).

Coincidence between the areas of anomalous uranium values and major structural features implies the possibility of structural control in possible uranium accumulation.

Anomalous values for a group of variables indicative of sulfide mineralization are present between Stillwell Creek (lat. 29°26' N. and long. 102°53' W.) and Maravillas Canyon (lat. 29°33' N. and long. 102°50'), trending SE-NW. This area exhibits high values for copper (Figure B-9b), molybdenum (Figure B-14b), nickel (Figure B-16b), and vanadium (Figure B-21b). High concentrations of the variables iron (Figure B-10b) and magnesium (Figure B-12b) also occur in this area. Tertiary extrusive rocks (TEV) are exposed almost exclusively within this area. Faulting, folding, and leaching of extrusive volcanic units may have resulted in the accumulation of high concentrations of elements associated with sulfides in this area.

Summary of Sediment Data

Stream sediment samples exhibiting anomalous concentrations of uranium in the Stillwell Mountains project area also contain high concentrations of the common uranium-related variables such as arsenic, molybdenum, and selenium. Samples exhibiting anomalous concentrations for these variables occur in two major areas: between Stillwell Mountain and the Sierra del Carmen Range, and along the Rio Grande.

A second suite of elements, commonly indicative of sulfide mineralization, occurs between Stillwell Creek and Maravillas Canyon. Variables that are anomalous in this area include copper, molybdenum, and nickel.

Major Tertiary faulting and folding and possible source rocks (Tertiary intrusive and extrusive igneous units) occur in all three of the designated anomalous areas of interest. These features and formations may be of significance in the location of geochemical systems that resulted in the development of the observed geochemical anomalies.

BIBLIOGRAPHY

1. Adler, H. H., *Concepts of Uranium-Ore Formation in Reducing Environments in Sandstones and Other Sediments,* Proceedings of a Symposium on the Formation of Uranium Ore Deposits, International Atomic Energy Agency, Athens, Greece, pp 141-168 (1974).

2. Arendt, J. W., Butz, T. R., Cagle, G. W., Kane, V. E., and Nichols, C. E., *Hydrogeochemical and Stream Sediment Reconnaissance Procedures of the Uranium Resource Evaluation Project,* Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, K/UR-100 (December 1979).

3. Barnes, V. E., *Geologic Atlas of Texas, Emory Peak, Presidio Sheet,* University of Texas, Austin, Bureau of Economic Geology (Preliminary Sheet) (1977).

4. Cagle, G. W., "The Oak Ridge Analytical Program," *Symposium on Hydrogeochemical and Stream Sediment Reconnaissance for Uranium in the United States, March 16 and 17, 1977.* United States Energy Research and Development Administration, Grand Junction, Colorado, pp 133-156 [GJBX-77(77] (October 1977).

5. D'Silva, A. P., Grabau, F., and Haas, W. J., Jr., *Multilaboratory Analytical Quality Control Program for the Hydrogeochemical and Stream Sediment Reconnaissance,* Ames Laboratory, Iowa State University, Ames, Iowa, IS-4736 (April 1980) (Available from National Technical Information Service, U. S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161).

6. Flawn, P. T., Goldstein, A., King, P. B., and Weaver, C. E., *The Ouachita System,* University of Texas, Bureau of Economic Geology, Austin, Publication 6120 (1961).

7. Gabelman, J. W., "Migration of Uranium and Thorium - Exploration Significance, Studies in Geology No. 3, " *AAPG Bulletin,* Tulsa, Oklahoma, pp 121-134 (1977).

8. Harshman, E. N., *Distribution of Elements in Some Roll-Type Uranium Deposits,* Proceedings of a Symposium on the Formation of Uranium Ore Deposits, International Atomic Energy Agency, Athens, Greece, pp 169-183 (1974).

9. Hem, J. D., *Study of Interpretation of the Chemical Characteristics of Natural Water,* U.S. Geological Survey, Water Supply Paper 1473, p. 155 (1970).

10. Kane, V. E., Baer, T., and Begovich, C. L., *Principal Component Testing for Outliers,* Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, K/UR-7 (July 1977). United States Department of Energy, Grand Junction, Colorado [GJBX-71(77)].

11. King, P. B., "Outline of Structural Development of Trans-Pecos, Texas," *AAPG Bulletin,* Vol. 19, No. 2, pp 221-261 (1935).

12. King, P. B., Beikman, H. M., and Edmonston, G. J., *Geologic Map of the United States,* U.S. Geological Survey (1974).

13. Krauskopf, K. B., *Introduction to Geochemistry,* McGraw-Hill Inc., New York, pp 151-175, 575-597 (1967).

14. Levinson, A. A., *Introduction to Exploration Geochemistry,* The 1980 Supplement, Applied Publishing Ltd., Alberta, Canada (1980).

15. LKB Resource, Inc., *NURE Areal Gamma-Ray and Magentic Reconnaissance Survey, Big Bend Area, Vol. 1,* LKB Resources, Inc., Huntingdon Valley, Pennsylvania (1979). United States Department of Energy, Grand Junction, Colorado [GJBX-88(79)].

16. Lonsdale, J. T., Maxwell, R. A., Wilson, J. A., and Hazzard, R. T., *West Texas Geological Society Guidebook, 1955 Spring Field Trip, Big Bend National Park, Texas* (1955).

17. Mason, B., *Principles of Geochemistry,* Third Edition, John Wiley and Sons, New York, pp 149-190, 223-234 (1966).

18. National Oceanic and Atmospheric Administration, *Climates of the States, Vol. II-Western States Including Alaska and Hawaii,* Department of Commerce, Water Information Center, Port Washington, New York, pp. 538.594 (1974).

19. Perel'man, A. I., *Geochemistry of Elements in the Supergene Zone,* Keterpress Enterprises, Jerusalen, p 266 (1977).

20. Reeves, C. C., Kenney, P., and Wright, E., "Known Radioactive Anomalies and Uranium Potential of Cenozoic Sediments, Trans-Pecos, Texas," *Cenozoic Geology of the Trans-Pecos Volcanic Field of Texas,* pp 86-99 (1978).

21. Rogers, J. J. W. and Adams, J. A. S., "Thorium," *Handbook of Geochemistry,* Spring-Verlag, New York, pp 90-D-1 - 90-0-1 (1969).

22. St. John, B. E., *Geology of Black Gap Area, Brewster County, Texas,* Geology Quadrangle Map and Text No. 30, University of Texas, Austin, Bureau of Economic Geology (1965).

23. Shambaugh, J. S., *Structure of the Black Gap Area, Brewster County, Texas,* University of Texas, Austin, Master's Thesis (1951).

24. Siegel, F. R., *Applied Geochemistry,* John Wiley and Sons, New York, pp 29-102, 152-201 (1974).

25. Southern Interstate Nuclear Board, *Uranium in the Southern United States,* Division of Raw Materials, United States Atomic Energy Commission, TID UC-51, pp 97-146 (1969).

26. Uranium Resource Evaluation Project, *Hydrogeochemical and Stream Sediment Reconnaissance Basic Data for Emory Peak NTMS Quadrangle, Texas,* Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, K/UR-112 (December 1978). United States Department of Energy, Grand Junction, Colorado [GJBX-6(79)].

27. Uranium Resource Evaluation Project, *Procedures Manual for Groundwater Reconnaissance Sampling,* Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, K/UR-12 (March 1978). United States Department of Energy, Grand Junction, Colorado [GJBX-62(78)].

28. Uranium Resource Evaluation Project, *Procedures Manual for Stream Sediment Reconnaissance Sampling,* Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, K/UR-13 (May 1978). United States Department of Energy, Grand Junction, Colorado [GJBX-84(78)].

29. Wilson, D. C. O., Jr., *Stratigraphy of Black Gap Area, Brewster County, Texas,* University of Texas, Austin, Master's Thesis (1951).

APPENDIX A

GROUNDWATER

*Where percentile plots are not present, they are unavailable because of the small number of samples.

APPENDIX A

GROUNDWATER

LIST OF TABLES

No.	Title	Page
A-1	Statistical Summary for Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-7
A-2	Partial Data Listing for Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-36

LIST OF FIGURES

No.	Title	Page
A-1a	Probability, Frequency, and Percentile Plots for Uranium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-8
A-1b	Geochemical Distribution of Uranium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-9
A-2a	Probability, Frequency, and Percentile Plots for Specific Conductance (μmhos/cm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-10
A-2b	Geochemical Distribution of Specific Conductance (μmhos/cm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-11
A-3a	Probability, Frequency, and Percentile Plots for 1,000·Uranium/Specific Conductance in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-12

LIST OF FIGURES, Continued

No.	Title	Page
A-3b	Geochemical Distribution of 1,000•Uranium/Specific Conductance in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-13
A-4a	Percentile Plot for Silver (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-14
A-4b	Geochemical Distribution of Silver (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-15
A-5a	Probability, Frequency, and Percentile Plots for Barium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-16
A-5b	Geochemical Distribution of Barium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-17
A-6a	Probability, Frequency, and Percentile Plots for Calcium (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-18
A-6b	Geochemical Distribution of Calcium (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-19
A-7a	Percentile Plot for Copper (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-20
A-7b	Geochemical Distribution of Copper (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-21
A-8a	Probability, Frequency, and Percentile Plots for Potassium (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-22

LIST OF FIGURES, Continued

No.	Title	Page
A-8b	Geochemical Distribution of Potassium (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-23
A-9a	Probability, Frequency, and Percentile Plots for Lithium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-24
A-9b	Geochemical Distribution of Lithium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-25
A-10a	Percentile Plot for Molybdenum (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-26
A-10b	Geochemical Distribution of Molybdenum (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-27
A-11a	Percentile Plot for Selenium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-28
A-11b	Geochemical Distribution of Selenium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-29
A-12a	Probability, Frequency, and Percentile Plots for Strontium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-30
A-12b	Geochemical Distribution of Strontium (ppb) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-31

LIST OF FIGURES, Continued

No.	Title	Page
A-13a	Probability, Frequency, and Percentile Plots for Sodium/Chloride in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-32
A-13b	Geochemical Distribution of Sodium/Chloride in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-33
A-14a	Probability, Frequency, and Percentile Plots for Sulfate (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	A-34
A-14b	Geochemical Distribution of Sulfate (ppm) in Groundwater of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	A-35

Table A-1

STATISTICAL SUMMARY FOR GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	NO. SAMPLES ANALYZED BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	LN TRANSFORMATION ROBUST MEAN	LN TRANSFORMATION ROBUST S. D.
U	10			1.41	17.35	5.19	3.53	17.37	4.623	0.890	1.39	0.72		
SP	10			591	3174	1360	1031	1007	779.4	0.6	7.09	0.52		
U/SP	10			0.58	8.43	4.17	3.15	2.35	2.571	0.617	1.21	0.78		
U/B	10			3.04	57.63	23.17	18.44	57.60	18.068	0.780	2.85	0.87		
U/SD	10			4.32	64.78	33.99	31.55	64.16	16.684	0.491	3.35	0.75		
AG	5	5	<2	<2	17	9	<2	<2	5.3	0.5	2.15	0.58		
AL	4	6	<10	<10	33	17	<10	<10	10.6	0.6	2.73	0.52		
AS	8	2	<0.5	<0.5	9.1	2.6	0.8	0.8	3.18	1.21	0.45	1.02		
B	10			59	601	272	275	274	148.6	0.5	5.45	0.65		
BA	10			6	96	40	23	95	32.5	0.8	3.35	0.93		
BE	0	10	<1	<1	<1		<1	<1						
CA	10			31.1	204.4	100.4	84.1	120.7	46.73	0.47	4.51	0.50		
CO	1	9	<2	<2	2	2	<2	<2	0.0	0.0	0.69	0.0		
CR	0	10	<4	<4	<4		<4	<4						
CU	6	4	<2	<2	19	9	3	<2	7.1	0.7	2.02	0.82		
FE	5	5	<10	<10	15	12	<10	<10	2.4	0.2	2.52	0.20		
K	10			2.4	17.0	6.8	6.1	16.9	4.40	0.64	1.75	0.62		
LI	10			10	134	64	35	134	50.3	0.8	3.81	0.97		
MG	10			6.5	109.1	26.5	15.9	24.9	29.79	1.12	2.95	0.76		
MN	8	2	<2	<2	205	49	<2	<2	77.8	1.6	2.36	1.97		
MO	8	2	<4	<4	45	22	12	<4	14.4	0.7	2.85	0.81		
NA	10			17.3	250.3	98.9	77.7	38.6	69.53	0.70	4.34	0.80		
NI	3	7	<4	<4	14	7	<4	<4	5.5	0.7	1.88	0.67		
P	1	9	<40	<40	53	53	<40	<40	0.0	0.0	3.97	0.0		
SC	0	10	<1	<1	<1		<1	<1						
SE	6	4	<0.2	<0.2	1.3	0.5	0.3	<0.2	0.38	0.72	-0.78	0.55		
SI	10			2.8	15.1	9.6	9.3	10.4	3.96	0.41	2.15	0.56		
SR	10			430	7951	2577	2304	774	2182.2	0.8	7.54	0.88		
TI	2	8	<2	<2	2	2	<2	<2	0.0	0.0	0.69	0.00		
V	1	9	<4	<4	4	4	<4	<4	0.0	0.0	1.39	0.0		
Y	1	9	<1	<1	1	1	<1	<1	0.0	0.0	0.0	0.0		
ZN	10			13	1402	224	22	21	443.8	2.0	3.99	1.65		
ZR	3	7	<2	<2	3	2	<2	<2	0.6	0.2	0.83	0.23		
T-AK	10			148	305	232	242	241	51.2	0.2	5.43	0.24		
M-AK	10			150	300	230	234	300	47.3	0.2	5.42	0.22		
P-AK	10			0	0	0	0	0	0.0	0.0				
CL	9	1	<10	<10	203	73	58	75	57.3	0.8	3.99	0.91		
NA/C	10			0.88	3.46	2.03	1.33	3.00	0.988	0.486	0.59	0.52		
PH	10			2.2	7.6	6.2	6.7	6.9	1.55	0.25				
SO4	10			31	550	197	175	178	167.8	0.9	4.95	0.90		

NOTE: Refer to Table 1, Page 21 and Table C-1, Page C-4 for concentration units and symbol defintions.

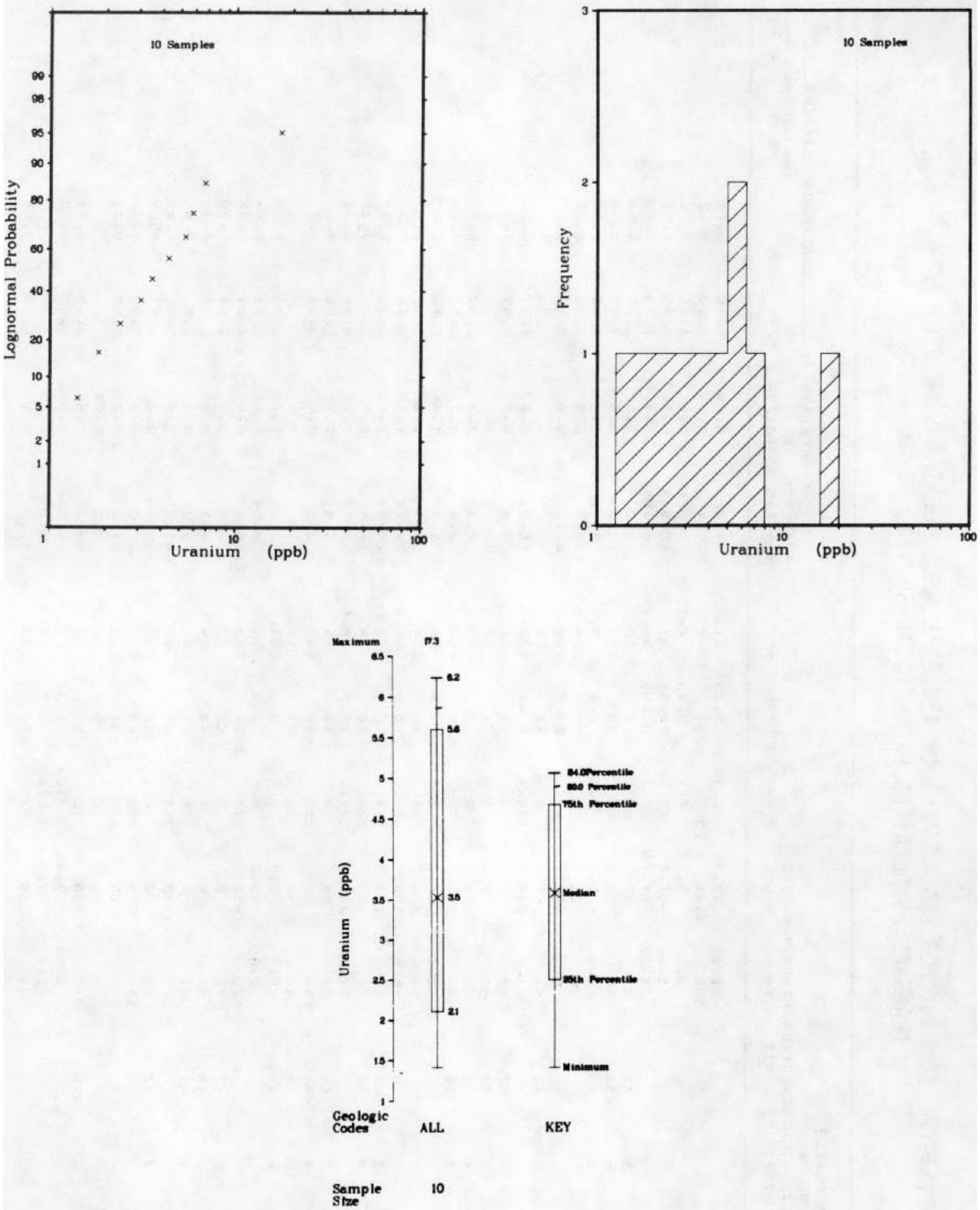


Figure A-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM (PPB) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

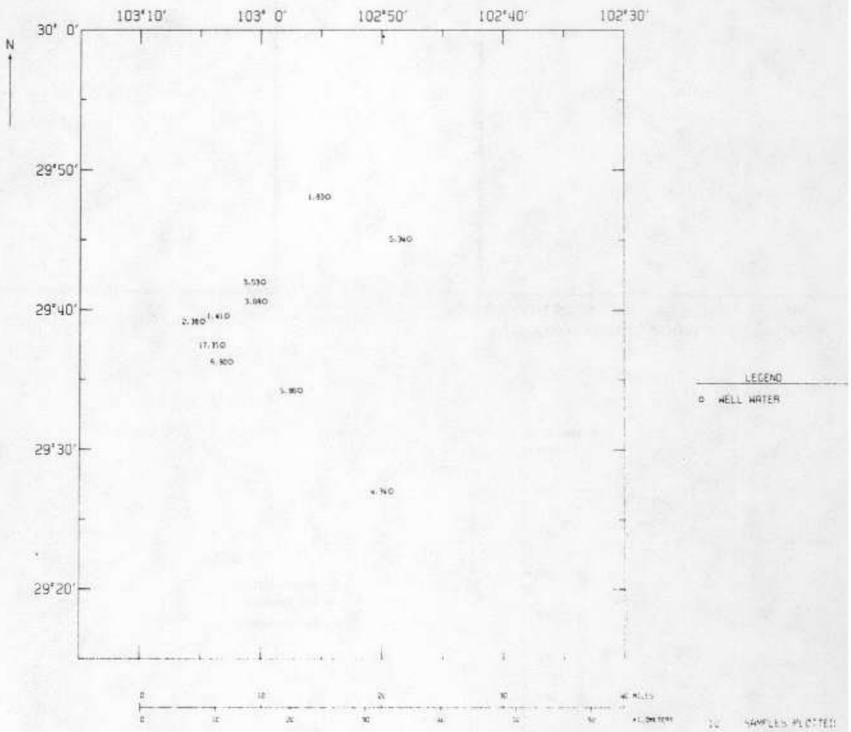


Figure A-1b

GEOCHEMICAL DISTRIBUTION OF URANIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

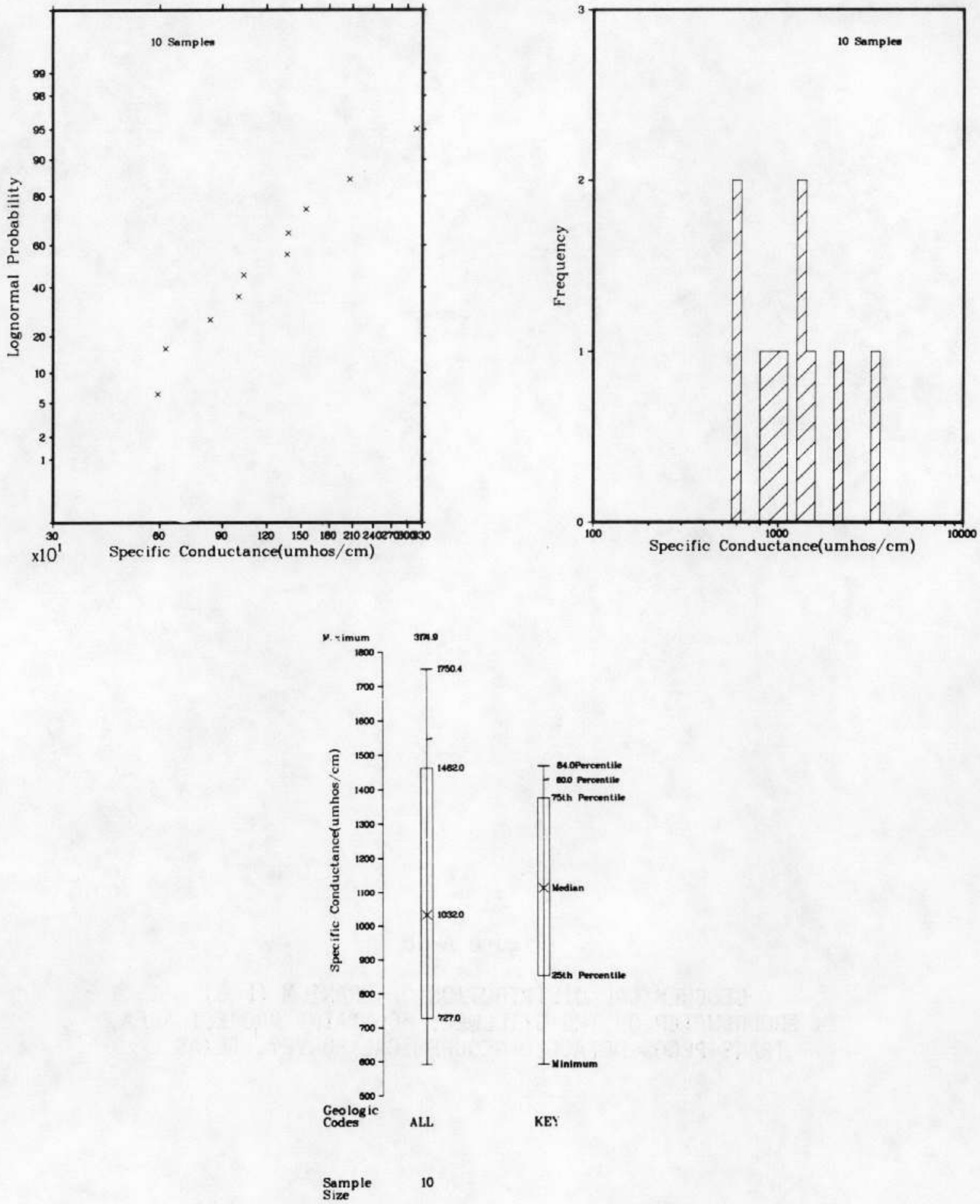


Figure A-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SPECIFIC CONDUCTANCE (μMHOS/CM)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

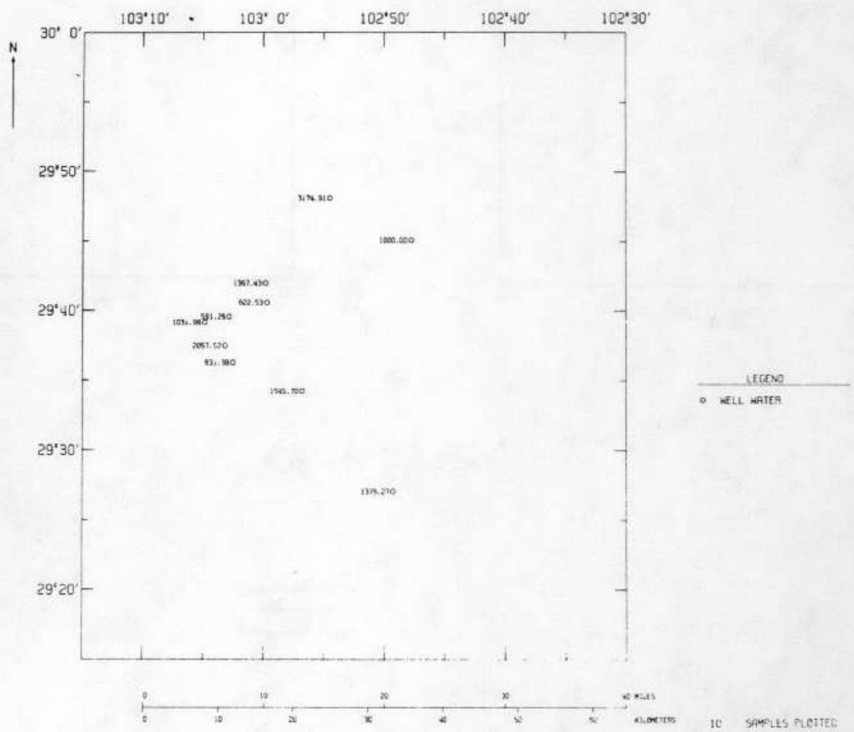
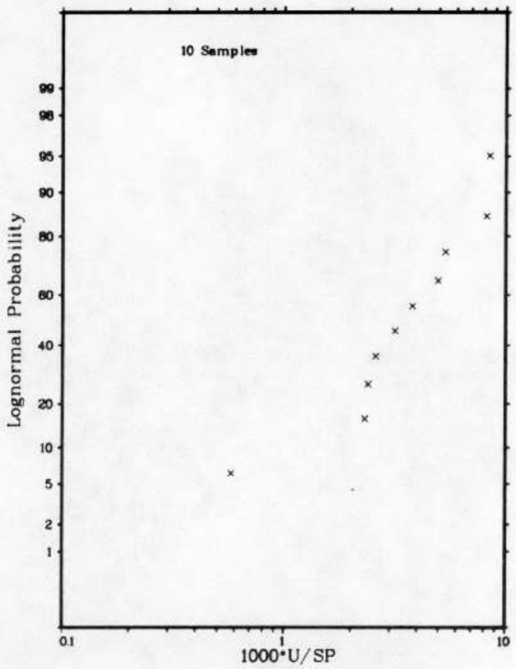
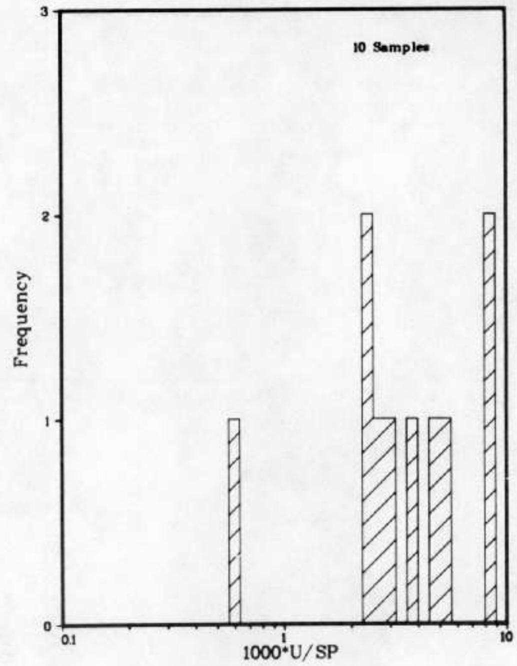


Figure A-2b

GEOCHEMICAL DISTRIBUTION OF SPECIFIC CONDUCTANCE (μMHOS/CM) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS





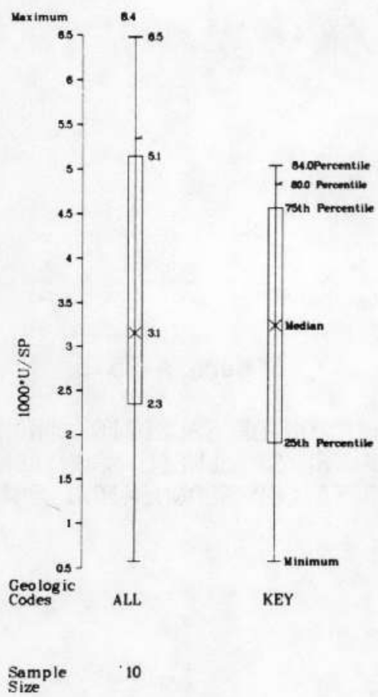


Figure A-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR 1,000·URANIUM/SPECIFIC CONDUCTANCE
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

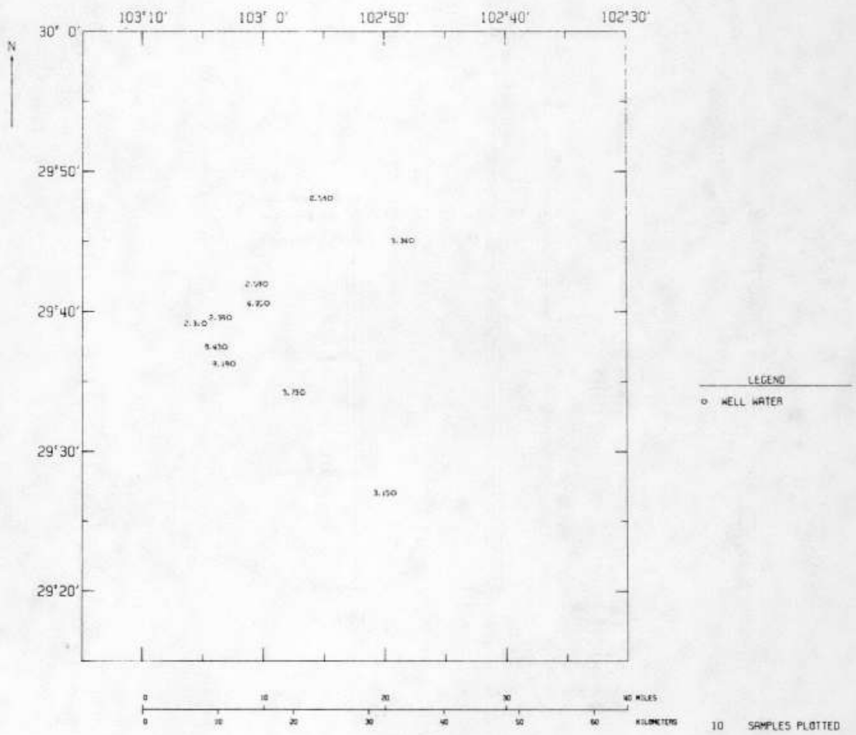


Figure A-3b

GEOCHEMICAL DISTRIBUTION OF 1,000·URANIUM/SPECIFIC CONDUCTANCE IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

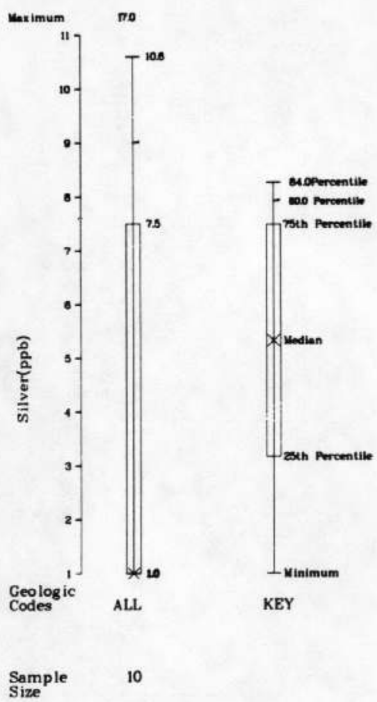


Figure A-4a

PERCENTILE PLOT FOR SILVER (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

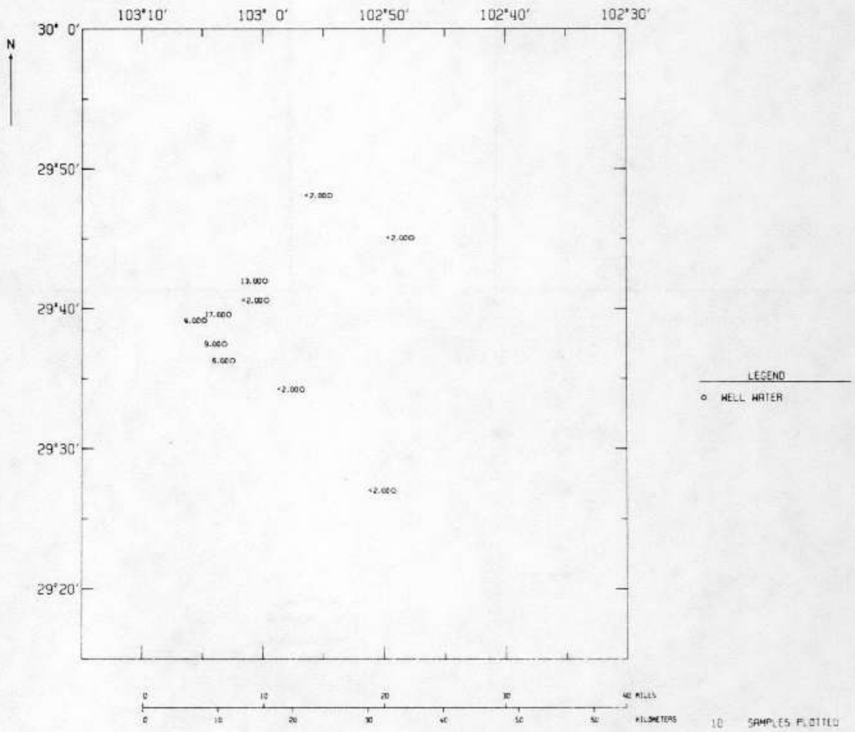


Figure A-4b

GEOCHEMICAL DISTRIBUTION OF SILVER (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

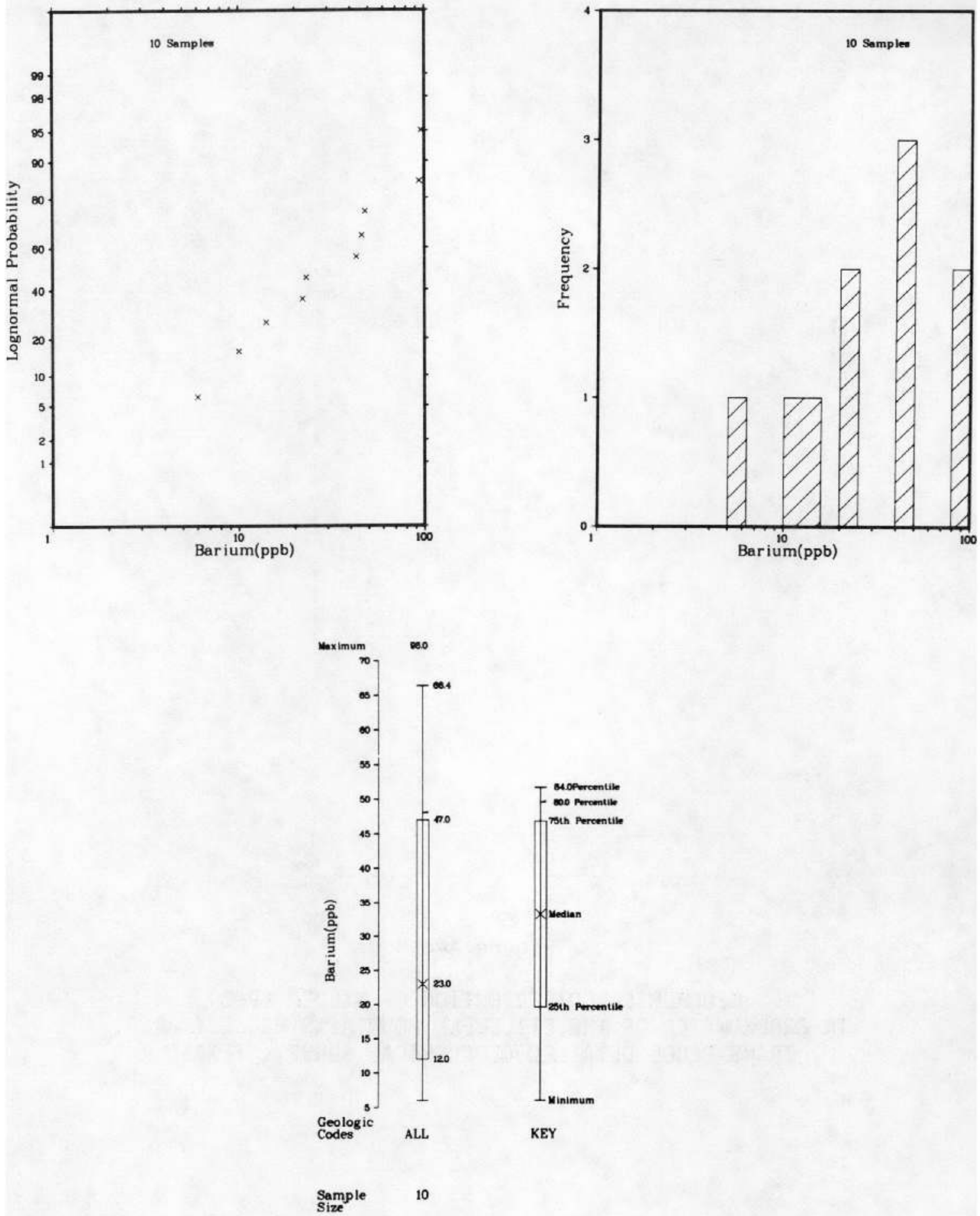


Figure A-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR BARIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

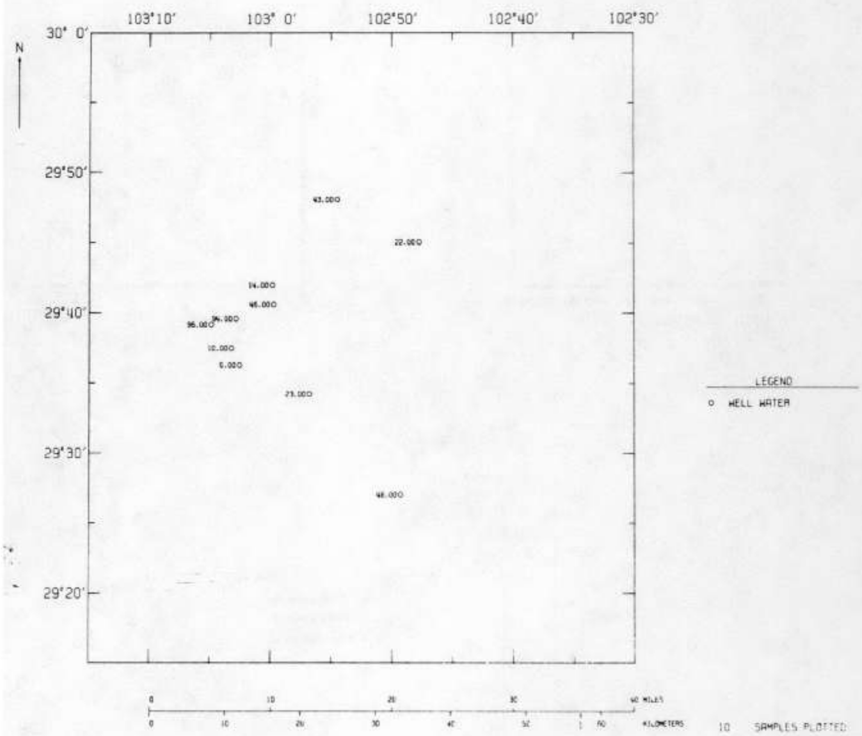


Figure A-5b

GEOCHEMICAL DISTRIBUTION OF BARIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

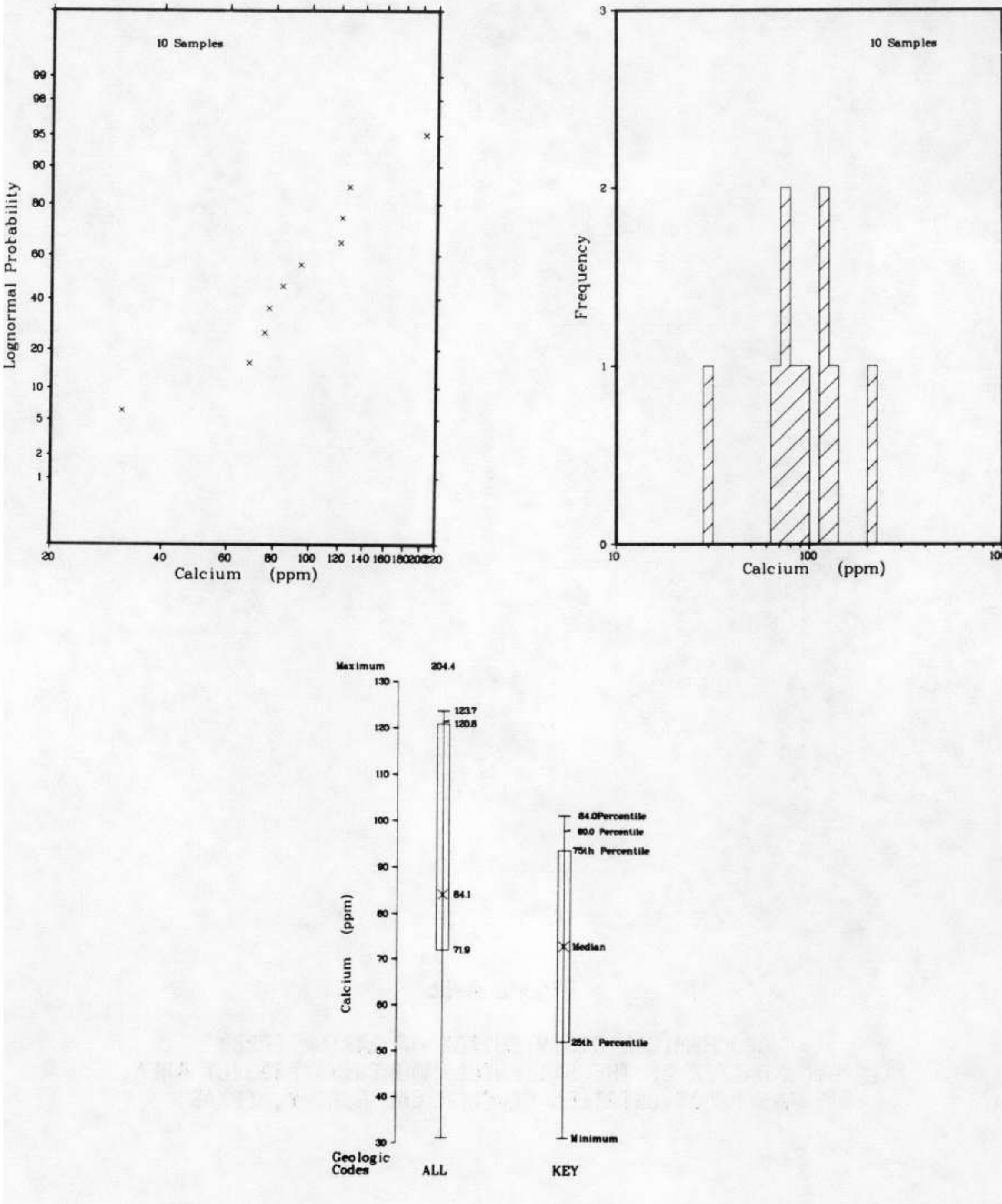


Figure A-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CALCIUM (PPM)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

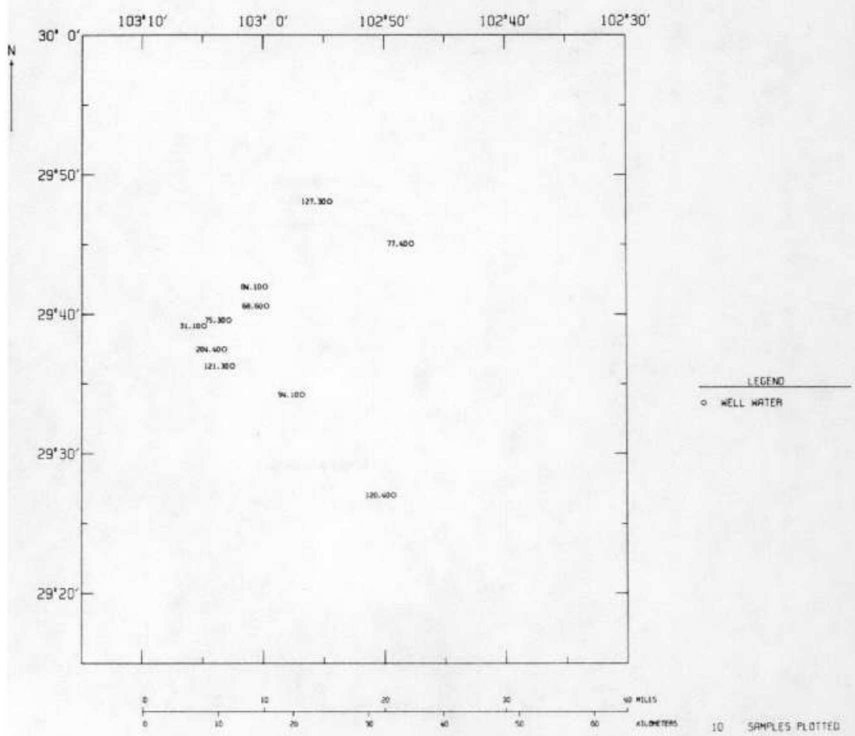


Figure A-6b

GEOCHEMICAL DISTRIBUTION OF CALCIUM (PPM)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

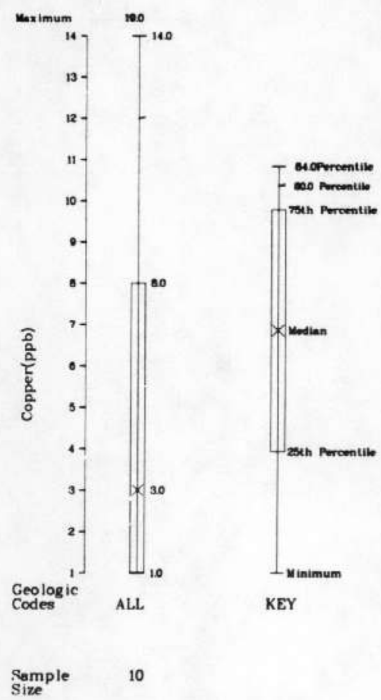


Figure A-7a

PERCENTILE PLOT FOR COPPER (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

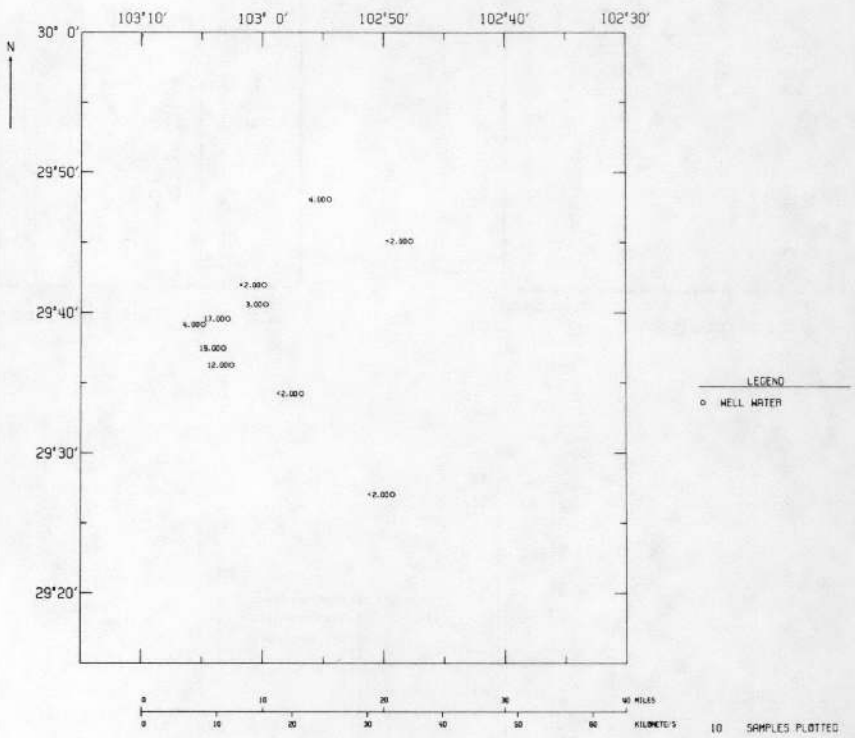


Figure A-7b

GEOCHEMICAL DISTRIBUTION OF COPPER (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

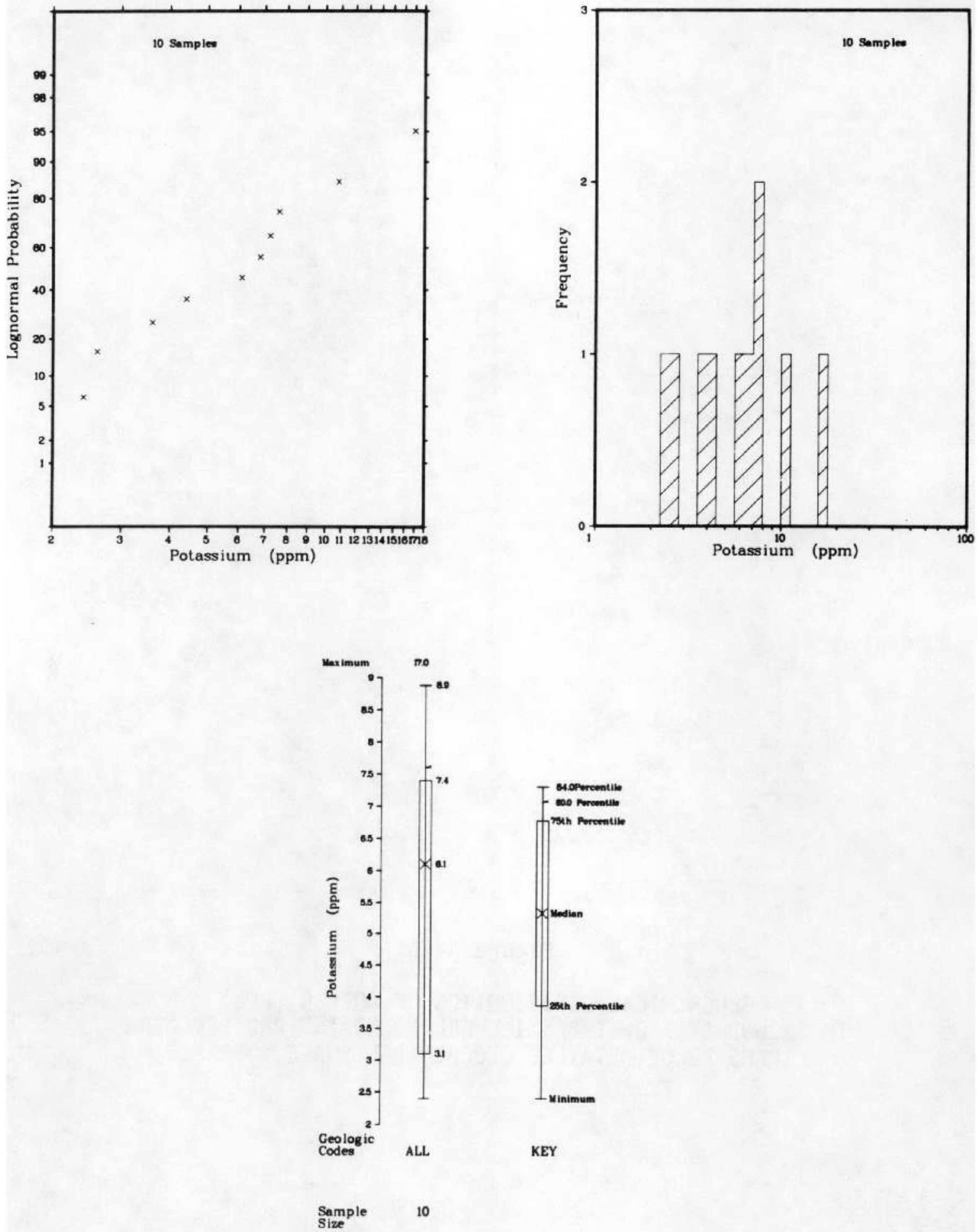


Figure A-8a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR POTASSIUM (PPM) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

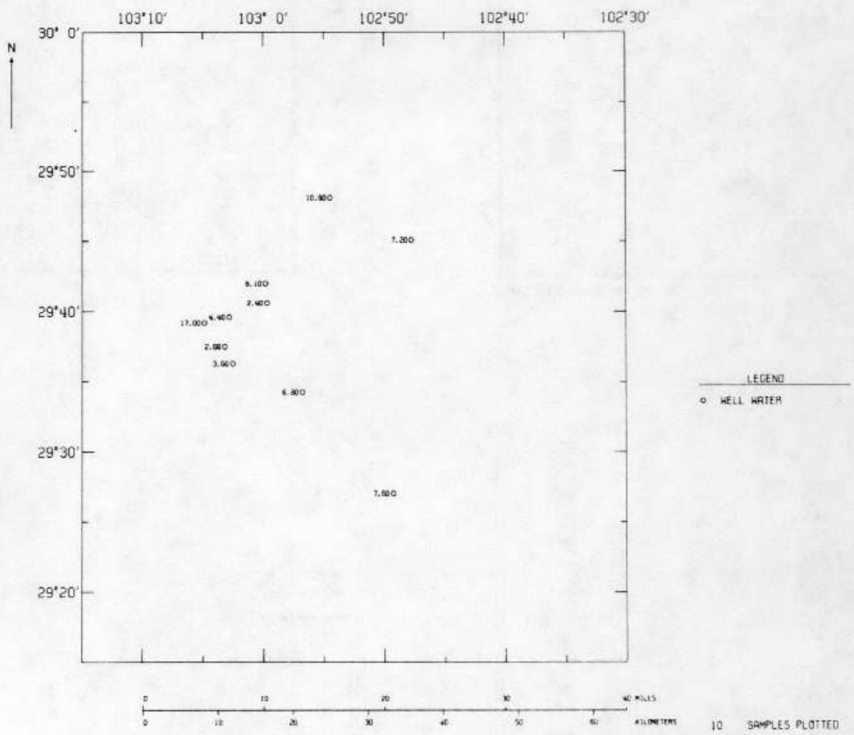


Figure A-8b

GEOCHEMICAL DISTRIBUTION OF POTASSIUM (PPM)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

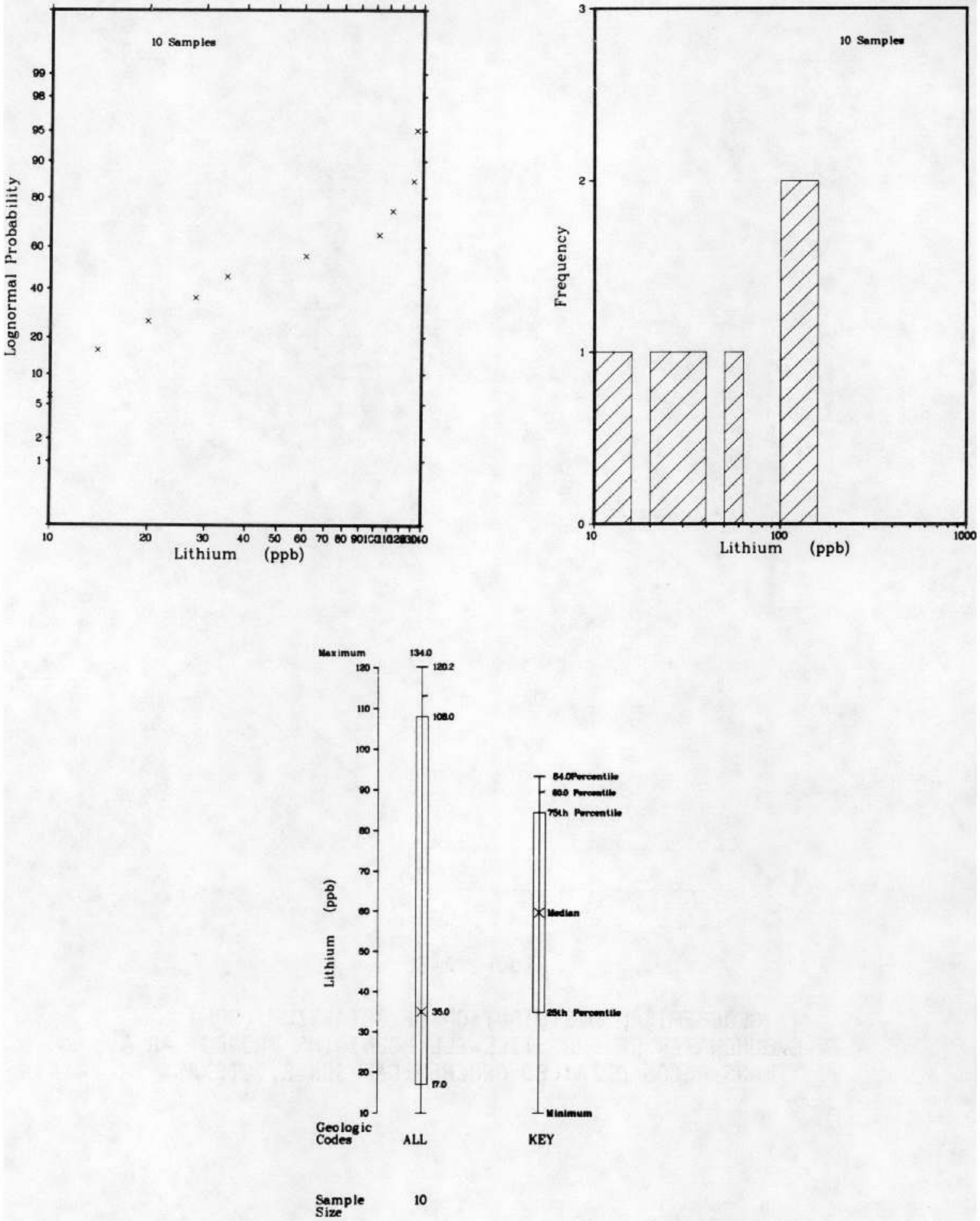


Figure A-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR LITHIUM (PPB) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

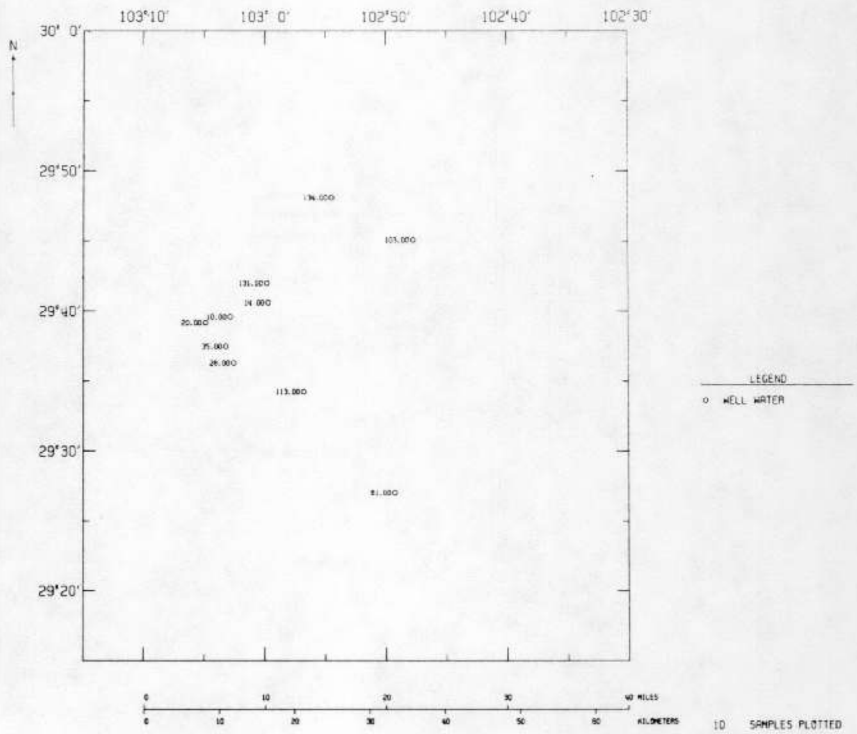


Figure A-9b

GEOCHEMICAL DISTRIBUTION OF LITHIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

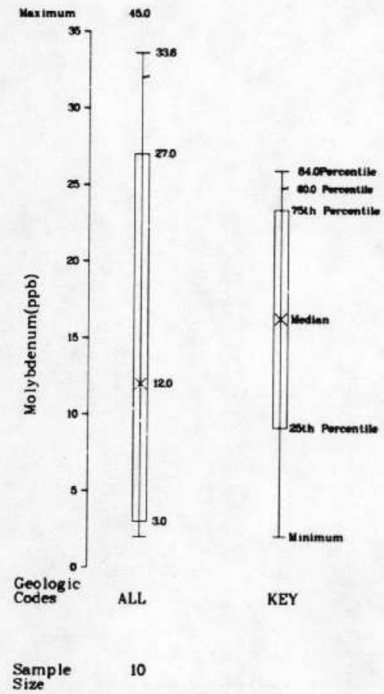


Figure A-10a

PERCENTILE PLOT FOR MOLYBDENUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

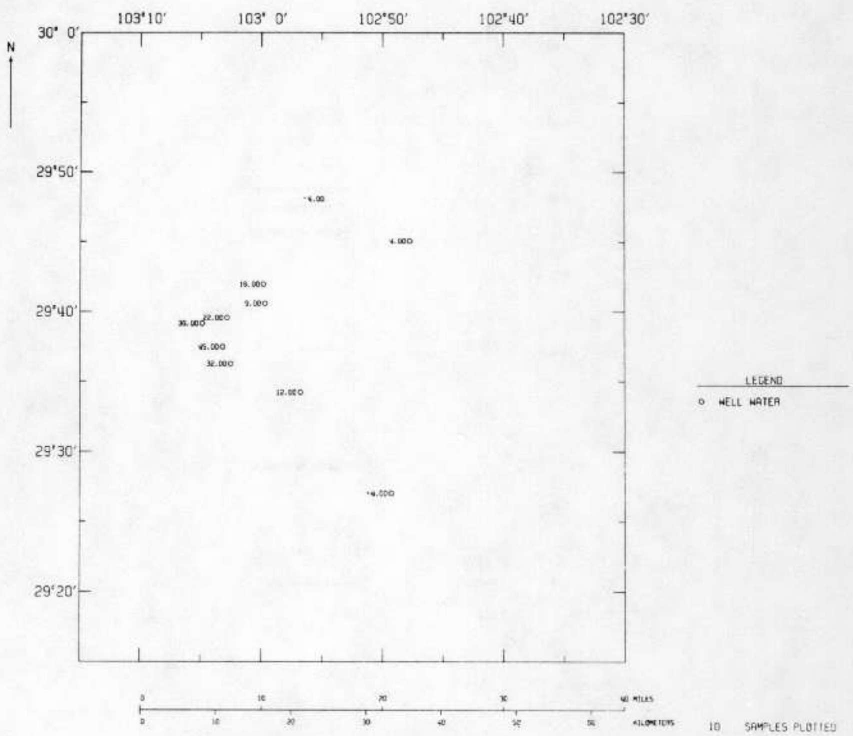


Figure A-10b

GEOCHEMICAL DISTRIBUTION OF MOLYBDENUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

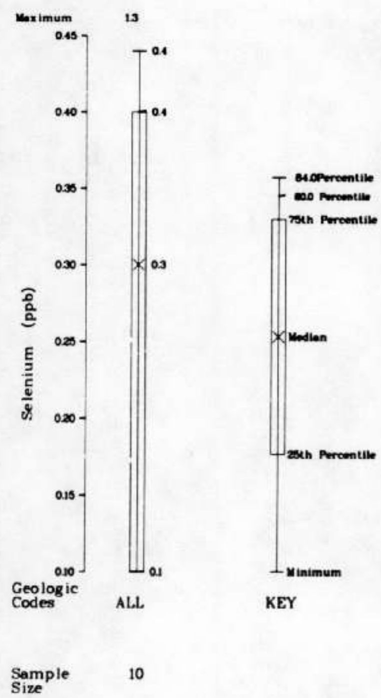


Figure A-11a

PERCENTILE PLOT FOR SELENIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

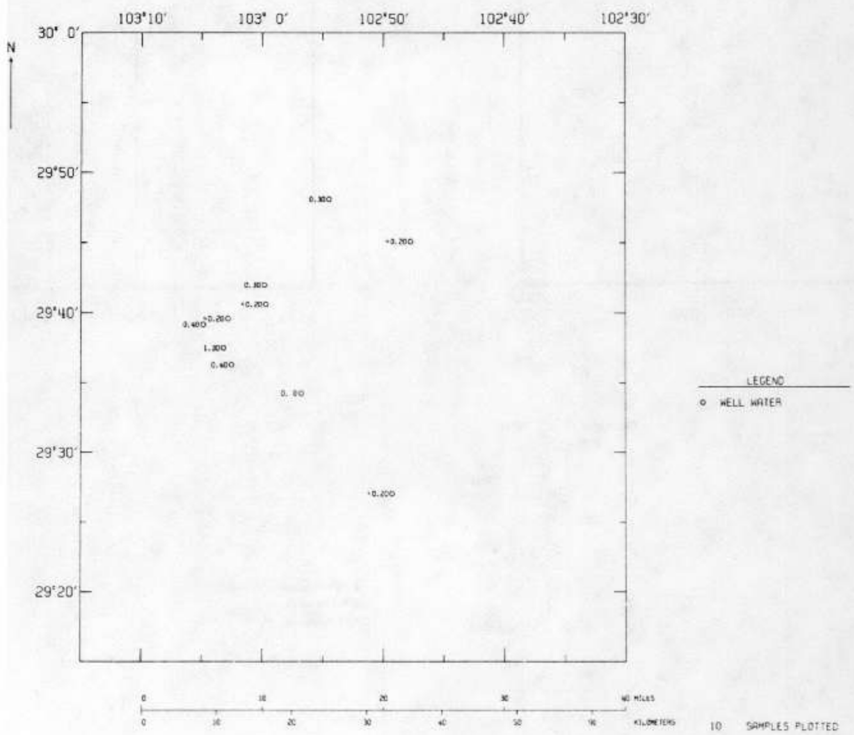


Figure A-11b

GEOCHEMICAL DISTRIBUTION OF SELENIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

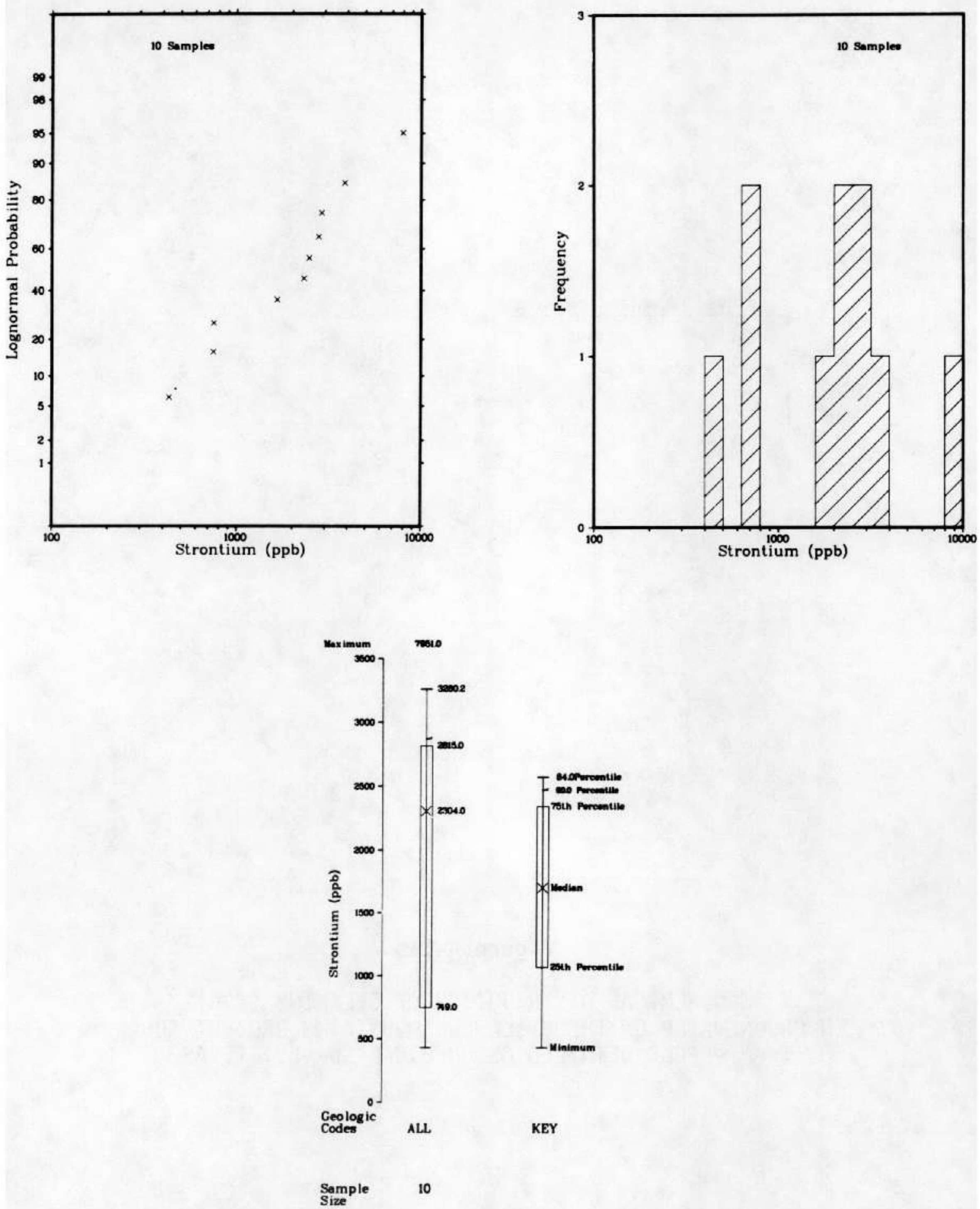


Figure A-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR STRONTIUM (PPB) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

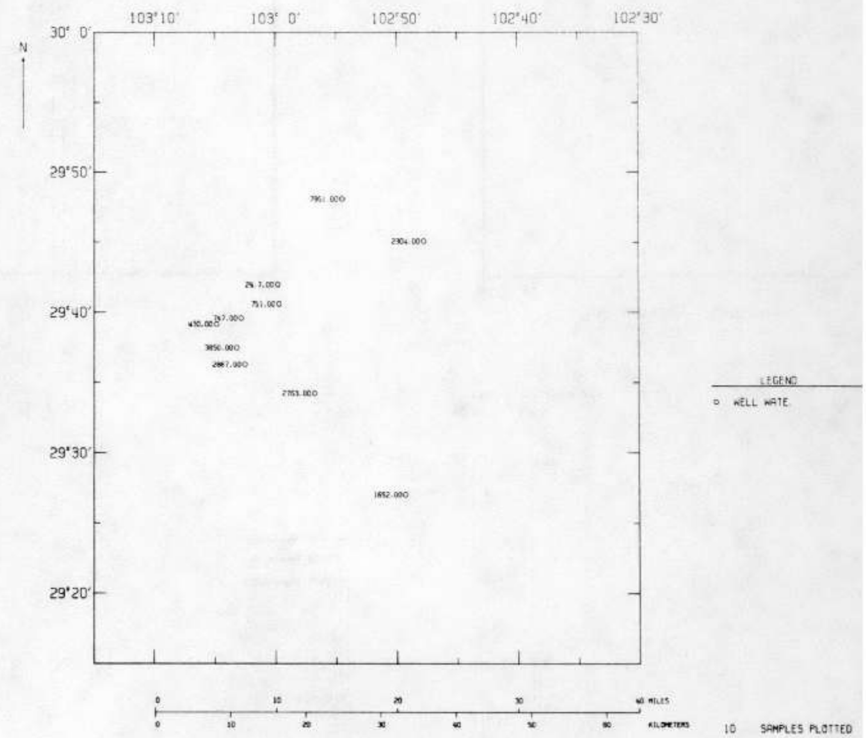
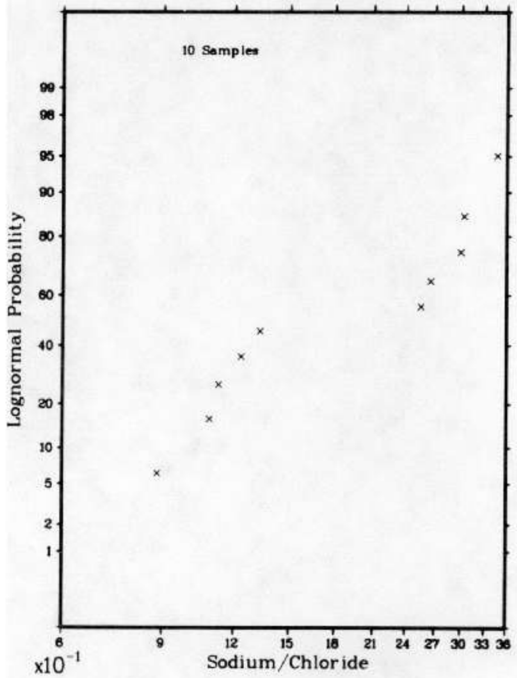
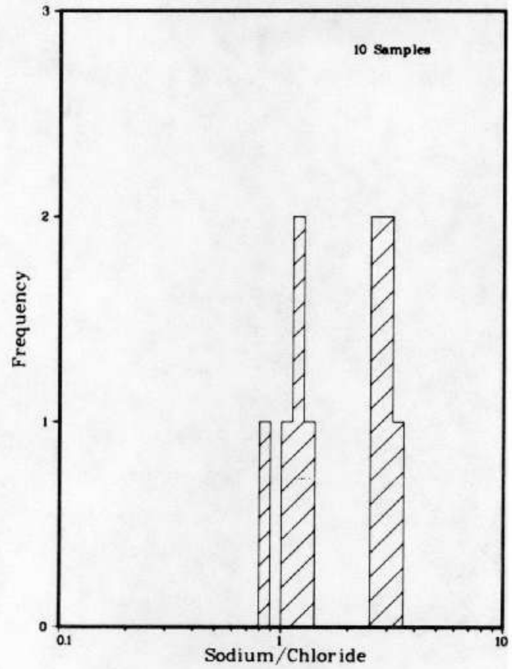


Figure A-12b

GEOCHEMICAL DISTRIBUTION OF STRONTIUM (PPB)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS





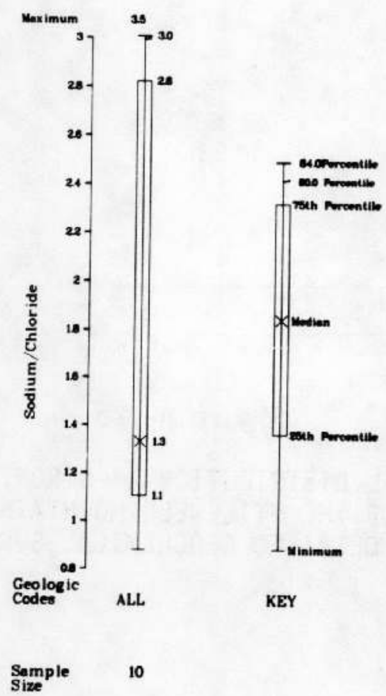


Figure A-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SODIUM/CHLORIDE IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

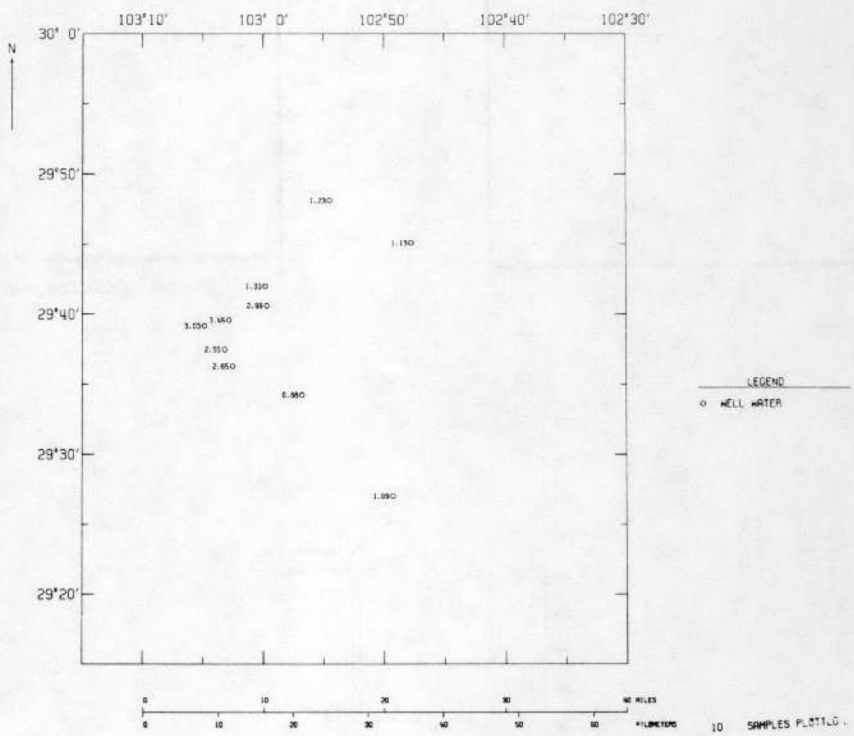


Figure A-13b

GEOCHEMICAL DISTRIBUTION OF SODIUM/CHLORIDE
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

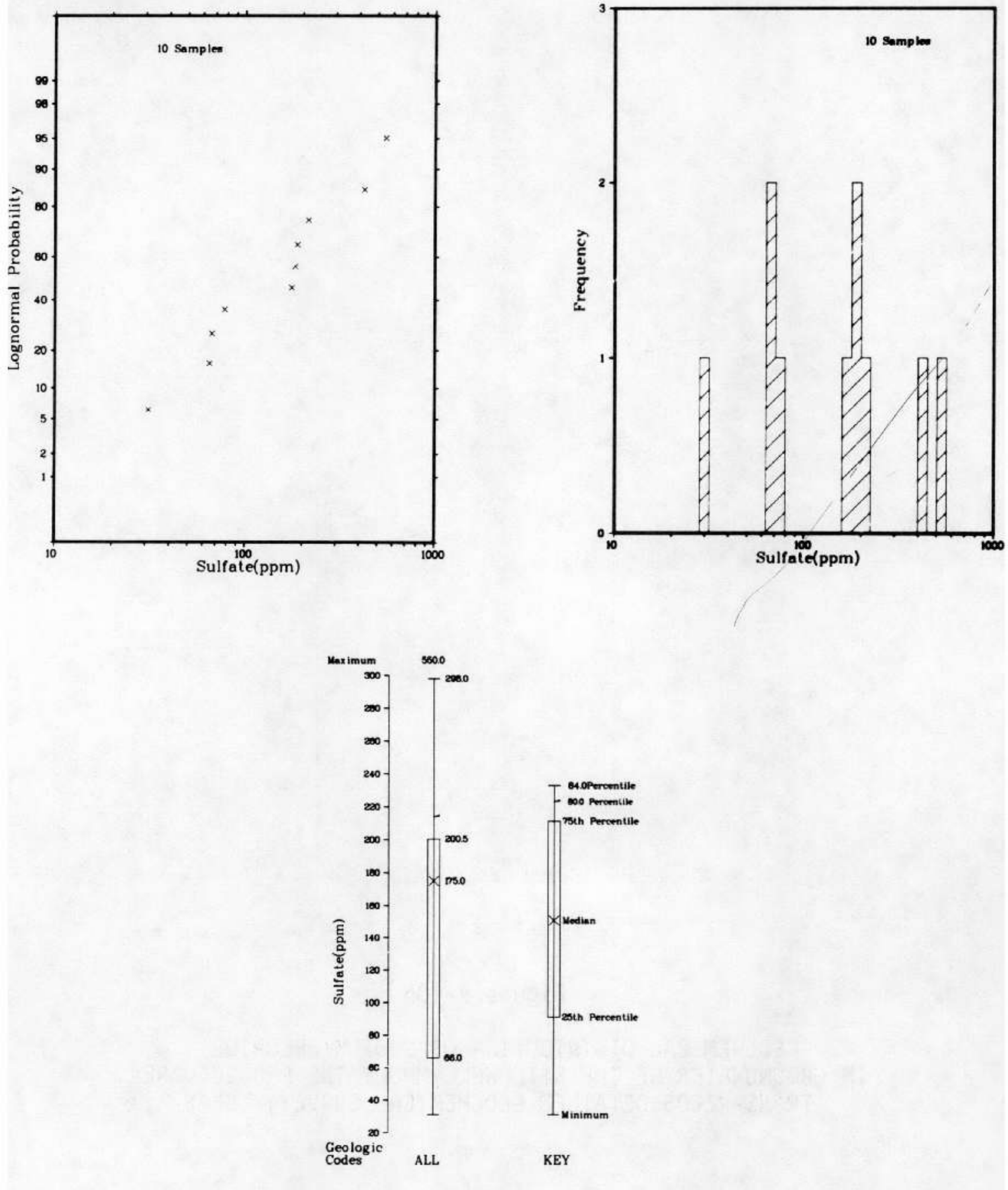


Figure A-14a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SULFATE (PPM) IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

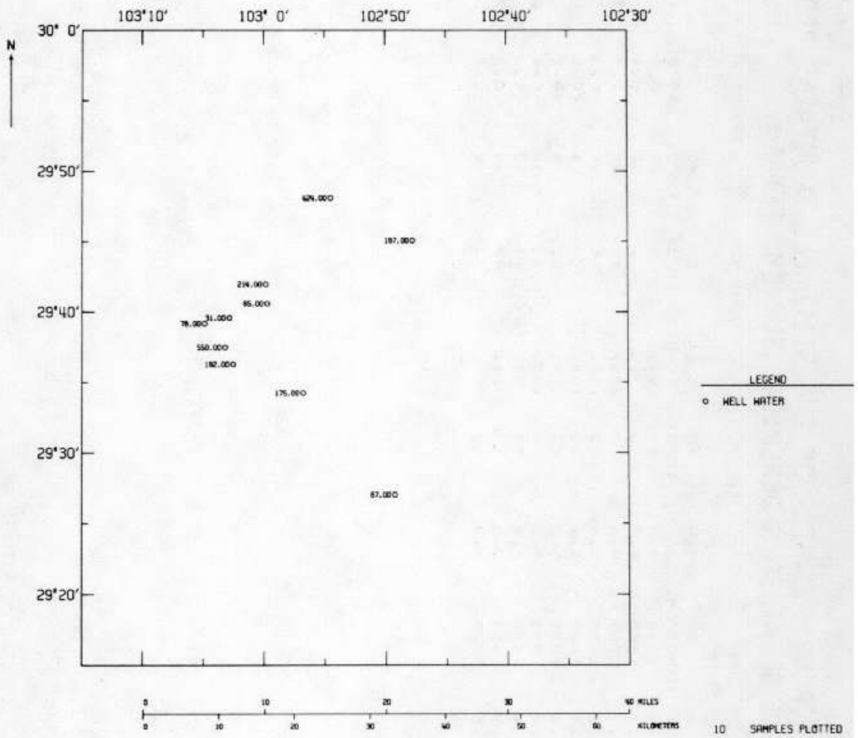


Figure A-14b

GEOCHEMICAL DISTRIBUTION OF SULFATE (PPM)
IN GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

Table A-2

PARTIAL DATA LISTING FOR GROUNDWATER OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPB)	SP UMHOS/CM	U/SP	AG (PPB)	CA (PPM)	CU (PPB)	MO (PPB)	SE (PPB)	SR (PPB)	NA/C	SO4 (PPM)
29269	48-29.571	-102.946	-3-03-	5.9	1500	3.8	<2	94.	<2	12	0.5	2800	0.88	180
29315	48-29.653	-103.081	-3-03-	2.4	1000	2.3	4	31.	4	36	0.4	430	3.0	78
29319	48-29.625	-103.053	-3-03-	17.	2100	8.4	9	200.	19	45	1.3	3900	2.5	550
29402	48-29.802	-102.908	-3-03-	1.8	3200	0.58	<2	130.	4	<4	0.3	8000	1.2	420
29409	48-29.451	-102.821	-3-03-	4.3	1400	3.1	<2	120.	<2	<4	<0.2	1700	1.1	67
29429	48-29.752	-102.796	-3-03-	5.3	1000	5.3	<2	77.	<2	4	<0.2	2300	1.1	190
29503	48-29.605	-103.042	-3-03-	6.8	830	8.2	6	120.	12	32	0.4	2900	2.6	180
29561	48-29.660	-103.047	-3-03-	1.4	590	2.4	17	75.	17	22	<0.2	750	3.5	31
29639	48-29.700	-102.997	-3-03-	3.5	1400	2.6	13	84.	<2	16	0.3	2500	1.3	210
29640	48-29.677	-102.995	-3-03-	3.1	620	4.9	<2	59.	3	9	<0.2	750	3.0	65

APPENDIX B

STREAM SEDIMENT

*Where percentile plots are not present, they are unavailable because of the small number of samples.

APPENDIX B

STREAM SEDIMENT

LIST OF TABLES

No.	Title	Page
B-1	Statistical Summary for Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-9
B-2	Correlation Matrix for Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-10
B-3	Partial Data Listing for Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-54

LIST OF FIGURES

No.	Title	Page
B-1a	Probability, Frequency, and Percentile Plots for Soluble Uranium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-12
B-1b	Geochemical Distribution of Soluble Uranium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-13
B-2a	Probability, Frequency, and Percentile Plots for Uranium by Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-14
B-2b	Geochemical Distribution of Uranium by Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-15

LIST OF FIGURES, Continued

No.	Title	Page
B-3a	Probability, Frequency, and Percentile Plots for Uranium Fluorometric/Uranium Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-16
B-3b	Geochemical Distribution of Uranium Fluorometric/ Uranium Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-17
B-4a	Probability, Frequency, and Percentile Plots for Thorium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	B-18
B-4b	Geochemical Distribution of Thorium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-19
B-5a	Probability, Frequency, and Percentile Plots for Thorium/Uranium Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-20
B-5b	Geochemical Distribution of Thorium/Uranium Neutron Activation in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	B-21
B-6a	Probability, Frequency, and Percentile Plots for Arsenic (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas .	B-22
B-6b	Geochemical Distribution of Arsenic (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-23
B-7a	Probability, Frequency, and Percentile Plots for Boron (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-24

LIST OF FIGURES, Continued

No.	Title	Page
B-7b	Geochemical Distribution of Boron (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-25
B-8a	Percentile Plot for Beryllium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-26
B-8b	Geochemical Distribution of Beryllium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-27
B-9a	Probability, Frequency, and Percentile Plots for Copper (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-28
B-9b	Geochemical Distribution of Copper (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-29
B-10a	Probability, Frequency, and Percentile Plots for Iron (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-30
B-10b	Geochemical Distribution of Iron (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-31
B-11a	Probability, Frequency, and Percentile Plots for Lithium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-32
B-11b	Geochemical Distribution of Lithium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-33

LIST OF FIGURES, Continued

No.	Title	Page
B-12a	Probability, Frequency, and Percentile Plots for Magnesium (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-34
B-12b	Geochemical Distribution of Magnesium (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-35
B-13a	Probability, Frequency, and Percentile Plots for Manganese (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-36
B-13b	Geochemical Distribution of Manganese (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-37
B-14a	Percentile Plot for Molybdenum (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-38
B-14b	Geochemical Distribution of Molybdenum (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-39
B-15a	Probability, Frequency, and Percentile Plots for Sodium (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-40
B-15b	Geochemical Distribution of Sodium (%) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-41
B-16a	Probability, Frequency, and Percentile Plots for Nickel (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-42

LIST OF FIGURES, Continued

No.	Title	Page
B-16b	Geochemical Distribution of Nickel (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-43
B-17a	Probability, Frequency, and Percentile Plots for Phosphorus (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-44
B-17b	Geochemical Distribution of Phosphorus (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-45
B-18a	Percentile Plot for Selenium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-46
B-18b	Geochemical Distribution of Selenium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-47
B-19a	Probability, Frequency, and Percentile Plots for Strontium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-48
B-19b	Geochemical Distribution of Strontium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-49
B-20a	Probability, Frequency, and Percentile Plots for Titanium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-50
B-20b	Geochemical Distribution of Titanium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-51

LIST OF FIGURES, Continued

No.	Title	Page
B-21a	Probability, Frequency, and Percentile Plots for Vanadium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas. .	B-52
B-21b	Geochemical Distribution of Vanadium (ppm) in Stream Sediment of the Stillwell Mountains Project Area, Trans-Pecos Detailed Geochemical Survey, Texas	B-53

Table B-1

STATISTICAL SUMMARY FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

	NO. SAMPLES ANALYZED										LN TRANSFORMATION			
													ROBUST	
ELEMENT	MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MEAN	S. D.	MEAN	S. D.
U-FL	228			0.60	3.58	1.88	1.88	1.97	0.463	0.246	0.60	0.26	0.61	0.24
U-NT	223			1.40	4.60	2.25	2.20	2.11	0.406	0.179	0.80	0.17	0.80	0.17
TH	215	12	<2	<2	25	5	5	5	2.4	0.4	1.59	0.41	1.58	0.40
U/TU	223			0.26	1.47	0.84	0.83	0.87	0.193	0.229	-0.20	0.24	-0.19	0.25
TH/U	222			0.33	13.89	2.34	2.27	2.35	1.298	0.554	0.71	0.56	0.74	0.53
AG	1	226	<2	<2	3	3	<2	<2	0.0	0.0	1.10	0.0		
AL	227			0.70	6.08	3.15	2.97	3.35	0.903	0.287	1.11	0.29	1.11	0.30
AS	228			0.4	9.2	2.9	2.7	1.7	1.33	0.45	0.98	0.46	0.99	0.44
B	20	207	<10	<10	25	14	<10	<10	3.7	0.3	2.66	0.24		
BA	227			137	980	374	357	361	129.9	0.3	5.87	0.32	5.87	0.33
BE	225	2	<1	<1	3	1	<1	<1	0.4	0.3	0.10	0.25		
CA	227			2.34	36.39	18.77	19.53	19.85	5.387	0.287	2.88	0.36	2.91	0.36
CE	219	8	<10	<10	197	28	26	25	15.5	0.5	3.27	0.38	3.24	0.45
CO	126	101	<4	<4	23	6	<4	<4	3.2	0.5	1.72	0.38		
CR	227			7	140	26	21	19	17.8	0.7	3.15	0.45	3.12	0.44
CU	226	1	<2	<2	32	10	10	9	3.5	0.3	2.33	0.30	2.33	0.30
FE	227			0.74	10.71	2.21	1.74	1.63	1.360	0.615	0.67	0.45	0.65	0.44
K	227			0.11	2.92	0.75	0.70	0.72	0.293	0.394	-0.36	0.37	-0.35	0.37
LI	227			8	40	18	18	16	4.4	0.2	2.92	0.21	2.91	0.20
MG	227			0.30	3.52	0.69	0.61	0.59	0.317	0.460	-0.44	0.35	-0.46	0.33
MN	227			170	1849	406	343	349	232.1	0.6	5.91	0.40	5.88	0.42
MO	63	164	<4	<4	17	5	<4	<4	2.2	0.4	1.64	0.31		
NA	226	1	<0.05	<0.05	2.15	0.49	0.43	0.42	0.240	0.494	-0.82	0.42	-0.82	0.45
NB	225	2	<4	<4	57	13	12	10	5.9	0.4	2.58	0.31	2.55	0.31
NI	227			5	92	17	13	9	12.1	0.7	2.72	0.51	2.69	0.52
P	227			183	4188	701	575	439	489.8	0.7	6.41	0.48	6.39	0.49
SC	226	1	<1	<1	14	4	4	3	1.9	0.4	1.41	0.38	1.40	0.37
SE	158	70	<0.1	<0.1	0.8	0.3	0.2	0.2	0.14	0.50	-1.39	0.48	-1.74	0.66
SR	227			195	875	398	355	296	133.3	0.3	5.94	0.30	5.93	0.30
TI	227			204	38032	3871	2601	1866	4171.9	1.1	8.01	0.63	7.97	0.59
V	227			9	282	64	49	35	40.1	0.6	4.04	0.49	4.02	0.43
Y	227			5	60	12	11	12	4.7	0.4	2.45	0.29	2.45	0.30
ZN	227			35	244	73	68	61	27.0	0.4	4.25	0.30	4.24	0.29
ZR	227			14	300	73	67	68	35.8	0.5	4.22	0.41	4.21	0.44

NOTE: Refer to Table 1, Page 21 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table B-2

CORRELATION MATRIX FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

	L-U	LUTU	L-CO	L-MG	L-SR	L-CR	L-NI	L-CU	L-BA	L-K	L-NA	L-CA	L-Y	L-ZR	L-CE
L-U	1.00 (228)														
LUTU	0.78*** 0.72*** (223)	1.00 (223)													
L-CO	0.04 0.06 (126)	0.23*** 0.19** (125)	1.00 (126)												
L-MG	-0.05 -0.04 (227)	0.07 0.07 (222)	0.80*** 0.74*** (126)	1.00 (227)											
L-SR	0.18*** 0.19*** (227)	0.06 0.08 (222)	0.47*** 0.50*** (126)	0.48*** 0.48*** (227)	1.00 (227)										
L-CR	0.12* 0.14** (227)	0.17** 0.12* (222)	0.73*** 0.63*** (126)	0.61*** 0.50*** (227)	0.52*** 0.47*** (227)	1.00 (227)									
L-NI	0.07 0.13* (227)	0.07 0.10 (222)	0.60*** 0.61*** (126)	0.48*** 0.45*** (227)	0.44*** 0.46*** (227)	0.69*** 0.65*** (227)	1.00 (227)								
L-CU	0.13** 0.10 (226)	0.05 0.04 (221)	0.51*** 0.56*** (126)	0.45*** 0.41*** (226)	0.38*** 0.37*** (226)	0.59*** 0.59*** (226)	0.68*** 0.73*** (226)	1.00 (226)							
L-BA	-0.04 -0.03 (227)	-0.07 -0.04 (222)	0.23*** 0.16* (126)	0.36*** 0.34*** (227)	-0.09 -0.05 (227)	0.26*** 0.29*** (227)	0.27*** 0.27*** (227)	0.31*** 0.31*** (226)	1.00 (227)						
L-K	0.07 0.03 (227)	0.01 0.01 (222)	0.13 0.09 (126)	0.33*** 0.30*** (227)	-0.11* -0.10 (227)	0.21*** 0.25*** (227)	0.18*** 0.18*** (227)	0.32*** 0.29*** (226)	0.86*** 0.85*** (227)	1.00 (227)					
L-NA	-0.01 0.01 (226)	-0.05 -0.03 (221)	0.34*** 0.34*** (125)	0.39*** 0.39*** (226)	0.01 0.07 (226)	0.38*** 0.37*** (226)	0.32*** 0.32*** (226)	0.29*** 0.36*** (225)	0.85*** 0.82*** (225)	0.82*** 0.80*** (226)	1.00 (226)				
L-CA	-0.12* -0.11* (227)	-0.05 -0.05 (222)	-0.36*** -0.36*** (126)	-0.43*** -0.43*** (227)	0.02 -0.08 (227)	-0.37*** -0.47*** (227)	-0.29*** -0.35*** (227)	-0.33*** -0.50*** (226)	-0.76*** -0.75*** (227)	-0.74*** -0.75*** (227)	-0.79*** -0.76*** (226)	1.00 (227)			
L-Y	0.15** 0.10 (227)	0.03 -0.00 (222)	0.27*** 0.32*** (126)	0.47*** 0.53*** (227)	0.11 0.20*** (227)	0.29*** 0.43*** (227)	0.27*** 0.38*** (227)	0.32*** 0.41*** (226)	0.78*** 0.72*** (227)	0.75*** 0.72*** (227)	0.75*** 0.71*** (226)	-0.81*** -0.77*** (227)	1.00 (227)		
L-ZR	0.15** 0.09 (227)	0.08 0.04 (222)	0.29*** 0.27*** (126)	0.46*** 0.51*** (227)	0.10 0.13* (227)	0.28*** 0.37*** (227)	0.31*** 0.35*** (227)	0.33*** 0.34*** (226)	0.79*** 0.72*** (227)	0.71*** 0.69*** (227)	0.71*** 0.69*** (226)	-0.67*** -0.70*** (227)	0.87*** 0.90*** (227)	1.00 (227)	
L-CE	-0.03 -0.03 (219)	-0.04 -0.07 (215)	0.21** 0.17* (123)	0.44*** 0.44*** (219)	-0.11* -0.02 (219)	0.13* 0.25*** (219)	0.16** 0.24*** (219)	0.21*** 0.29*** (219)	0.76*** 0.70*** (219)	0.76*** 0.72*** (219)	0.71*** 0.62*** (218)	-0.74*** -0.68*** (219)	0.86*** 0.85*** (219)	0.75*** 0.79*** (219)	1.00 (219)
L-BE	0.10 0.10 (225)	-0.08 -0.11* (220)	0.07 0.14 (125)	0.13* 0.13* (225)	0.04 0.08 (225)	0.06 0.17*** (225)	0.15** 0.19*** (225)	0.21*** 0.22*** (225)	0.55*** 0.50*** (225)	0.51*** 0.48*** (225)	0.49*** 0.44*** (224)	-0.59*** -0.47*** (225)	0.60*** 0.49*** (225)	0.52*** 0.43*** (225)	0.53*** 0.45*** (219)
L-LI	0.26*** 0.17*** (227)	0.05 -0.02 (222)	0.16* 0.21** (126)	0.34*** 0.36*** (227)	0.27*** 0.30*** (227)	0.41*** 0.50*** (227)	0.33*** 0.39*** (227)	0.48*** 0.49*** (226)	0.53*** 0.54*** (227)	0.68*** 0.68*** (227)	0.50*** 0.60*** (226)	-0.51*** -0.63*** (227)	0.55*** 0.59*** (227)	0.51*** 0.49*** (227)	0.45*** 0.50*** (219)
L-V	0.35*** 0.29*** (227)	0.10 0.06 (222)	0.54*** 0.62*** (126)	0.45*** 0.43*** (227)	0.59*** 0.63*** (227)	0.60*** 0.66*** (227)	0.53*** 0.61*** (227)	0.47*** 0.52*** (226)	0.42*** 0.34*** (227)	0.32*** 0.26*** (227)	0.50*** 0.47*** (226)	-0.55*** -0.52*** (227)	0.62*** 0.61*** (227)	0.58*** 0.56*** (227)	0.35*** 0.37*** (219)
L-ZN	0.21*** 0.19*** (227)	-0.02 -0.07 (222)	0.35*** 0.43*** (126)	0.35*** 0.35*** (227)	0.28*** 0.32*** (227)	0.32*** 0.42*** (227)	0.35*** 0.48*** (227)	0.43*** 0.58*** (226)	0.58*** 0.68*** (227)	0.47*** 0.60*** (227)	0.55*** 0.54*** (226)	-0.63*** -0.50*** (227)	0.71*** 0.64*** (227)	0.69*** 0.59*** (227)	0.58*** 0.52*** (219)
L-FE	0.16** 0.14** (227)	0.07 0.06 (222)	0.64*** 0.71*** (126)	0.63*** 0.63*** (227)	0.40*** 0.46*** (227)	0.53*** 0.59*** (227)	0.51*** 0.59*** (227)	0.36*** 0.48*** (226)	0.62*** 0.56*** (227)	0.48*** 0.47*** (227)	0.67*** 0.65*** (226)	-0.69*** -0.64*** (227)	0.77*** 0.78*** (227)	0.79*** 0.78*** (227)	0.63*** 0.62*** (219)
L-MN	0.08 0.08 (227)	0.00 -0.00 (222)	0.50*** 0.59*** (126)	0.56*** 0.58*** (227)	0.25*** 0.33*** (227)	0.37*** 0.47*** (227)	0.39*** 0.50*** (227)	0.27*** 0.42*** (226)	0.68*** 0.54*** (227)	0.53*** 0.53*** (227)	0.69*** 0.68*** (226)	-0.70*** -0.63*** (227)	0.83*** 0.82*** (227)	0.81*** 0.81*** (227)	0.74*** 0.69*** (219)
L-TI	0.18*** 0.10 (227)	0.09 0.05 (222)	0.45*** 0.56*** (126)	0.51*** 0.56*** (227)	0.31*** 0.35*** (227)	0.38*** 0.47*** (227)	0.36*** 0.47*** (227)	0.23*** 0.34*** (226)	0.57*** 0.54*** (227)	0.44*** 0.43*** (227)	0.61*** 0.64*** (226)	-0.58*** -0.54*** (227)	0.71*** 0.74*** (227)	0.77*** 0.79*** (227)	0.58*** 0.59*** (219)
L-P	0.09 0.09 (227)	-0.01 0.02 (222)	0.42*** 0.49*** (126)	0.56*** 0.57*** (227)	0.35*** 0.39*** (227)	0.34*** 0.45*** (227)	0.33*** 0.44*** (227)	0.40*** 0.50*** (226)	0.56*** 0.48*** (227)	0.45*** 0.44*** (227)	0.60*** 0.57*** (226)	-0.61*** -0.60*** (227)	0.77*** 0.70*** (227)	0.68*** 0.68*** (227)	0.64*** 0.57*** (219)
L-AL	0.20*** 0.16** (227)	0.12* 0.06 (222)	0.48*** 0.56*** (126)	0.56*** 0.56*** (227)	0.27*** 0.33*** (227)	0.60*** 0.65*** (227)	0.46*** 0.52*** (227)	0.59*** 0.60*** (226)	0.75*** 0.71*** (227)	0.82*** 0.74*** (227)	0.80*** 0.77*** (226)	-0.77*** -0.85*** (227)	0.80*** 0.83*** (227)	0.75*** 0.74*** (227)	0.67*** 0.69*** (219)
L-SC	0.15** 0.13* (226)	0.12* 0.04 (221)	0.76*** 0.82*** (126)	0.73*** 0.72*** (226)	0.43*** 0.47*** (226)	0.70*** 0.72*** (226)	0.52*** 0.59*** (226)	0.58*** 0.60*** (226)	0.59*** 0.53*** (226)	0.57*** 0.50*** (226)	0.63*** 0.61*** (225)	-0.69*** -0.70*** (226)	0.78*** 0.80*** (226)	0.71*** 0.70*** (226)	0.61*** 0.60*** (219)
L-NB	0.06 0.08 (225)	0.07 0.10 (220)	0.13 0.12 (126)	0.18*** 0.12* (225)	-0.05 -0.06 (225)	-0.05 -0.04 (225)	0.16** 0.09 (225)	-0.01 -0.02 (225)	0.51*** 0.33*** (225)	0.42*** 0.26*** (225)	0.41*** 0.25*** (224)	-0.35*** -0.09 (225)	0.52*** 0.33*** (225)	0.61*** 0.48*** (225)	0.54*** 0.36*** (219)
L-TH	-0.01 -0.03 (215)	0.00 0.02 (211)	0.05 -0.02 (120)	0.13* 0.11 (215)	-0.02 -0.03 (215)	0.14** 0.16** (215)	0.04 0.01 (215)	0.15** 0.15** (215)	0.08 0.09 (215)	0.10 0.11 (215)	0.02 0.06 (214)	-0.08 -0.14** (215)	0.15** 0.19*** (215)	0.09 0.13* (215)	0.22*** 0.28*** (212)
LTUN	-0.10 -0.16** (222)	0.08 0.11 (222)	0.16* 0.05 (125)	0.17** 0.15** (222)	-0.09 -0.10 (222)	0.18*** 0.14** (222)	0.08 -0.01 (222)	0.15** 0.09 (221)	0.17** 0.13** (222)	0.13** 0.12* (222)	0.09 0.05 (221)	-0.09 -0.11* (222)	0.19*** 0.16** (222)	0.17** 0.13* (222)	0.22*** 0.23*** (215)
LUNT	0.44*** 0.42*** (223)	-0.23*** -0.25*** (223)	-0.28*** -0.07 (125)	-0.18*** -0.12* (222)	0.19*** 0.23*** (222)	-0.05 0.11 (222)	0.05 0.12* (222)	0.15** 0.14** (221)	0.04 0.02 (222)	0.11 0.06 (222)	0.06 0.11 (221)	-0.12* -0.13* (222)	0.20*** 0.21*** (222)	0.12* 0.15** (222)	0.02 0.09 (215)
L-AS	0.26*** 0.26*** (228)	-0.05 -0.07 (223)	0.18** 0.28*** (126)	-0.03 -0.03 (227)	0.38*** 0.37*** (227)	0.33*** 0.37*** (227)	0.34*** 0.37*** (227)	0.33*** 0.34*** (226)	0.09 0.12* (227)	0.03 0.04 (227)	0.15** 0.18*** (226)	-0.15** -0.22*** (227)	0.13* 0.20*** (227)	0.13* 0.08 (227)	-0.04 0.10 (219)
L-SE	0.03 0.02	-0.06 -0.06	0.00 0.06	0.10 0.14*	0.34*** 0.33***	0.15* 0.20**	0.27*** 0.25***	0.15* 0.17**	-0.05 -0.02	-0.04 -0.01	-0.06 -0.01	0.05 0.03	0.03 0.08	0.01 0.09	-0.04 0.06

NOTE: (1) Pearson correlation/Spearman correlation/(sample size). If either element has a concentration below the laboratory detection limits, it is omitted from the pairwise computations.
(2) Significance levels: *-10%, **-5%, ***-1%.
(3) No correlation computed because of insufficient number of pairs: ******.

	L-BE	L-LI	L-V	L-ZN	L-FE	L-MN	L-TI	L-P	L-AL	L-SC	L-NB	L-TH	LTUN	LUNT	L-AS	L-SE
L-BE	1.00 (225)															
L-LI	0.39*** 0.38*** (225)	1.00 (227)														
L-V	0.41*** 0.38*** (225)	0.48*** 0.49*** (227)	1.00 (227)													
L-ZN	0.54*** 0.46*** (225)	0.48*** 0.54*** (227)	0.76*** 0.71*** (227)	1.00 (227)												
L-FE	0.45*** 0.38*** (225)	0.45*** 0.54*** (227)	0.85*** 0.84*** (227)	0.79*** 0.72*** (227)	1.00 (227)											
L-MN	0.53*** 0.43*** (225)	0.40*** 0.49*** (227)	0.75*** 0.75*** (227)	0.81*** 0.71*** (227)	0.96*** 0.95*** (227)	1.00 (227)										
L-TI	0.38*** 0.32*** (225)	0.32*** 0.38*** (227)	0.80*** 0.77*** (227)	0.74*** 0.62*** (227)	0.93*** 0.94*** (227)	0.92*** 0.93*** (227)	1.00 (227)									
L-P	0.39*** 0.32*** (225)	0.40*** 0.50*** (227)	0.66*** 0.64*** (227)	0.72*** 0.70*** (227)	0.77*** 0.75*** (227)	0.78*** 0.74*** (227)	0.72*** 0.71*** (227)	1.00 (227)								
L-AL	0.46*** 0.46*** (225)	0.80*** 0.80*** (227)	0.63*** 0.68*** (227)	0.62*** 0.68*** (227)	0.70*** 0.80*** (227)	0.65*** 0.76*** (227)	0.58*** 0.67*** (227)	0.64*** 0.72*** (227)	1.00 (227)							
L-SC	0.38*** 0.39*** (225)	0.56*** 0.59*** (226)	0.77*** 0.80*** (226)	0.68*** 0.69*** (226)	0.83*** 0.87*** (226)	0.77*** 0.80*** (226)	0.73*** 0.77*** (226)	0.71*** 0.75*** (226)	0.84*** 0.85*** (226)	1.00 (226)						
L-NB	0.37*** 0.24*** (224)	0.17** 0.11* (225)	0.31*** 0.18*** (225)	0.44*** 0.16** (225)	0.53*** 0.35*** (225)	0.60*** 0.41*** (225)	0.57*** 0.44*** (225)	0.39*** 0.18*** (225)	0.31*** 0.16** (225)	0.29*** 0.16** (225)	1.00 (225)					
L-TH	-0.00 0.02 (214)	0.10 0.06 (215)	0.03 0.05 (215)	0.05 0.04 (215)	0.03 0.07 (215)	0.06 0.10 (215)	-0.01 0.03 (215)	0.02 -0.00 (215)	0.13* 0.13* (215)	0.15** 0.15** (215)	0.02 0.06 (215)	1.00 (215)				
LTUN	-0.03 -0.05 (220)	-0.01 -0.08 (222)	-0.04 -0.06 (222)	-0.02 -0.07 (222)	0.03 0.03 (222)	0.06 0.06 (222)	-0.02 0.02 (222)	-0.03 -0.05 (222)	0.12* 0.07 (222)	0.19*** 0.11* (221)	0.05 0.07 (220)	0.93*** 0.92*** (211)	1.00 (222)			
LUNT	0.27*** 0.32*** (220)	0.34*** 0.29*** (222)	0.40*** 0.40*** (222)	0.36*** 0.41*** (222)	0.14** 0.20*** (222)	0.12* 0.17*** (222)	0.15** 0.16** (222)	0.16** 0.16** (222)	0.17** 0.22*** (222)	0.07 0.17** (221)	-0.00 0.05 (220)	-0.02 -0.04 (211)	-0.27*** -0.32*** (222)	1.00 (223)		
L-AS	0.26*** 0.30*** (225)	0.40*** 0.41*** (227)	0.51*** 0.57*** (227)	0.38*** 0.46*** (227)	0.30*** 0.36*** (227)	0.21*** 0.30*** (227)	0.18*** 0.24*** (227)	0.15** 0.21*** (227)	0.29*** 0.37*** (227)	0.23*** 0.36*** (226)	0.08 0.06 (225)	-0.00 -0.02 (215)	-0.11 -0.16** (222)	0.40*** 0.47*** (223)	1.00 (228)	
L-SE	0.00 -0.03 (155)	0.19** 0.16** (157)	0.27*** 0.28*** (157)	0.13* 0.16** (157)	0.16** 0.20** (157)	0.11 0.16** (157)	0.11 0.17** (157)	0.12 0.16** (157)	0.07 0.11 (157)	0.11 0.18** (156)	0.03 0.07 (155)	0.03 0.00 (151)	-0.00 -0.02 (153)	0.13* 0.05 (154)	0.27*** 0.25*** (158)	1.00 (180)

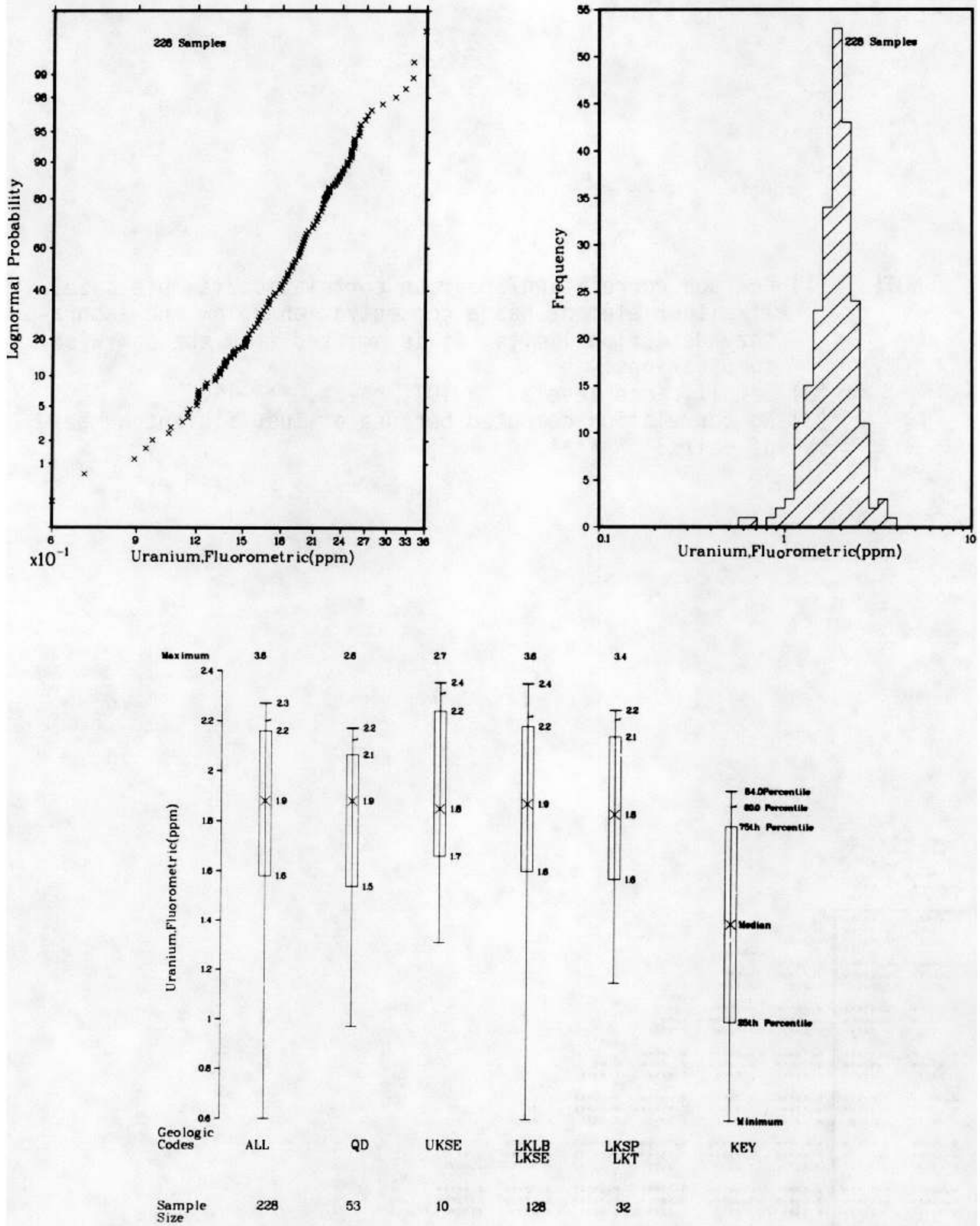


Figure B-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SOLUBLE URANIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

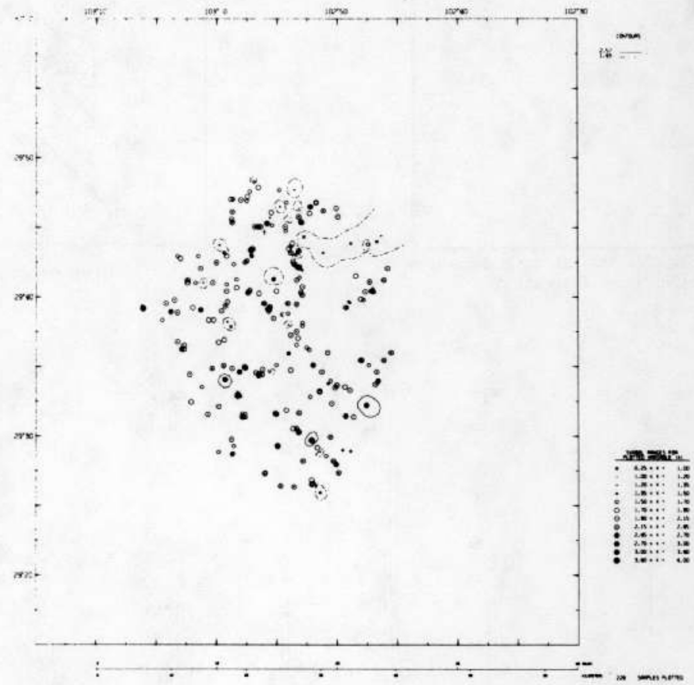


Figure B-1b

GEOCHEMICAL DISTRIBUTION OF SOLUBLE URANIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

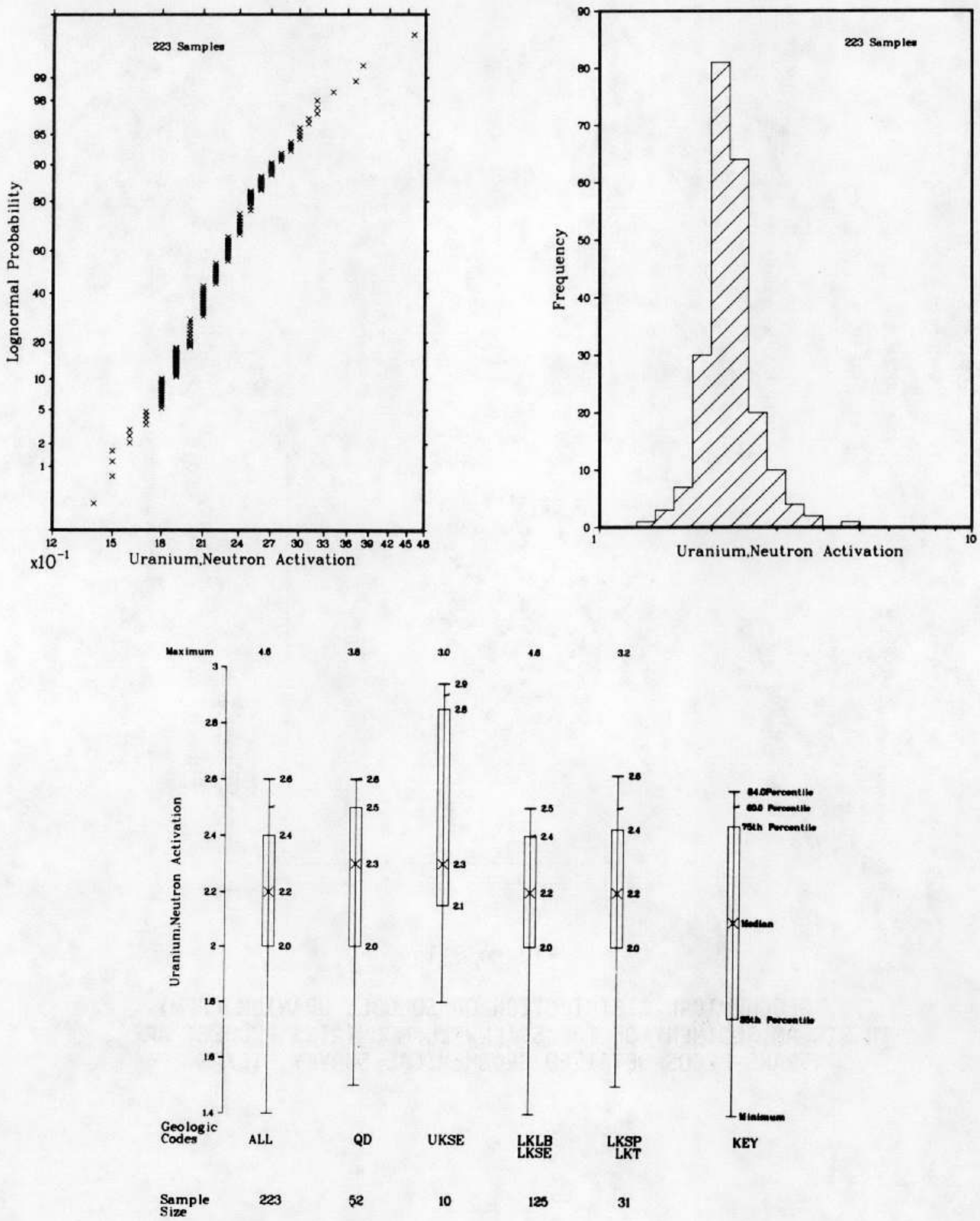


Figure B-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM BY NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

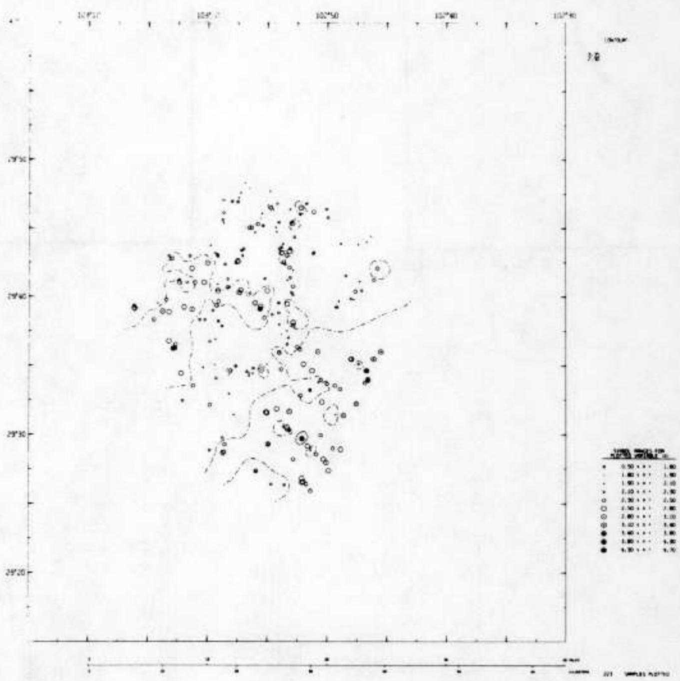


Figure B-2b

GEOCHEMICAL DISTRIBUTION OF URANIUM BY NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

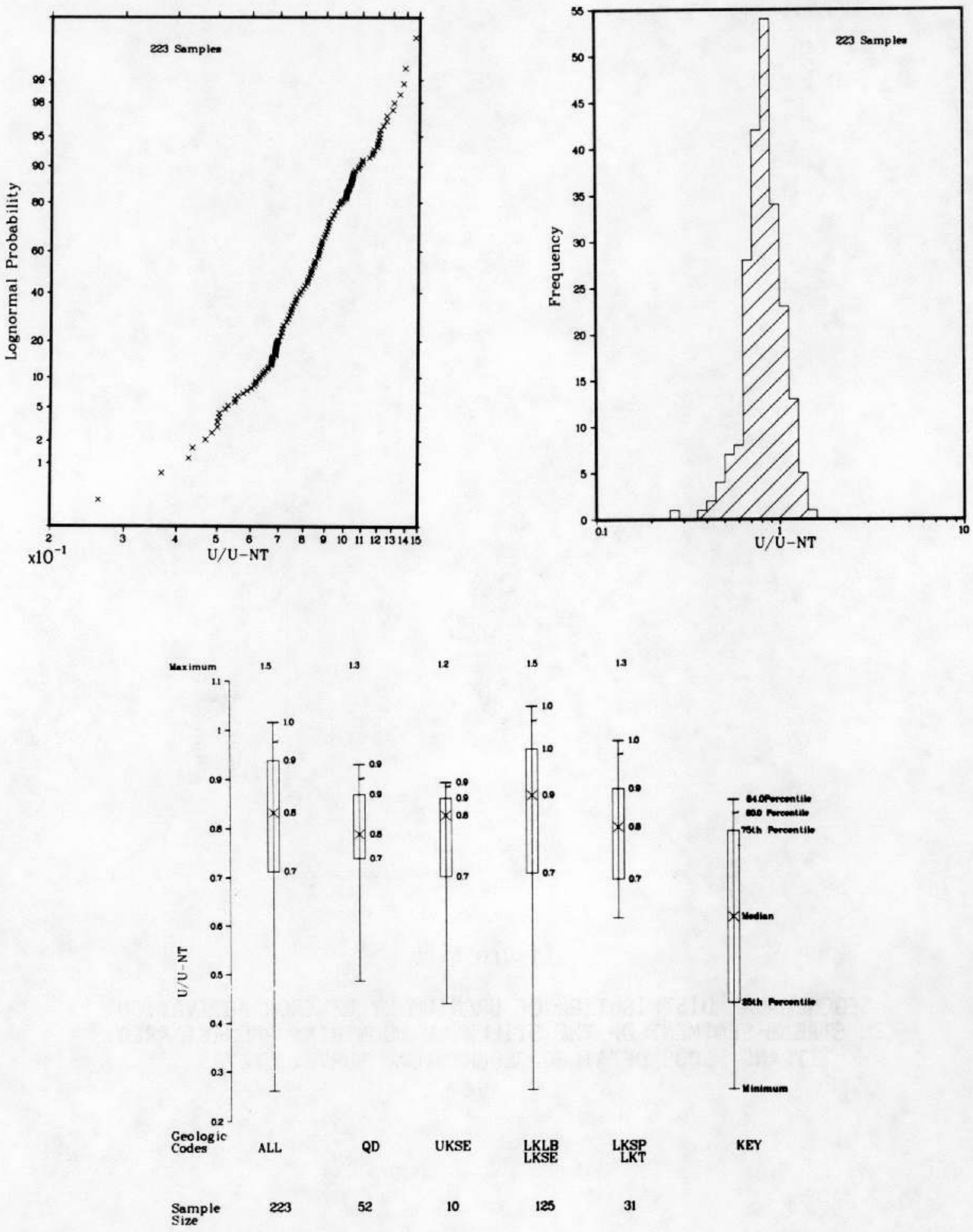


Figure B-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM FLUOROMETRIC/
URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

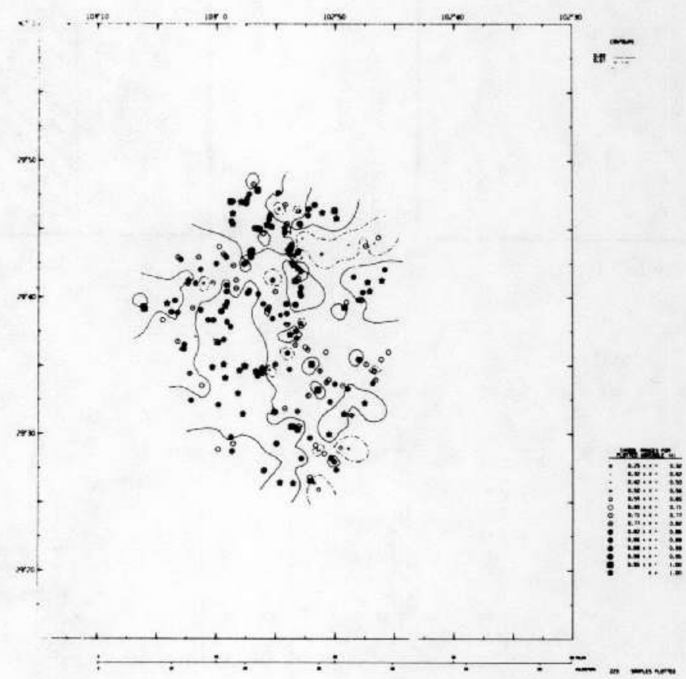


Figure B-3b

GEOCHEMICAL DISTRIBUTION OF URANIUM FLUOROMETRIC/URANIUM NEUTRON ACTIVATION
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

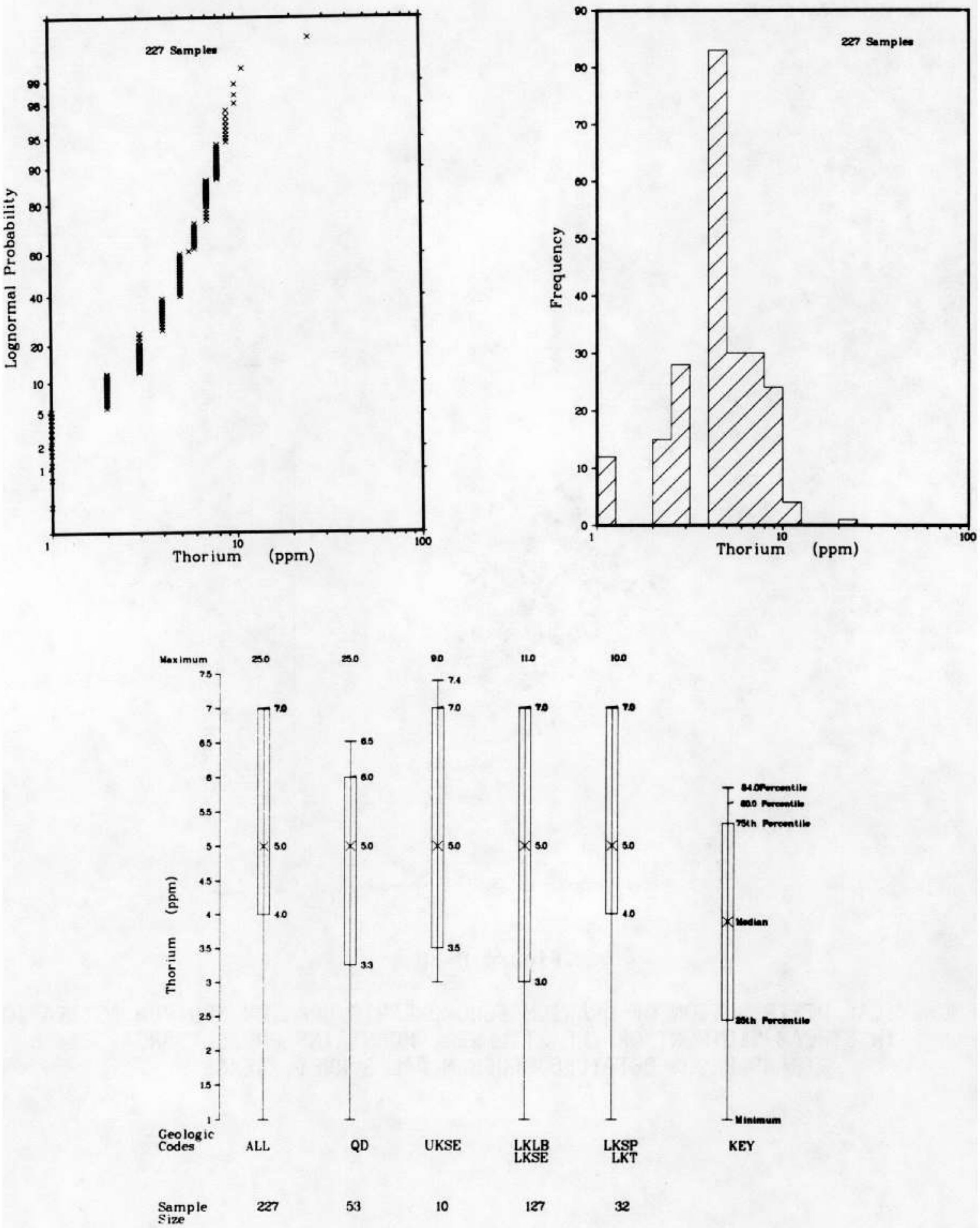


Figure B-4a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR THORIUM (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

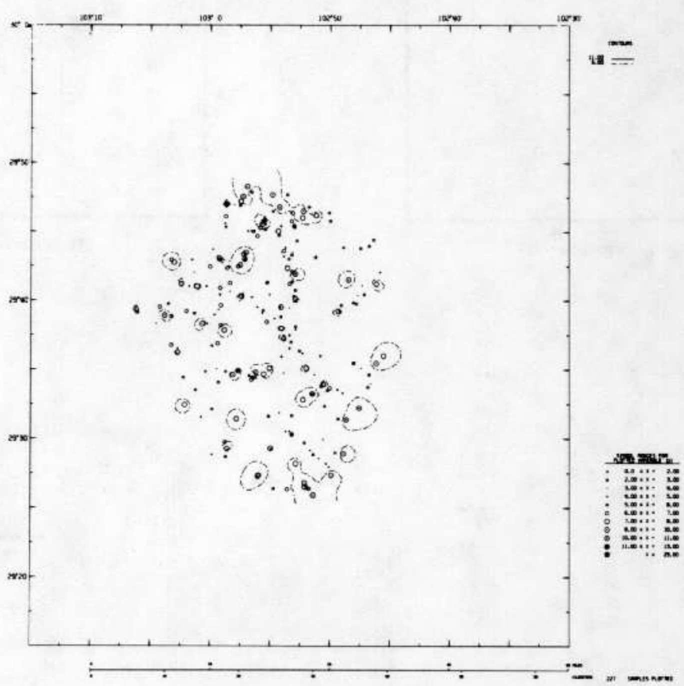


Figure B-4b

GEOCHEMICAL DISTRIBUTION OF THORIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

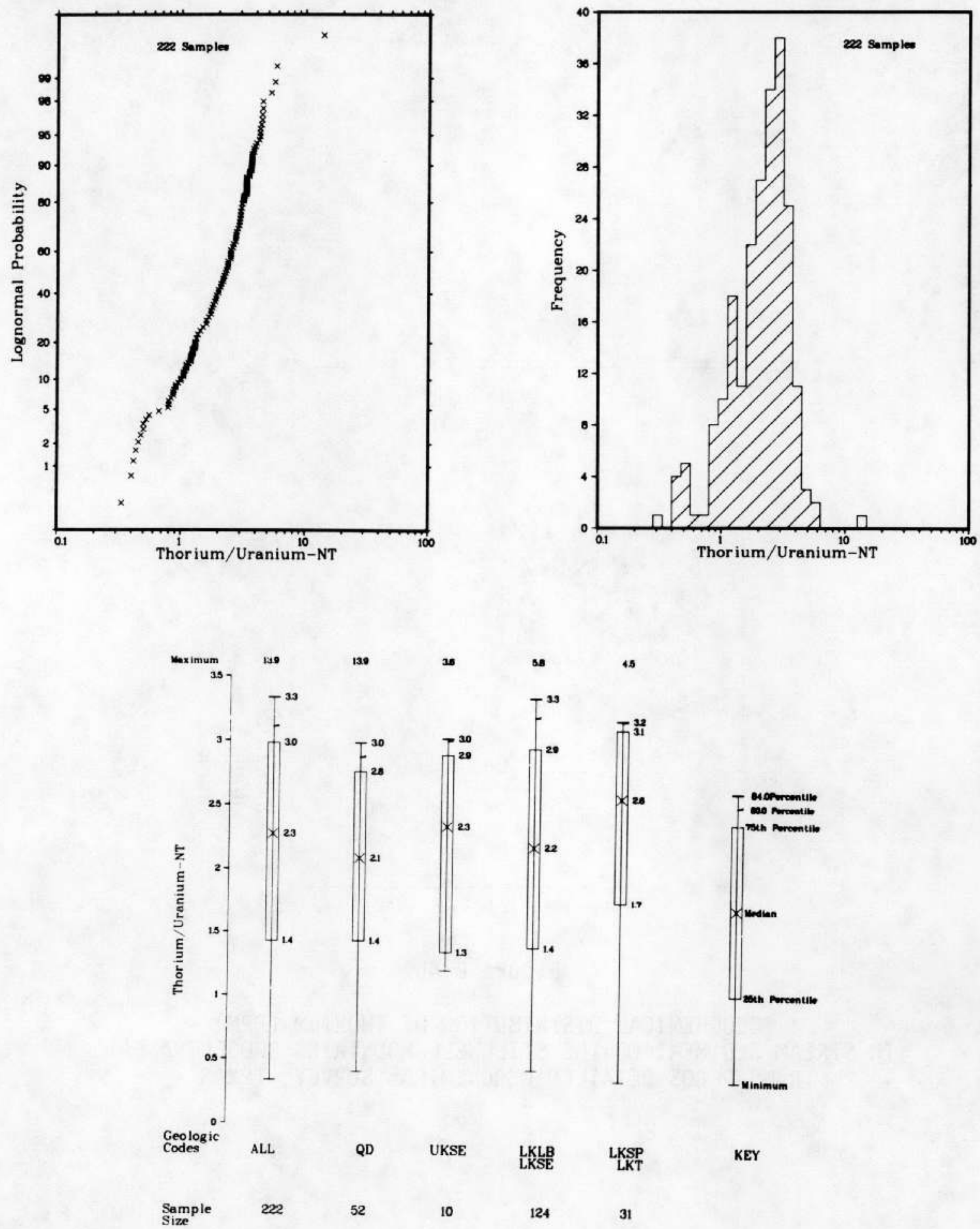


Figure B-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR THORIUM/URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

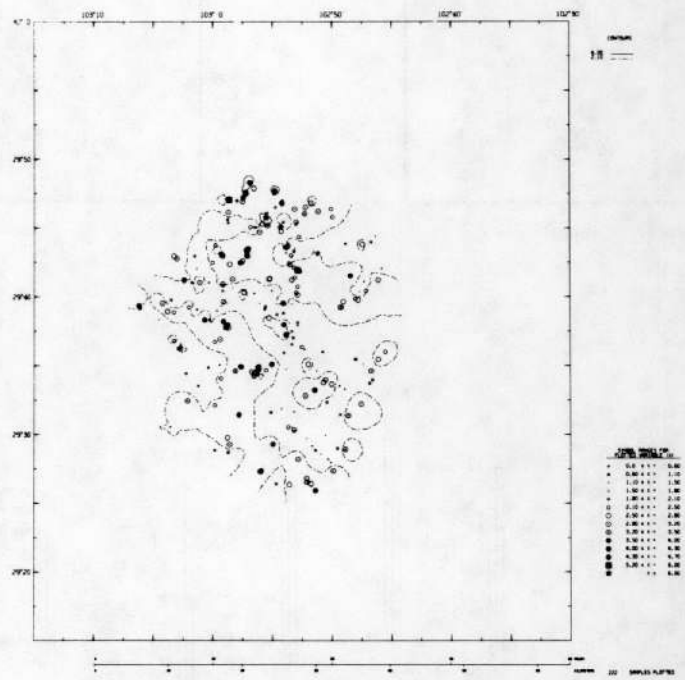


Figure B-5b

GEOCHEMICAL DISTRIBUTION OF THORIUM/URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

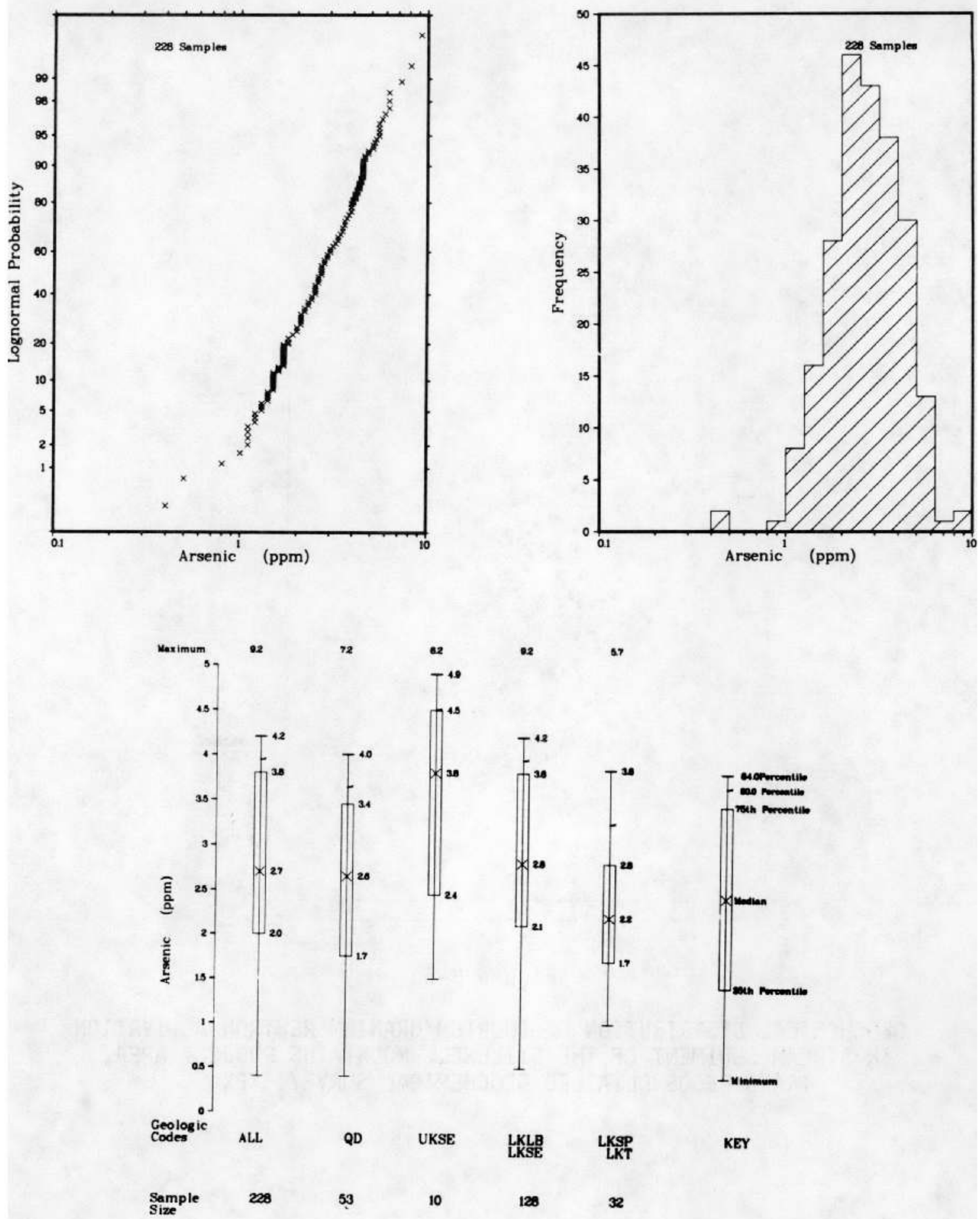


Figure B-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR ARSENIC (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

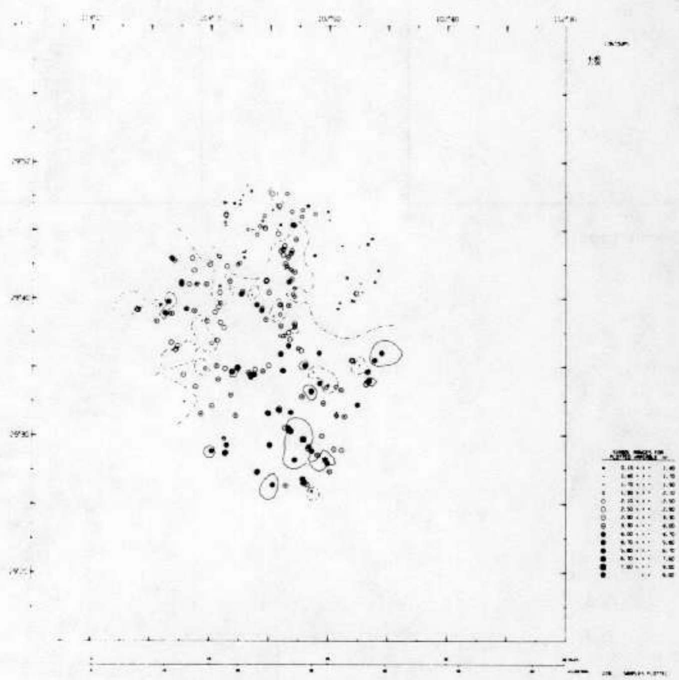


Figure B-6b

GEOCHEMICAL DISTRIBUTION OF ARSENIC (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

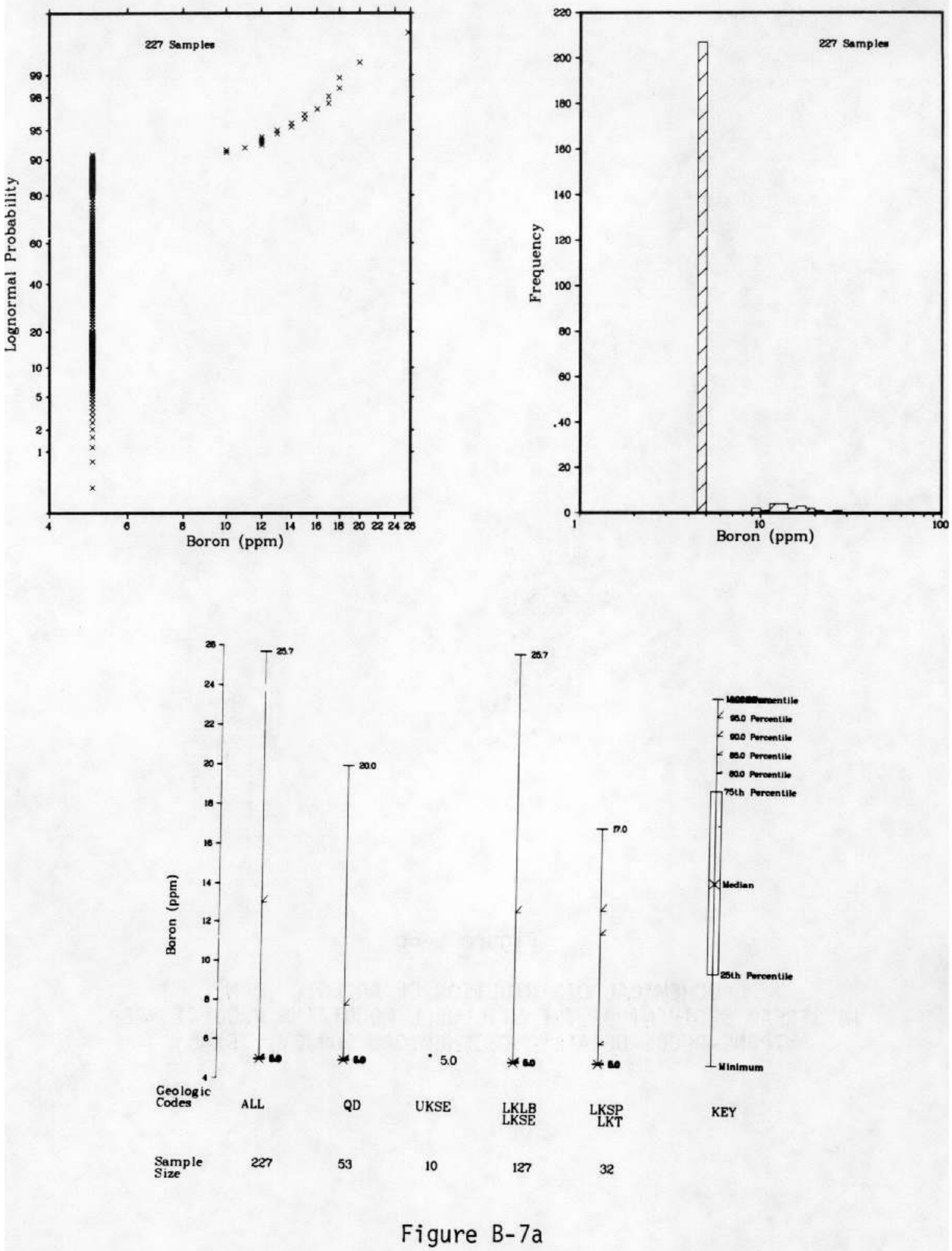


Figure B-7a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR BORON (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

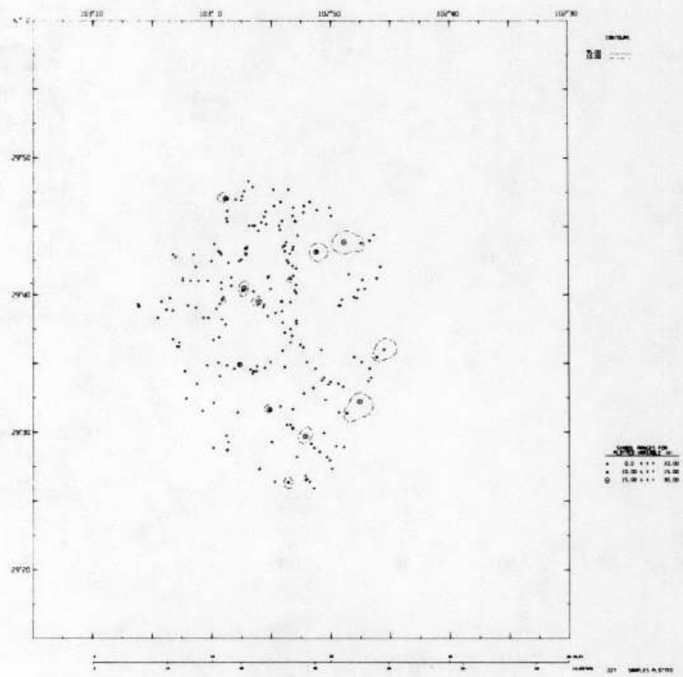


Figure B-7b

GEOCHEMICAL DISTRIBUTION OF BORON (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

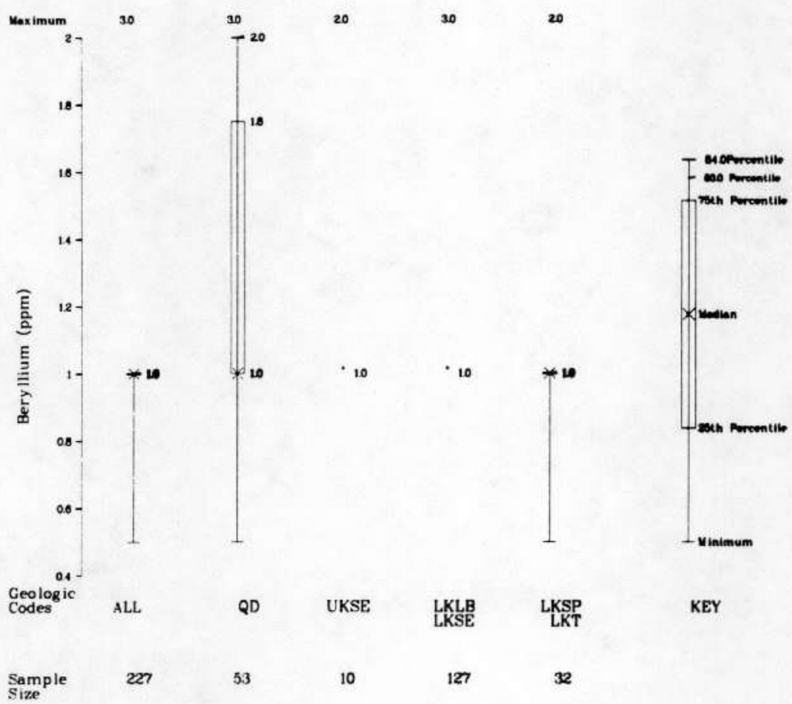


Figure B-8a

PERCENTILE PLOT FOR BERYLLIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

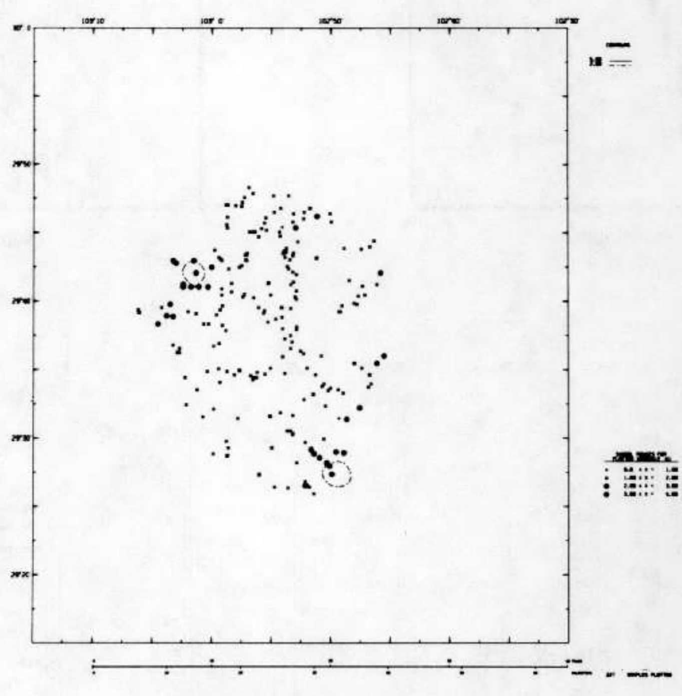


Figure B-8b

GEOCHEMICAL DISTRIBUTION OF BERYLLIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

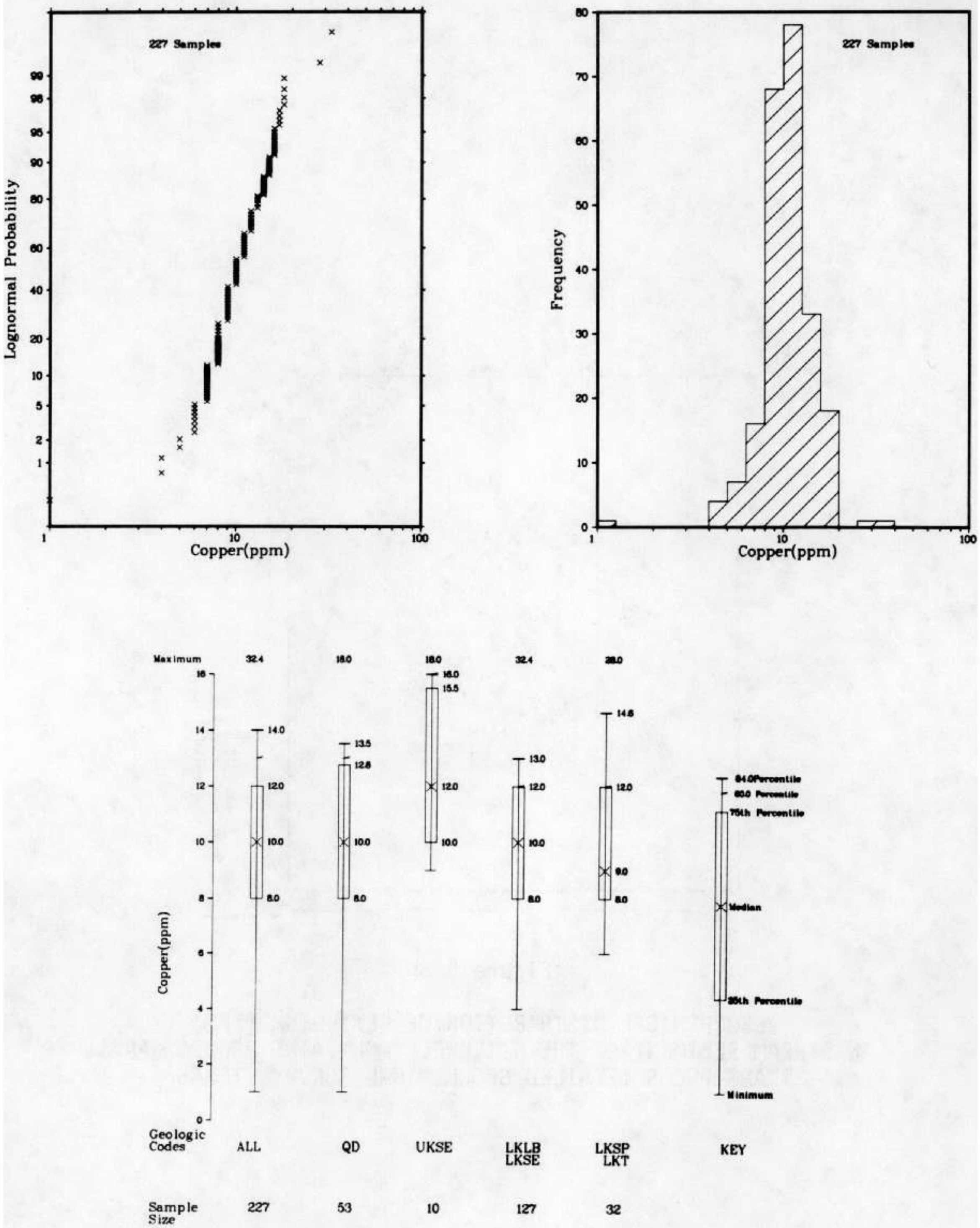


Figure B-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR COPPER (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

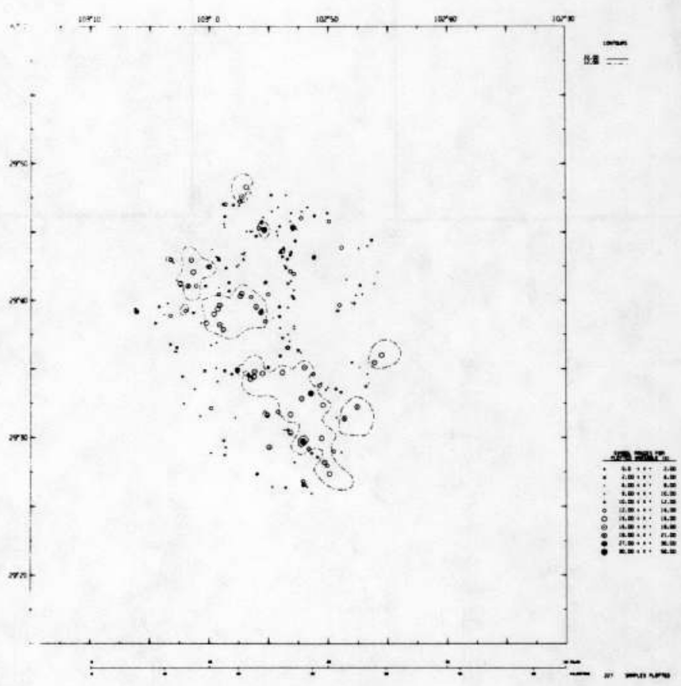


Figure B-9b

GEOCHEMICAL DISTRIBUTION OF COPPER (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

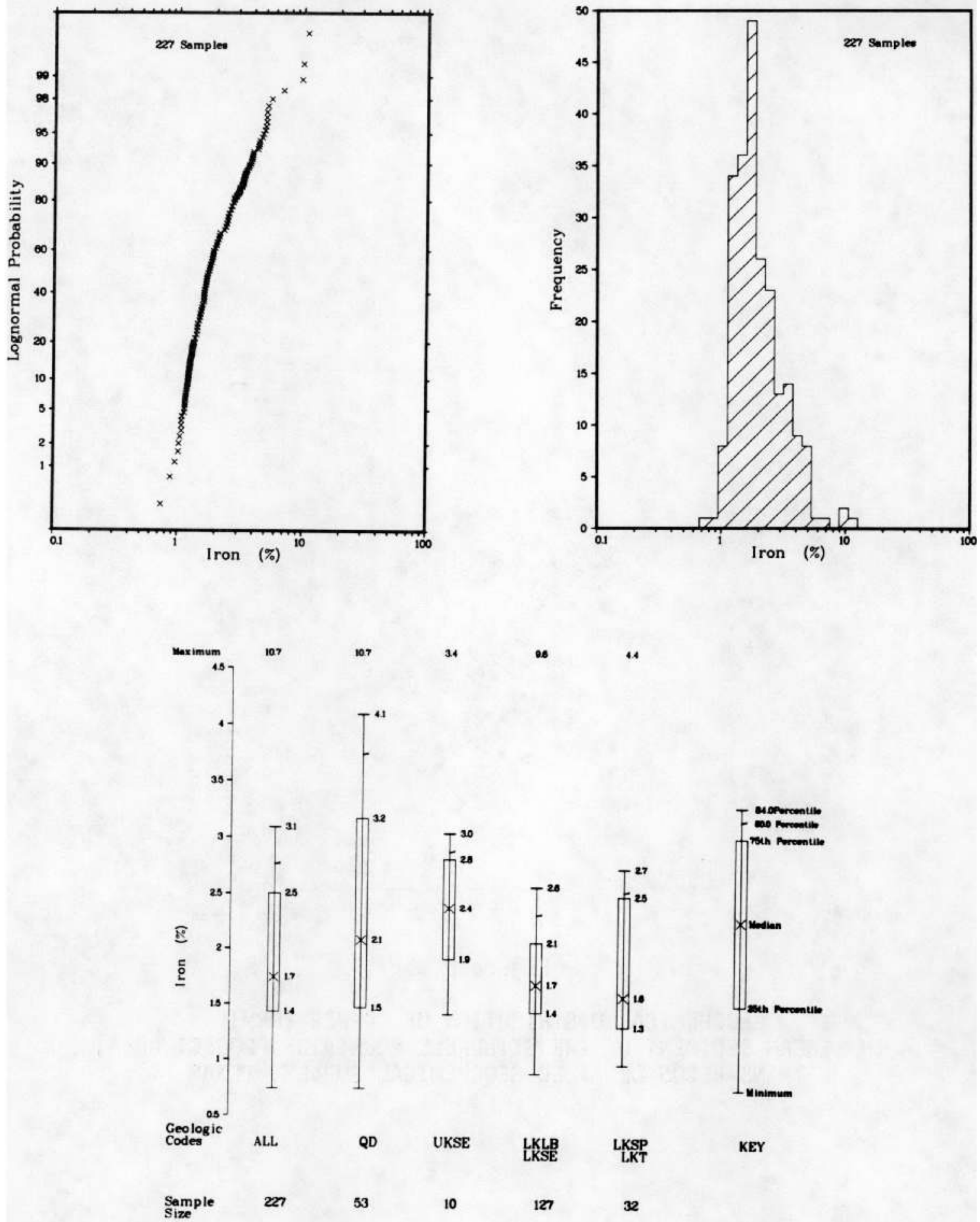


Figure B-10a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR IRON (%) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

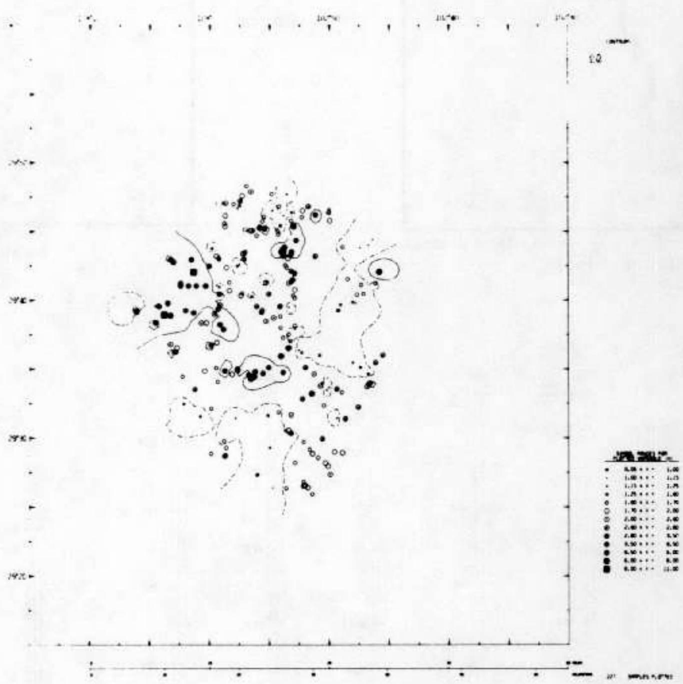


Figure B-10b

GEOCHEMICAL DISTRIBUTION OF IRON (%)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

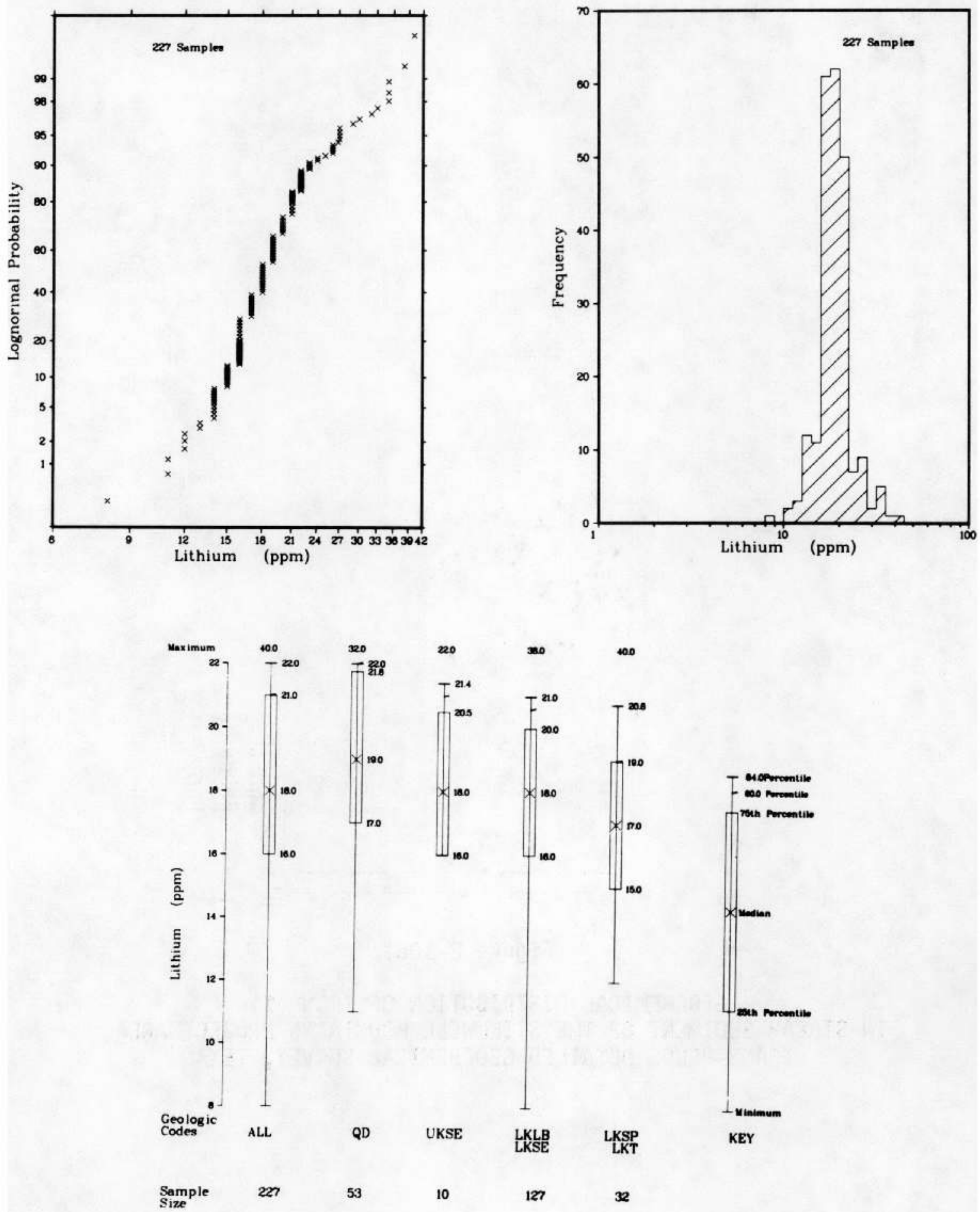


Figure B-11a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR LITHIUM (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

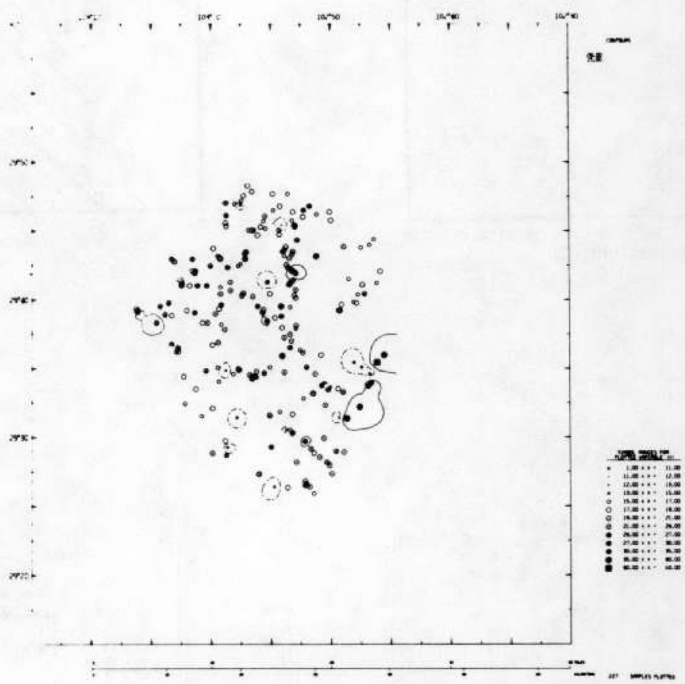


Figure B-11b

GEOCHEMICAL DISTRIBUTION OF LITHIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

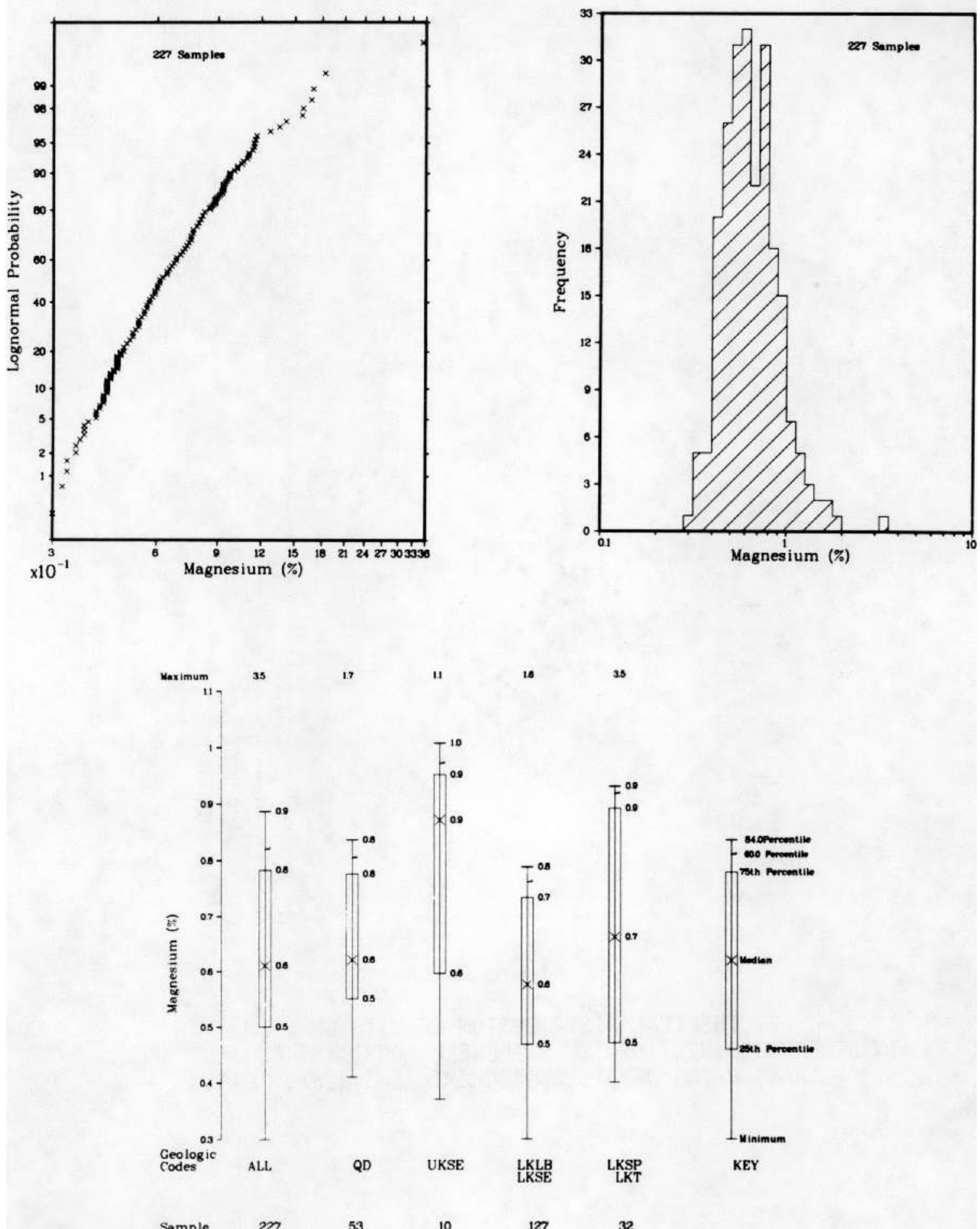


Figure B-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MAGNESIUM (%) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

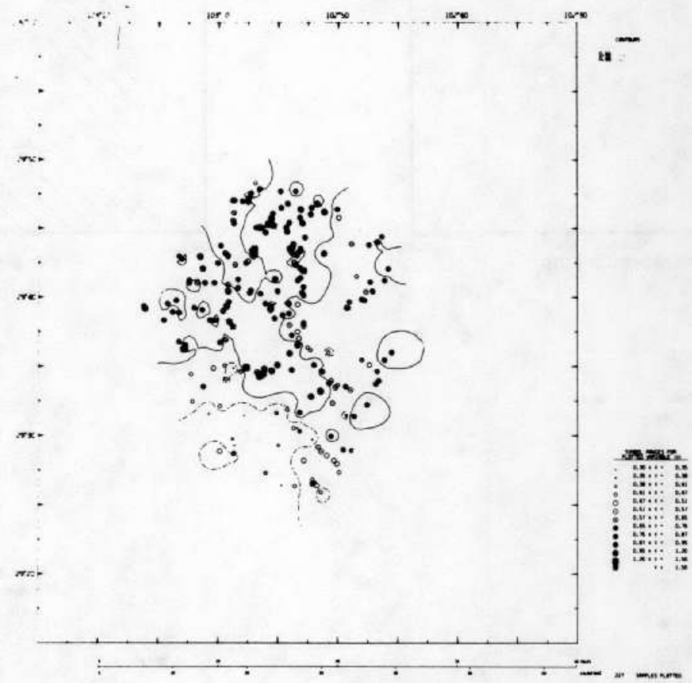


Figure B-12b

GEOCHEMICAL DISTRIBUTION OF MAGNESIUM (%)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

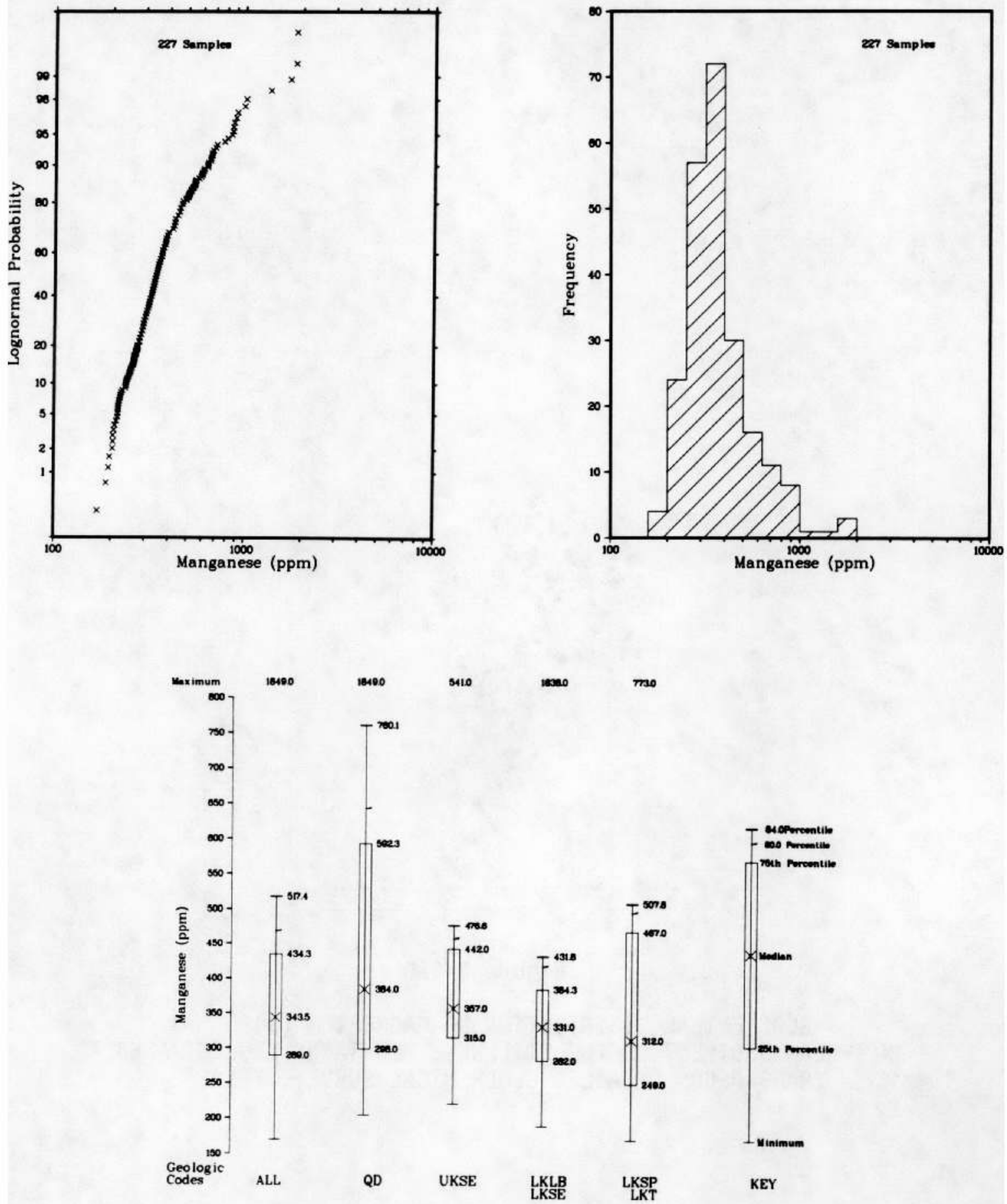


Figure B-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MANGANESE (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

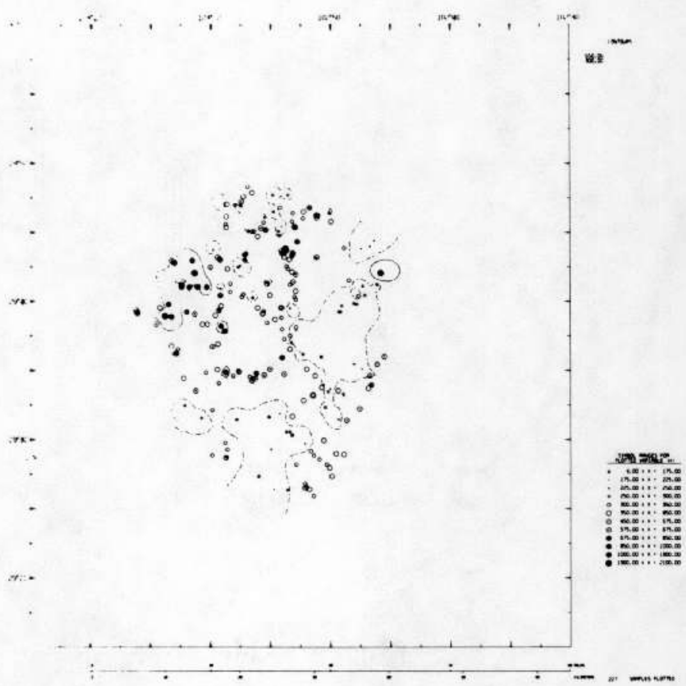


Figure B-13b

GEOCHEMICAL DISTRIBUTION OF MANGANESE (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

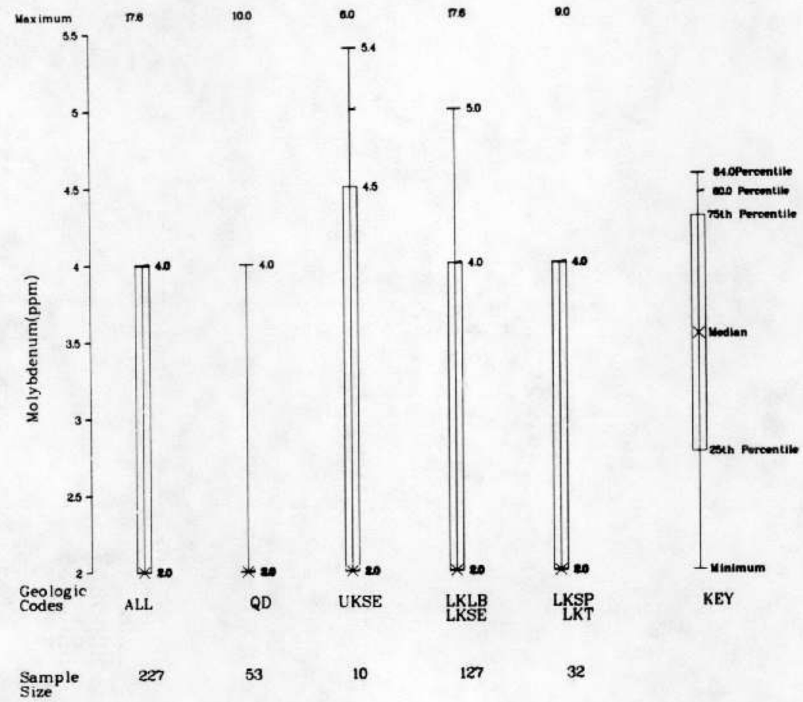


Figure B-14a

PERCENTILE PLOT FOR MOLYBDENUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

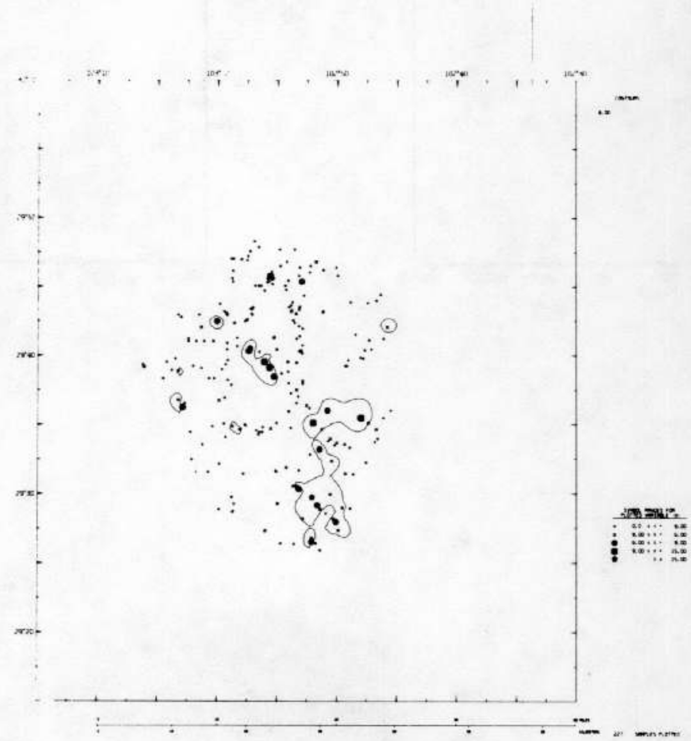


Figure B-14b

GEOCHEMICAL DISTRIBUTION OF MOLYBDENUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

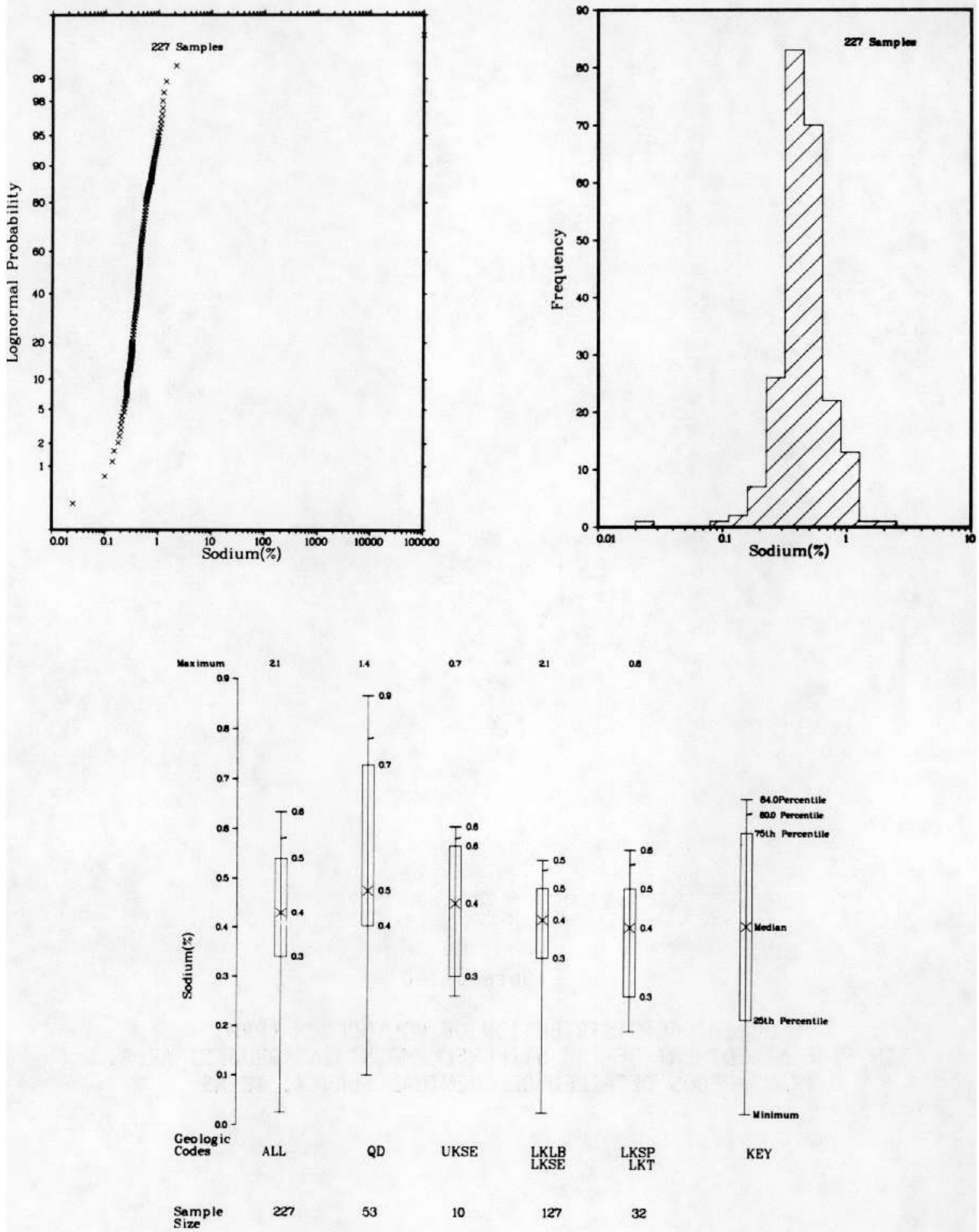


Figure B-15a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SODIUM (%) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

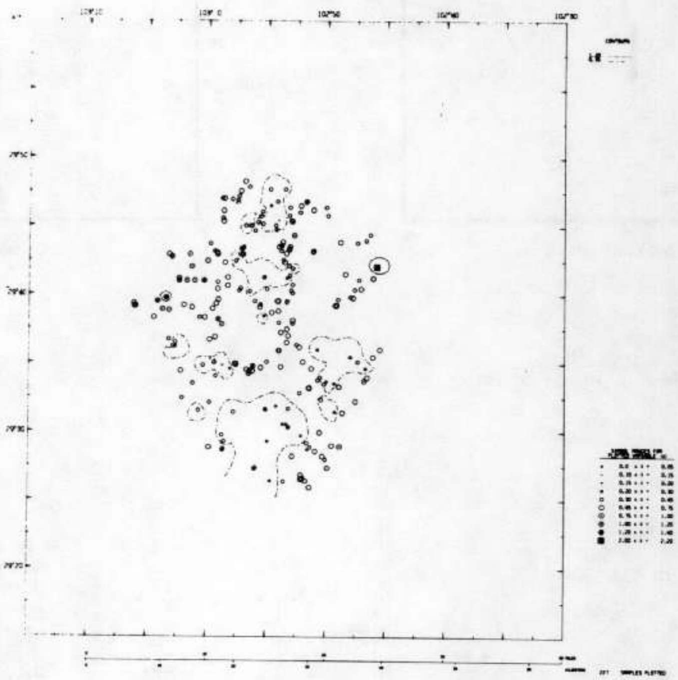


Figure B-15b

GEOCHEMICAL DISTRIBUTION OF SODIUM (%)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

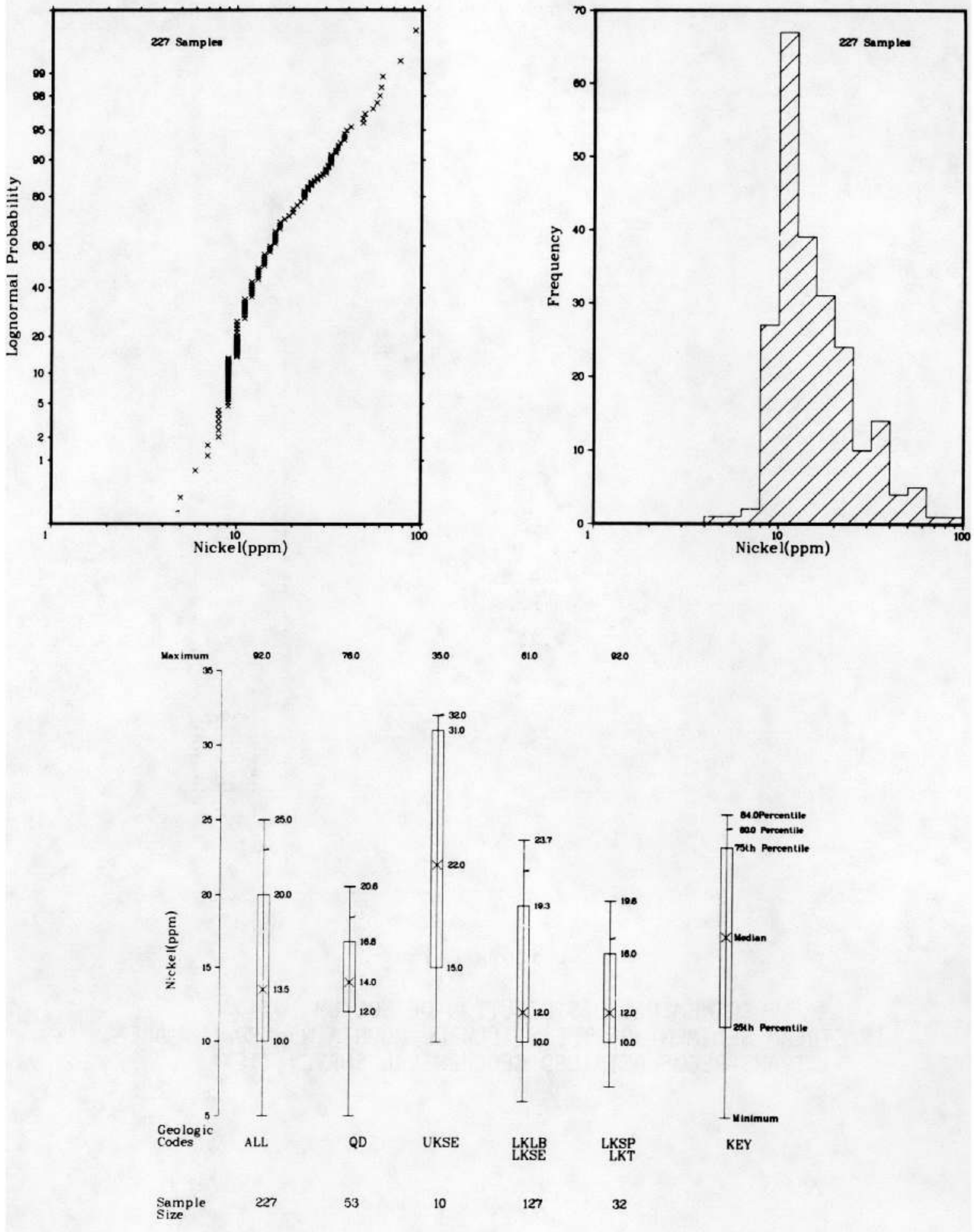


Figure B-16a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR NICKEL (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

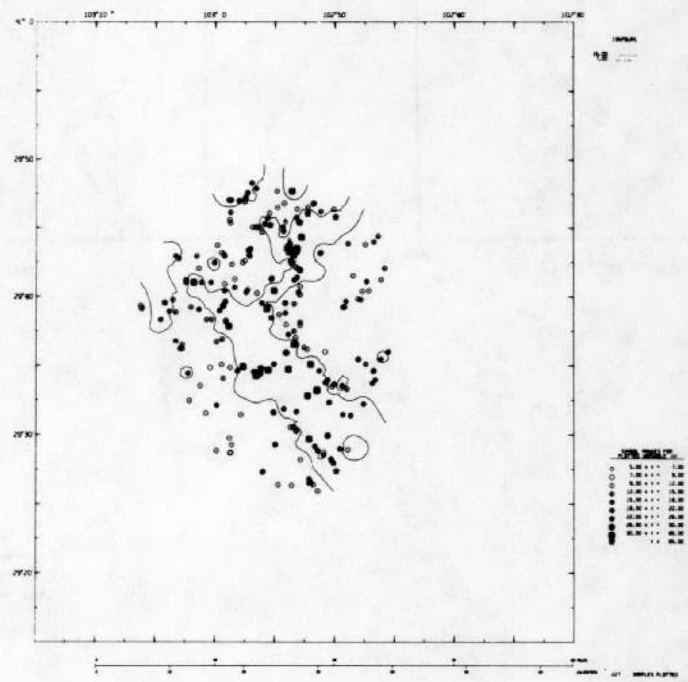


Figure B-16b

GEOCHEMICAL DISTRIBUTION OF NICKEL (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

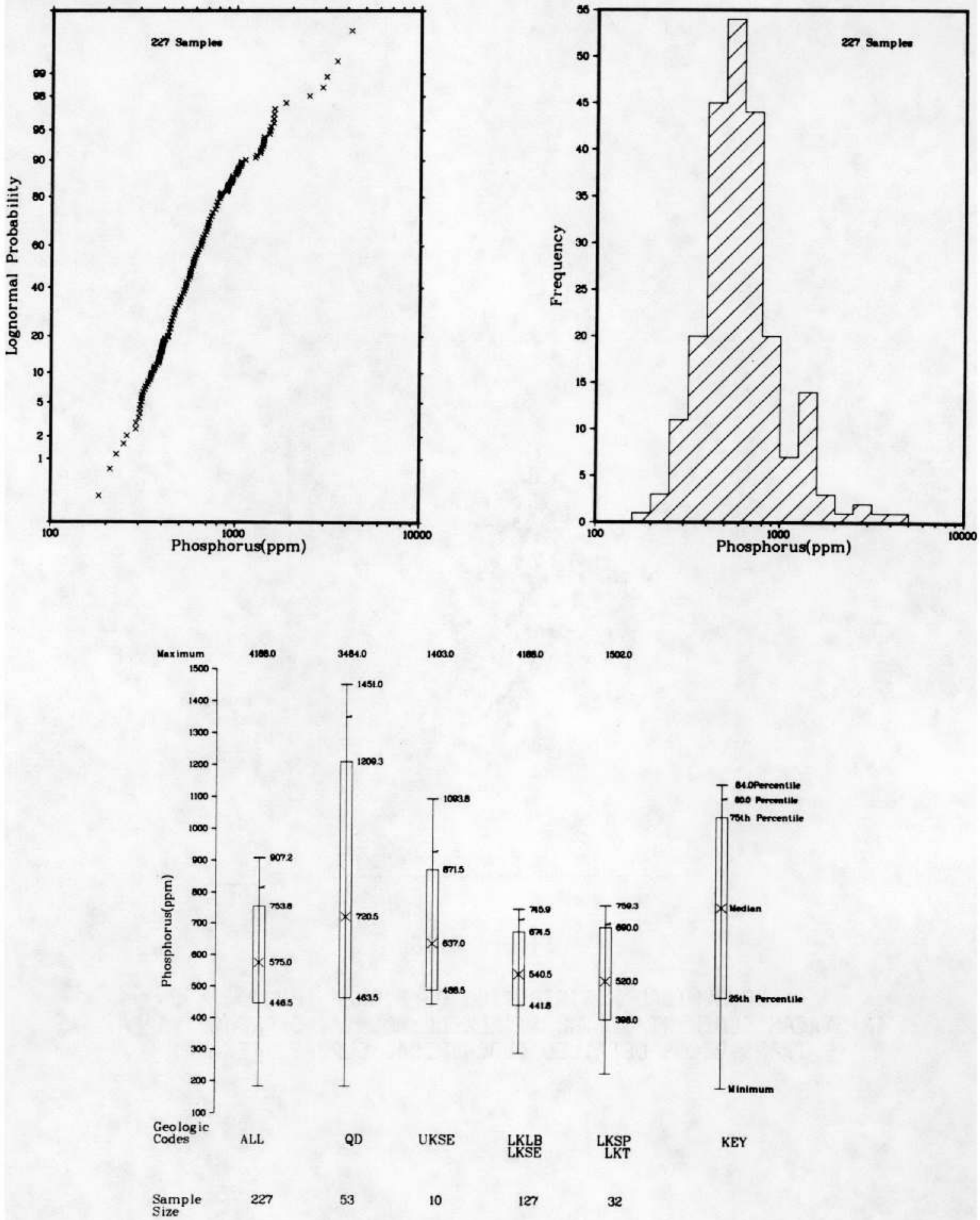


Figure B-17a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR PHOSPHORUS (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

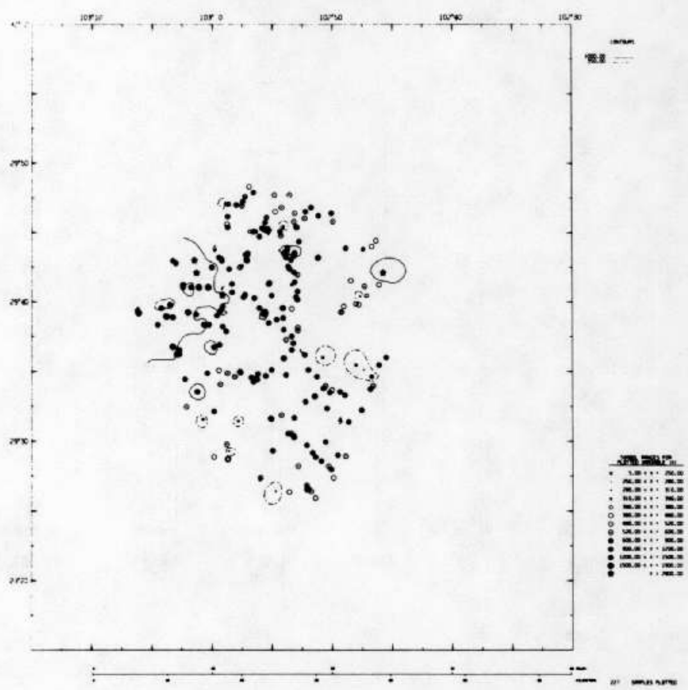


Figure B-17b

GEOCHEMICAL DISTRIBUTION OF PHOSPHORUS (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

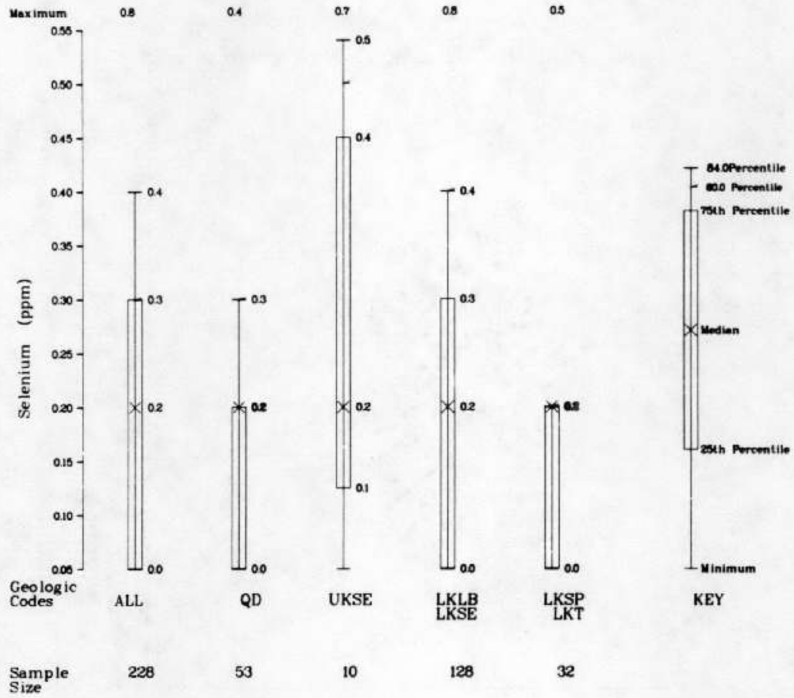


Figure B-18a

PERCENTILE PLOT FOR SELENIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

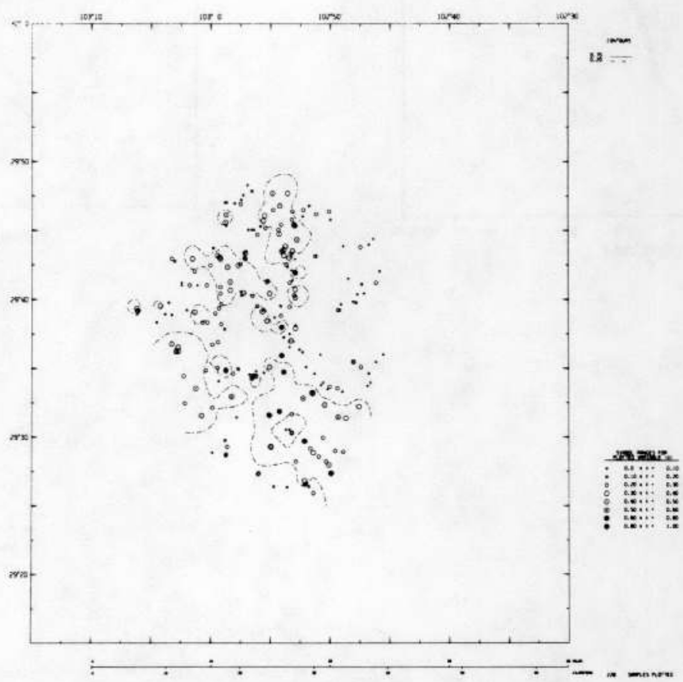


Figure B-18b

GEOCHEMICAL DISTRIBUTION OF SELENIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

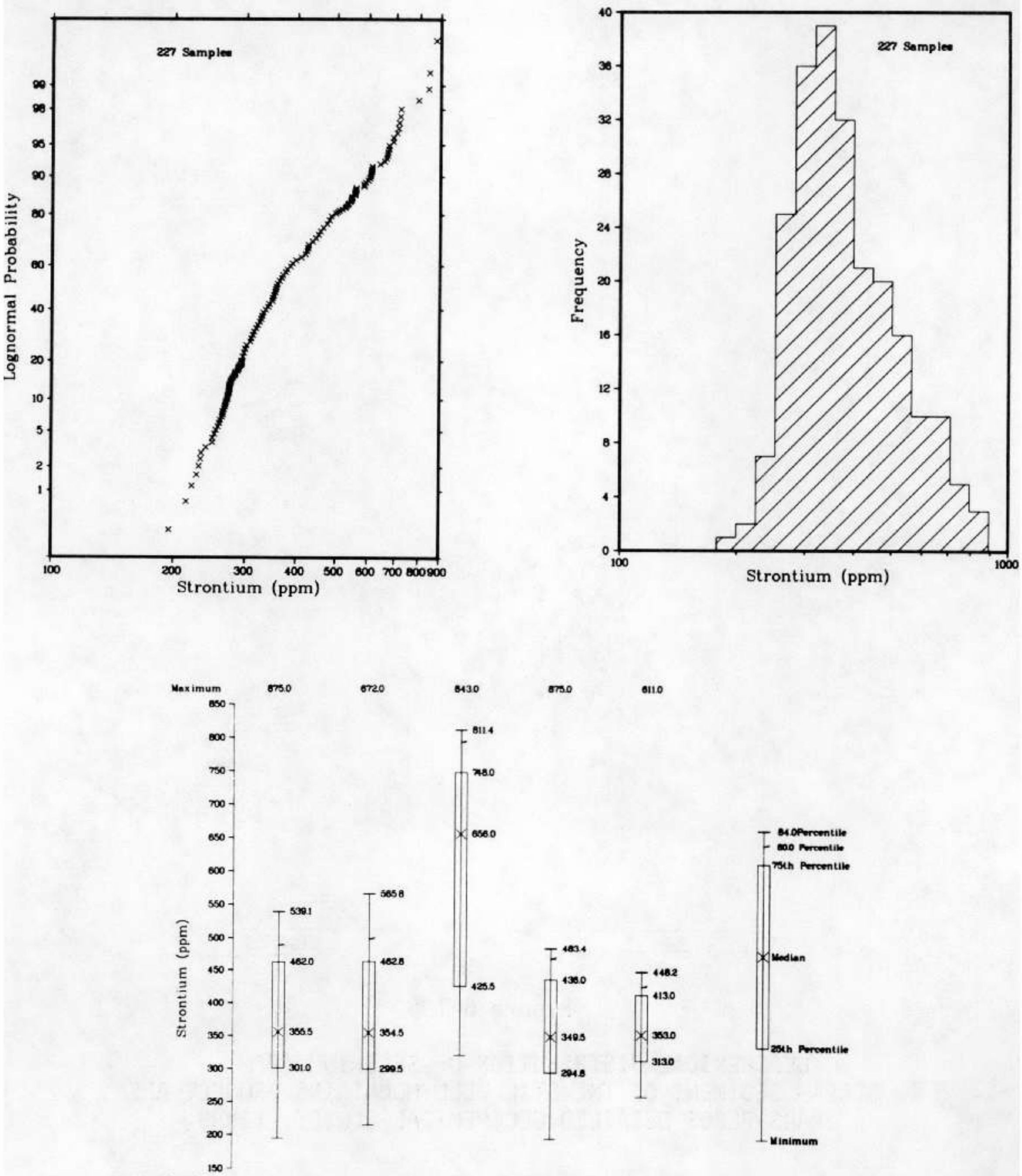


Figure B-19a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR STRONTIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

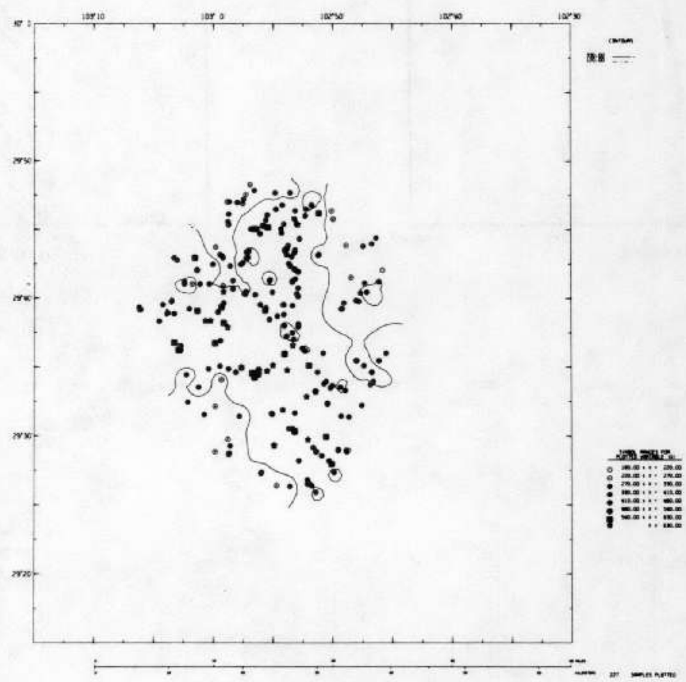


Figure B-19b

GEOCHEMICAL DISTRIBUTION OF STRONTIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

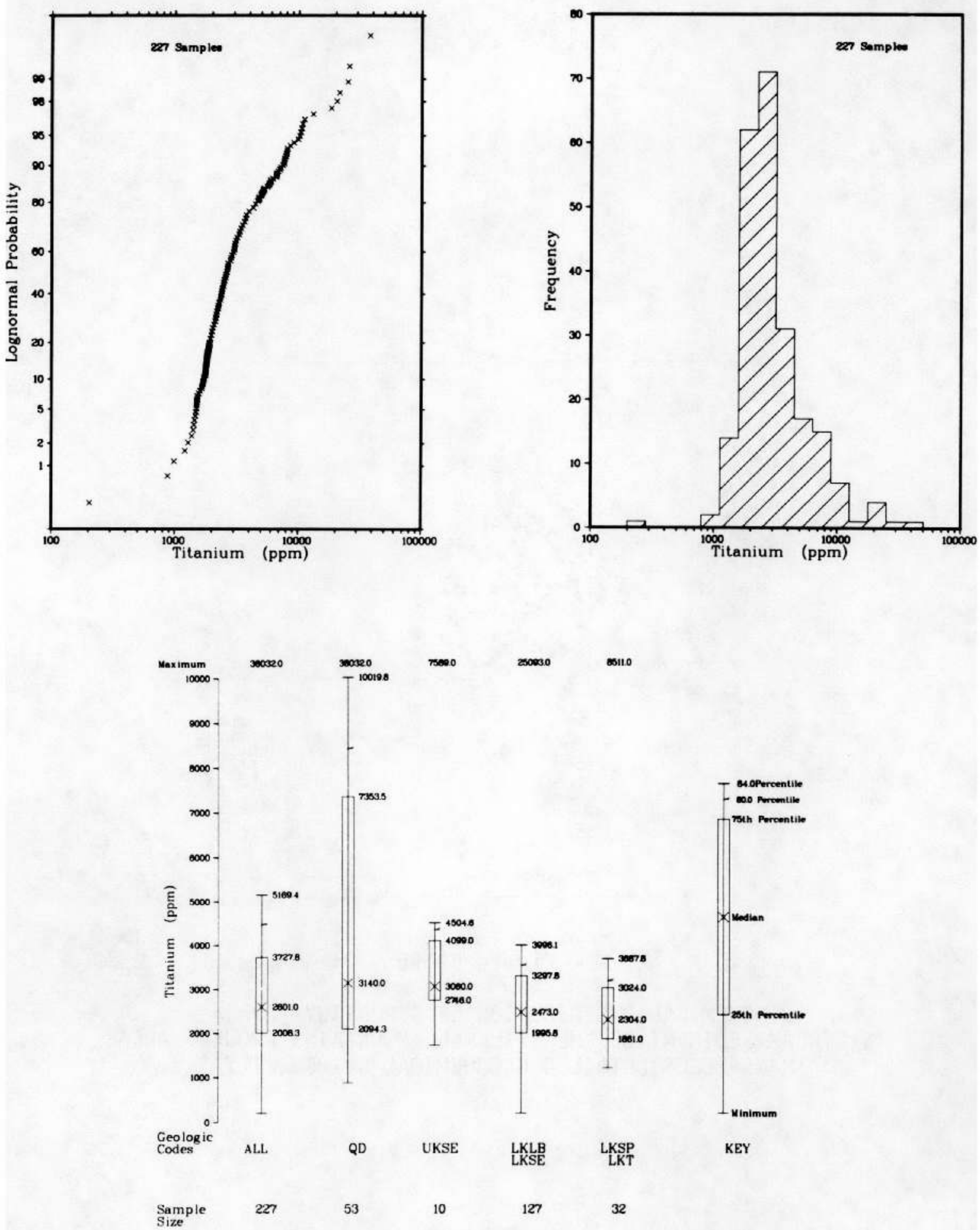


Figure B-20a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR TITANIUM (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

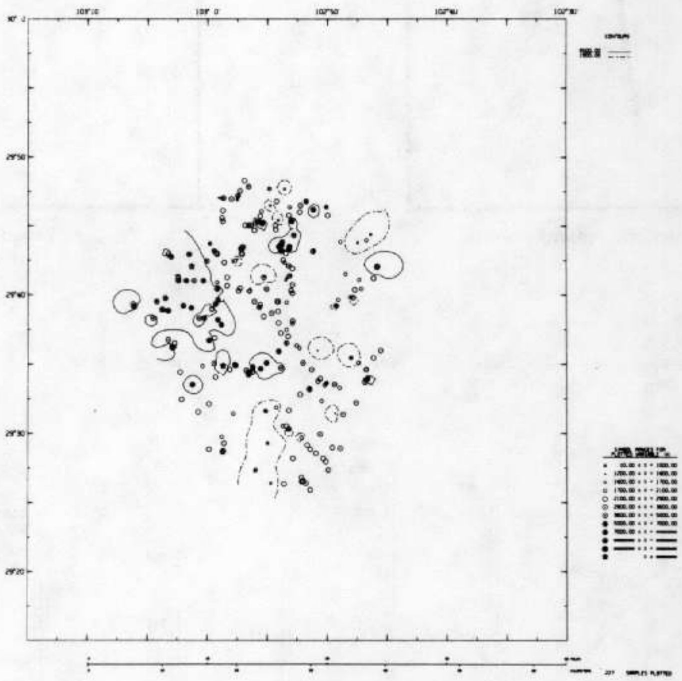


Figure B-20b

GEOCHEMICAL DISTRIBUTION OF TITANIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

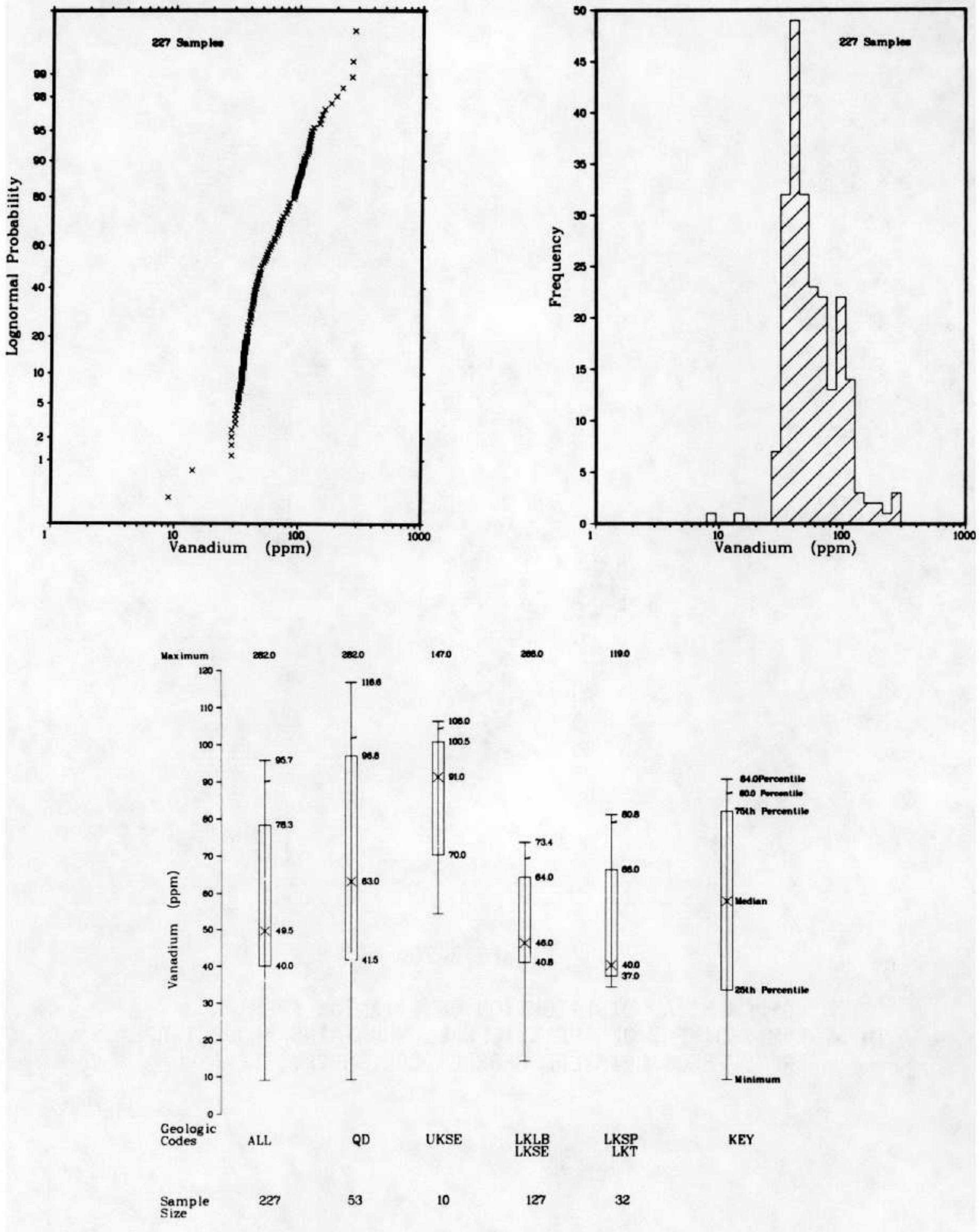


Figure B-21a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR VANADIUM (PPM) IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

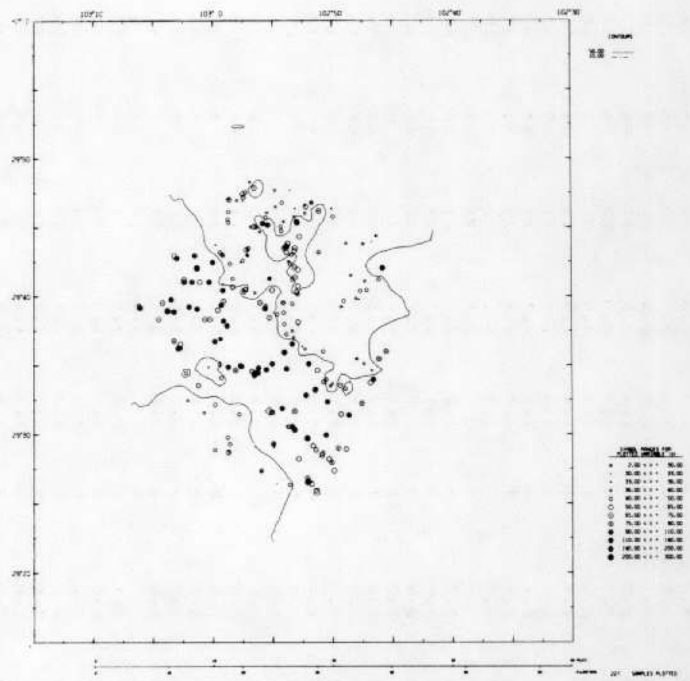


Figure B-21b

GEOCHEMICAL DISTRIBUTION OF VANADIUM (PPM)
IN STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

Table B-3

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	TH (PPM)	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	P (PPM)	TI (PPM)	V (PPM)
27347	48-29.456	-102.832	-3-15-	2.2	2.7	8	3.0	3.5	19	4	60	400	3500	63
27348	48-29.470	-102.839	-3-15-	2.2	2.5	4	1.6	9.2	21	4	61	500	2500	59
27350	48-29.481	-102.857	-3-15-	1.1	2.0	2	1.0	4.5	18	5	19	540	2200	67
27461	48-29.682	-102.987	-3-15-	1.6	1.8	6	3.3	1.3	16	<4	9	310	1800	33
27462	48-29.678	-102.973	-3-15-	1.7	2.3	3	1.3	1.8	20	<4	12	700	2700	50
27463	48-29.674	-102.987	-3-15-	2.1	2.5	<2	0.40	2.5	19	<4	22	2900	11000	120
27464	48-29.661	-102.986	-3-15-	2.0	2.4	6	2.5	2.4	21	<4	16	890	3700	67
27465	48-29.656	-102.989	-3-15-	2.4	2.3	3	1.3	2.8	17	<4	27	1300	10000	120
27466	48-29.672	-102.957	-3-15-	2.7	2.9	8	2.8	4.0	20	8	13	590	2300	48
27467	48-29.675	-102.955	-3-15-	2.2	2.5	4	1.6	3.9	20	7	14	710	2200	52
27468	48-29.671	-102.942	-3-15-	1.7	2.1	3	1.4	1.8	19	<4	11	670	1800	38
27469	48-29.659	-102.935	-3-15-	2.5	3.0	4	1.3	4.8	21	9	23	670	3500	68
27470	48-29.650	-102.994	-3-15-	2.0	2.1	3	1.4	2.7	20	<4	23	730	2800	63
29206	48-29.585	-102.867	-3-15-	2.5	2.6	7	2.7	5.3	23	10	31	710	3700	110
29208	48-29.563	-102.846	-3-15-	1.4	2.0	5	2.5	4.1	26	<4	25	600	3500	68
29209	48-29.558	-102.837	-3-15-	2.1		5		2.2	21	<4	9	530	1800	38
29211	48-29.555	-102.816	-3-15-	2.0	2.3	4	1.7	3.9	23	<4	12	530	2100	44
29212	48-29.562	-102.781	-3-15-	2.0	2.4	5	2.1	2.7	24	<4	13	760	3300	61
29213	48-29.566	-102.777	-3-15-	2.5	3.4	3	0.88	7.2	32	<4	12	490	7400	98
29214	48-29.600	-102.847	-3-15-	2.1	3.0	<2	0.33	4.4	17	6	8	230	1200	41
29217	48-29.603	-102.872	-3-15-	1.7	2.3	4	1.7	2.6	19	<4	9	540	1900	36
29221	48-29.600	-102.759	-3-15-	2.2	3.2	7	2.2	5.7	35	<4	16	690	2900	78
29222	48-29.591	-102.769	-3-15-	2.2	3.2	8	2.5	5.5	40	<4	17	640	2600	81
29237	48-29.769	-102.979	-3-15-	2.2	2.1	6	2.9	2.8	22	<4	13	630	2900	45
29259	48-29.528	-102.887	-3-15-	2.2	2.8	5	1.8	4.3	17	<4	24	810	2700	75
29260	48-29.509	-102.890	-3-15-	2.4	2.9	4	1.4	6.2	15	5	18	450	2700	97
29262	48-29.504	-102.887	-3-15-	2.2	2.1	<2	0.48	4.0	15	<4	10	400	1500	49
29264	48-29.509	-102.895	-3-15-	1.9	1.9	4	2.1	2.5	14	<4	9	800	1900	45
29266	48-29.577	-102.969	-3-15-	2.5	2.4	8	3.3	5.1	16	5	15	470	2400	83
29268	48-29.506	-102.887	-3-15-	1.7	2.4	6	2.5	6.2	22	7	21	530	2300	110
29270	48-29.571	-102.943	-3-15-	1.4	1.9	6	3.2	4.5	21	<4	34	690	5100	120
29288	48-29.559	-103.021	-3-15-	1.6	2.3	<2	0.43	3.0	18	<4	11	1400	7800	70
29294	48-29.526	-103.013	-3-15-	2.0		4		3.4	16	<4	9	310	2500	36
29300	48-29.757	-102.884	-3-15-	2.0	2.1	6	2.9	2.5	17	<4	57	530	5200	69
29301	48-29.756	-102.883	-3-15-	2.5	2.8	5	1.8	4.5	30	6	48	650	5900	120
29302	48-29.763	-102.833	-3-15-	2.1	2.1	5	2.4	1.7	18	<4	54	450	2600	41
29304	48-29.767	-102.872	-3-15-	1.8	2.1	7	3.3	2.1	18	<4	59	460	2200	36
29307	48-29.648	-103.055	-3-15-	2.1	2.6	6	2.3	3.3	13	5	14	1300	13000	150
29310	48-29.654	-103.034	-3-15-	1.8	2.6	6	2.3	4.1	18	<4	14	1500	7600	100
29312	48-29.651	-103.023	-3-15-	2.5	2.8	5	1.8	3.5	21	<4	16	880	7000	120
29313	48-29.659	-103.071	-3-15-	2.0	2.0	6	3.0	2.0	22	<4	76	940	4300	66
29314	48-29.649	-103.064	-3-15-	2.6	2.9	8	2.8	5.2	22	<4	16	1600	26000	280
29316	48-29.687	-103.041	-3-15-	2.3	2.2	8	3.6	4.5	26	<4	15	1400	3200	54
29317	48-29.684	-103.041	-3-15-	1.8	2.4	3	1.3	4.4	22	<4	12	950	9100	100
29318	48-29.663	-103.059	-3-15-	2.0	2.3	2	0.87	5.9	23	<4	14	950	11000	120
29320	48-29.639	-103.005	-3-15-	1.9	2.1	4	1.9	3.1	19	<4	12	630	4600	71
29321	48-29.639	-103.076	-3-15-	1.7	2.4	3	1.3	3.7	29	<4	16	1100	3700	66
29322	48-29.653	-103.102	-3-15-	2.0	2.0	2	1.0	2.9	27	4	15	1000	6600	95
29323	48-29.653	-103.103	-3-15-	2.5	2.5	5	2.0	2.7	24	<4	14	1300	4000	78
29324	48-29.716	-103.026	-3-15-	1.7	2.2	4	1.8	2.6	22	<4	13	3500	9900	98
29325	48-29.684	-103.019	-3-15-	1.2	2.3	7	3.0	2.4	21	<4	16	1600	4900	62
29326	48-29.684	-103.030	-3-15-	1.6	2.1	4	1.9	2.9	18	<4	30	700	7100	92
29327	48-29.684	-103.006	-3-15-	1.9	2.6	4	1.5	3.6	21	4	15	1500	10000	120
29328	48-29.701	-103.023	-3-15-	2.1	2.6	3	1.2	2.7	25	4	11	3100	38000	270
29329	48-29.713	-103.051	-3-15-	1.9	2.4	7	2.9	3.9	20	<4	14	1000	11000	130

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT LONG L TY REP	U (PPM)	U-NT (PPM)	TH (PPM)	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	P (PPM)	TI (PPM)	V (PPM)
29330	48-29.716 -103.055 -3-15-	1.6	2.2	6	2.7	4.1	21	<4	19	1000	3500	56
29338	48-29.466 -102.835 -3-15-	2.5	2.9	4	1.4	4.5	20	6	20	530	2600	88
29339	48-29.476 -102.849 -3-15-	1.7	2.4	3	1.3	3.8	20	<4	12	620	2100	44
29340	48-29.486 -102.861 -3-15-	1.7	2.5	3	1.2	4.2	23	7	16	730	2200	57
29342	48-29.495 -102.869 -3-15-	3.6	4.6	5	1.1	8.1	26	17	41	650	1800	270
29344	48-29.482 -102.815 -3-15-	1.4	2.7	9	3.3	2.9	19	<4	9	440	3000	56
29345	48-29.443 -102.867 -3-15-	1.9	2.7	5	1.9	3.6	22	5	16	580	2500	80
29346	48-29.432 -102.857 -3-15-	1.3	2.3	9	3.9	2.0	16	<4	9	390	2600	48
29347	48-29.442 -102.869 -3-15-	1.9	2.5	7	2.8	4.4	22	6	15	560	2400	73
29355	48-29.576 -102.946 -3-15-	2.1	1.7	5	2.9	3.3	19	<4	24	650	3300	74
29356	48-29.574 -102.942 -3-15-	2.2	1.8	5	2.8	2.7	20	<4	22	820	3100	72
29357	48-29.574 -102.938 -3-15-	2.0	1.9	2	1.1	4.0	26	<4	28	660	3000	91
29359	48-29.621 -102.898 -3-15-	2.1	1.8	8	4.4	2.3	19	<4	14	500	2200	45
29362	48-29.584 -102.991 -3-15-	2.2	1.8	3	1.7	3.3	16	<4	10	400	3100	47
29363	48-29.549 -102.971 -3-15-	2.6	2.0			3.9						
29364	48-29.524 -102.964 -3-15-	2.6	1.9	7	3.7	3.5	14	<4	11	330	1900	41
29365	48-29.568 -102.989 -3-15-	2.9	2.1	5	2.4	3.4	15	<4	14	490	2200	44
29368	48-29.625 -102.890 -3-15-	2.0	1.8	<2	0.56	2.5	19	4	14	570	2000	38
29370	48-29.617 -102.888 -3-15-	1.8	2.2	2	0.91	2.6	20	<4	11	590	2100	38
29372	48-29.609 -102.890 -3-15-	1.6	2.2	<2	0.45	4.2	21	<4	30	830	4700	100
29373	48-29.606 -102.876 -3-15-	1.6	2.3	5	2.2	2.4	16	4	6	300	1800	35
29374	48-29.599 -102.901 -3-15-	1.3	2.4	<2	0.42	3.8	21	<4	17	520	2100	64
29375	48-29.599 -102.901 -3-15-	1.6	2.4	4	1.7	3.9	17	<4	26	1000	5900	100
29376	48-29.579 -102.898 -3-15-	1.8	2.3	3	1.3	4.5	20	<4	32	600	4700	110
29377	48-29.531 -102.904 -3-15-	1.8	2.5	3	1.2	4.5	16	4	23	450	1700	91
29380	48-29.526 -102.918 -3-15-	1.8	2.7	3	1.1	4.3	18	<4	11	410	1500	55
29381	48-29.527 -102.919 -3-15-	2.5	2.6	5	1.9	3.0	16	<4	12	780	1700	44
29382	48-29.582 -102.961 -3-15-	2.0	2.0	7	3.5	5.1	22	<4	31	790	5000	110
29383	48-29.583 -102.962 -3-15-	2.5	2.1	5	2.4	3.2	22	<4	18	720	2400	63
29384	48-29.580 -102.937 -3-15-	1.9	1.6	9	5.6	2.6	19	<4	48	670	5600	110
29385	48-29.578 -102.926 -3-15-	1.3	3.0	7	2.3	3.9	21	4	32	930	7600	150
29386	48-29.585 -102.918 -3-15-	1.5	1.9	7	3.7	2.6	16	<4	24	900	6600	100
29387	48-29.692 -102.808 -3-15-	1.8	2.1	8	3.8	1.2	15	<4	11	400	2000	36
29389	48-29.654 -102.822 -3-15-	2.3	2.2	7	3.2	1.5	19	<4	10	380	1800	37
29391	48-29.664 -102.801 -3-15-	1.8	2.1	5	2.4	1.0	16	<4	9	400	1900	37
29393	48-29.674 -102.786 -3-15-	2.8	2.2	5	2.3	1.6	21	<4	10	370	2000	44
29394	48-29.687 -102.769 -3-15-	2.4	2.3	7	3.0	1.3	15	<4	10	410	2100	41
29396	48-29.760 -102.980 -3-15-	1.9	2.1	4	1.9	1.9	17	<4	10	440	2600	42
29397	48-29.756 -102.979 -3-15-	2.2	1.9	<2	0.53	1.8	18	<4	10	560	3000	42
29398	48-29.755 -102.931 -3-15-	3.1	2.3	6	2.6	2.4	18	<4	25	1100	8500	100
29399	48-29.751 -102.940 -3-15-	1.9	2.3	2	0.87	1.5	16	<4	11	370	2800	46
29400	48-29.751 -102.943 -3-15-	2.3	2.4	4	1.7	1.6	17	<4	13	520	3300	50
29401	48-29.751 -102.948 -3-15-	2.2	1.8	4	2.2	1.9	16	<4	10	360	2200	37
29405	48-29.483 -102.826 -3-15-	1.4	2.4	2	0.83	3.2	21	5	20	590	2600	82
29406	48-29.440 -102.863 -3-15-	1.2	2.4	6	2.5	3.0	19	<4	10	440	3100	58
29408	48-29.447 -102.869 -3-15-	1.9	2.7	8	3.0	4.6	20	4	15	540	2200	80
29410	48-29.481 -102.998 -3-15-	1.5	2.2	4	1.8	4.6	19	<4	10	400	2400	41
29412	48-29.478 -102.979 -3-15-	1.6	2.5	5	2.0	5.5	15	<4	8	390	3900	51
29413	48-29.479 -102.978 -3-15-	1.6	2.3	3	1.3	2.7	15	<4	8	390	2100	37
29415	48-29.488 -102.977 -3-15-	1.7	2.4	7	2.9	4.5	14	<4	9	300	2700	45
29417	48-29.496 -102.980 -3-15-	2.0	2.2	6	2.7	2.4	17	<4	10	500	2000	46
29418	48-29.488 -102.916 -3-15-	1.8	2.1	4	1.9	4.3	14	<4	9	350	990	38
29419	48-29.488 -102.916 -3-15-	2.3	2.7	7	2.6	3.5	17	5	17	510	1400	71
29421	48-29.470 -102.881 -3-15-	2.2	2.4	7	2.9	4.8	20	4	11	470	2400	64
29423	48-29.455 -102.934 -3-15-	1.8	2.2	8	3.6	4.1	15	<4	10	320	1700	36

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT LONG L TY REP	U (PPM)	U-NT (PPM)	TH (PPM)	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	P (PPM)	TI (PPM)	V (PPM)
29424	48-29.456 -102.933 -3-15-	1.6	2.3	7	3.0	3.8	17	<4	10	470	1800	46
29426	48-29.440 -102.912 -3-15-	2.4	2.2	2	0.91	5.2	13	<4	9	290	1400	32
29428	48-29.439 -102.893 -3-15-	2.2	2.2	6	2.7	3.4	18	<4	11	430	2300	49
29430	48-29.730 -102.791 -3-15-	1.5	2.0	5	2.5	1.5	16	<4	10	350	1400	29
29431	48-29.733 -102.779 -3-15-	0.89	1.9	2	1.1	1.1	16	<4	12	390	1700	31
29432	48-29.740 -102.773 -3-15-	1.2	1.8	2	1.1	1.2	15	<4	12	420	1600	29
29433	48-29.731 -102.815 -3-15-	0.97	2.0	<2	0.50	1.7	20	<4	14	580	1900	36
29434	48-29.720 -102.853 -3-15-	1.2	2.2	4	1.8	1.7	21	<4	14	650	3000	41
29435	48-29.719 -102.854 -3-15-	1.0	2.1	5	2.4	2.0	19	<4	14	500	1800	33
29437	48-29.661 -102.818 -3-15-	1.4	2.0	5	2.5	1.9	17	<4	16	430	2000	43
29438	48-29.654 -102.820 -3-15-	1.5	2.1	5	2.4	1.7	17	<4	13	350	2000	35
29440	48-29.663 -102.797 -3-15-	1.5	2.0	5	2.5	1.4	18	<4	13	390	1800	34
29441	48-29.673 -102.795 -3-15-	2.1	2.3	3	1.3	2.8	15	<4	11	300	2900	44
29443	48-29.685 -102.789 -3-15-	2.2	2.0	3	1.5	1.7	18	<4	15	440	2100	39
29444	48-29.701 -102.764 -3-15-	2.1	2.4	4	1.7	0.5	13	5	12	4200	21000	200
29445	48-29.636 -102.882 -3-15-	1.7	2.7	5	1.9	3.3	19	5	13	440	3000	53
29447	43-29.647 -102.902 -3-15-	1.6	2.1	2	0.95	2.1	21	<4	16	700	2500	41
29448	48-29.659 -102.903 -3-15-	1.4	2.0	4	2.0	2.1	20	<4	12	680	2600	42
29449	48-29.659 -102.902 -3-15-	1.9	2.1	7	3.3	2.7	19	<4	16	730	3400	48
29450	48-29.658 -102.890 -3-15-	2.4	2.5	3	1.2	3.7	15	4	13	430	1900	43
29452	48-29.637 -102.986 -3-15-	1.3	1.5	6	4.0	2.6	15	<4	49	700	7900	130
29453	48-29.631 -102.981 -3-15-	1.4	1.6	7	4.4	2.8	19	<4	38	910	6600	120
29454	48-29.655 -102.927 -3-15-	1.9	2.6	5	1.9	2.1	17	<4	11	610	2100	42
29455	48-29.652 -102.928 -3-15-	3.3	3.7	4	1.1	4.3	27	10	32	1800	4700	160
29456	48-29.645 -102.911 -3-15-	1.3	2.1	4	1.9	1.8	17	<4	10	660	3300	45
29457	48-29.641 -102.922 -3-15-	2.0	2.4	6	2.5	3.8	26	6	18	550	2200	69
29458	48-29.639 -103.012 -3-15-	1.8	2.2	8	3.6	1.5	18	<4	12	1300	3900	68
29459	48-29.656 -103.104 -3-15-	1.4	2.1	8	3.8	1.7	18	<4	11	950	3000	47
29460	48-29.708 -103.001 -3-15-	2.3	2.8	6	2.1	2.9	22	6	22	1400	4300	100
29461	48-29.729 -102.997 -3-15-	1.3	1.9	4	2.1	1.4	17	<4	9	310	1800	33
29462	48-29.720 -102.991 -3-15-	1.4	1.9	3	1.6	1.7	15	<4	8	620	3600	47
29463	48-29.718 -102.988 -3-15-	1.2	2.2	8	3.6	2.1	18	<4	10	620	2700	42
29464	48-29.716 -102.987 -3-15-	1.9	2.2	6	2.7	1.7	18	4	11	660	2600	42
29465	48-29.706 -102.977 -3-15-	1.6	2.2	6	2.7	2.5	21	4	9	780	2700	43
29466	48-29.688 -102.973 -3-15-	1.6	2.1	6	2.9	3.3	19	<4	9	740	2300	43
29467	48-29.723 -102.954 -3-15-	1.9	2.1	7	3.3	1.5	16	<4	10	500	3500	52
29468	48-29.725 -102.951 -3-15-	1.7	2.1	7	3.3	1.7	17	<4	9	520	2500	40
29469	48-29.723 -102.952 -3-15-	1.8	1.9	5	2.6	1.5	18	<4	7	560	2400	37
29470	48-29.717 -102.953 -3-15-	1.4	2.0	9	4.5	2.0	17	<4	10	480	2400	39
29471	48-29.716 -102.952 -3-15-	1.5	2.0	5	2.5	1.7	19	<4	10	600	2300	39
29472	48-29.708 -102.962 -3-15-	1.5	1.7	6	3.5	2.1	15	<4	8	440	1800	34
29473	48-29.710 -102.959 -3-15-	2.3	2.6	8	3.1	2.1	15	4	8	310	1400	40
29474	48-29.632 -102.882 -3-15-	1.5	2.3	4	1.7	2.1	16	<4	9	450	1900	35
29475	48-29.669 -102.882 -3-15-	2.0	2.2	7	3.2	2.1	18	<4	9	780	2600	41
29477	48-29.672 -102.884 -3-15-	2.4	2.1	5	2.4	2.3	17	5	14	720	2500	55
29478	48-29.679 -102.882 -3-15-	2.1	2.3	5	2.2	2.3	19	<4	11	620	2900	52
29481	48-29.633 -102.901 -3-15-	1.3	2.0	7	3.5	3.7	18	<4	11	560	2600	47
29482	48-29.731 -102.896 -3-15-	1.8	2.0	4	2.0	2.6	18	<4	12	890	4400	58
29483	48-29.727 -102.898 -3-15-	1.7	1.4	6	4.3	3.0	27	<4	38	2500	18000	220
29484	48-29.720 -102.898 -3-15-	2.2	2.5	4	1.6	2.5	15	5	18	560	3600	58
29485	48-29.709 -102.895 -3-15-	2.1	2.4	3	1.3	3.2	17	<4	10	590	2300	39
29486	48-29.725 -102.901 -3-15-	1.8	2.2	3	1.4	3.0	16	<4	21	890	6800	83
29487	48-29.746 -102.905 -3-15-	1.6	2.0	5	2.5	2.5	17	<4	13	520	2500	46
29488	48-29.688 -102.922 -3-15-	1.6	2.0	5	2.5	2.5	16	4	16	650	2900	48
29489	48-29.689 -102.921 -3-15-	0.70	1.9	5	2.6	2.5	8	<4	9	820	200	14

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	TH (PPM)	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	P (PPM)	TI (PPM)	V (PPM)
29490	48-29.674	-102.918	-3-15-	1.9	2.5	4	1.6	3.0	18	4	35	750	4000	63
29491	48-29.745	-102.935	-3-15-	1.3	2.0	6	3.0	2.2	18	<4	11	590	2300	39
29492	48-29.553	-102.858	-3-15-	1.8	2.1	5	2.4	5.5	18	6	35	640	3300	96
29493	48-29.547	-102.871	-3-15-	1.5	2.3	7	3.0	3.8	16	<4	30	690	2800	90
29499	48-29.613	-103.055	-3-15-	1.9	2.6	6	2.3	2.7	21	5	16	1600	3100	86
29500	48-29.609	-103.046	-3-15-	1.9	2.3	4	1.7	2.8	21	<4	12	740	2500	59
29501	48-29.604	-103.046	-3-15-	1.8	2.1	7	3.3	1.6	19	<4	13	440	1500	43
29502	48-29.604	-103.049	-3-15-	2.3	3.8	3	0.79	2.7	16	7	17	1600	20000	180
29504	48-29.574	-103.038	-3-15-	2.0	2.5	5	2.0	2.5	18	<4	17	570	2600	49
29505	48-29.585	-102.790	-3-15-	1.6	2.2	3	1.4	1.7	14	4	12	260	1900	37
29506	48-29.591	-102.800	-3-15-	2.1	2.5	2	0.80	3.0	12	9	13	290	1800	38
29507	48-29.591	-102.801	-3-15-	2.1	2.4	5	2.1	2.5	13	6	12	320	1500	35
29510	48-29.577	-102.779	-3-15-	1.1	1.7	5	2.9	2.8	14	<4	13	350	2200	35
29511	48-29.577	-102.779	-3-15-	1.9	3.1	4	1.3	2.0	12	5	12	250	1800	35
29513	48-29.559	-102.823	-3-15-	1.7	2.3	4	1.7	2.3	18	4	22	820	3700	66
29514	48-29.561	-102.834	-3-15-	1.9	2.3	6	2.6	1.9	14	4	15	420	1800	36
29515	48-29.566	-102.843	-3-15-	1.6	2.4	7	2.9	1.7	14	4	12	460	2200	41
29516	48-29.577	-102.855	-3-15-	1.9	2.5	3	1.2	1.7	19	4	16	700	3000	60
29517	48-29.536	-102.998	-3-15-	2.0	2.3	5	2.2	2.9	18	<4	15	790	2200	48
29522	48-29.615	-102.990	-3-15-	1.8	2.0	6	3.0	2.6	19	<4	12	540	2400	47
29523	48-29.612	-102.998	-3-15-	1.8	2.2	5	2.3	2.2	17	4	13	1400	8000	93
29524	48-29.499	-102.843	-3-15-	2.4	2.3	3	1.3	3.0	20	5	29	570	3400	96
29525	48-29.581	-102.979	-3-15-	2.0		<2		2.6	11	5	10	460	25000	150
29526	48-29.763	-102.887	-3-15-	2.3		6		1.5	16	<4	11	470	2100	37
29527	48-29.751	-102.906	-3-15-	2.0	1.9	7	3.7	1.5	16	<4	15	540	2400	43
29528	48-29.757	-102.902	-3-15-	1.1	1.5	<2	0.67	0.4	11	<4	5	180	880	9
29530	48-29.773	-102.886	-3-15-	1.2	1.9	6	3.2	2.1	17	<4	10	490	1900	35
29531	48-29.780	-102.904	-3-15-	1.5	2.1	9	4.3	2.9	17	<4	10	470	2500	44
29532	48-29.795	-102.914	-3-15-	1.6	1.9	8	4.2	2.7	18	<4	11	490	1900	39
29536	48-29.762	-102.927	-3-15-	1.3	1.8	25	14.	1.9	15	10	16	570	2400	43
29537	48-29.753	-102.924	-3-15-	1.5	1.5	5	3.3	2.7	16	<4	92	1500	7600	94
29538	48-29.768	-102.925	-3-15-	1.7	2.0	4	2.0	2.2	19	<4	9	590	1900	39
29539	48-29.775	-102.913	-3-15-	1.2	2.4	5	2.1	1.7	15	<4	10	390	1500	29
29540	48-29.795	-102.893	-3-15-	1.3		5		2.2	16	<4	32	460	1700	32
29559	48-29.581	-103.007	-3-15-	2.2	2.0	<2	0.50	2.2	21	<4	7	560	2000	33
29560	48-29.541	-103.036	-3-15-	1.8	2.1	7	3.3	1.4	15	<4	9	500	2100	36
29570	48-29.798	-102.943	-3-15-	1.8	1.8	5	2.8	1.1	17	<4	13	520	4500	68
29571	48-29.783	-102.967	-3-15-	2.0	1.6	3	1.9	1.1	15	<4	17	700	3200	36
29573	48-29.782	-102.959	-3-15-	1.6	1.7	5	2.9	1.2	14	<4	10	460	1700	31
29576	48-29.775	-102.871	-3-15-	2.7	3.0	9	3.0	2.2	22	<4	10	520	3000	54
29577	48-29.780	-102.863	-3- -	1.8	2.2	3	1.4	2.0	19	4	11	770	3800	49
29578	48-29.780	-102.863	-3-15-	1.5	1.8	5	2.8	1.1	14	<4	9	360	1500	29
29579	48-29.770	-102.853	-3-15-	2.3	2.3	7	3.0	2.3	16	<4	14	1100	8000	79
29580	48-29.773	-102.835	-3-15-	2.0	2.1	5	2.4	1.3	18	<4	10	650	1800	34
29590	48-29.537	-102.793	-3-15-	3.4	3.2	10	3.1	4.2	35	<4	17	800	3100	83
29592	48-29.524	-102.822	-3-15-	2.5	1.9	2	1.1	2.4	12	4	16	330	1300	51
29595	48-29.739	-102.880	-3-15-	0.94	2.2	5	2.3	3.6	22	<4	36	1000	5200	60
29597	48-29.725	-102.886	-3-15-	1.1	2.1	3	1.4	3.1	19	4	38	1400	5800	56
29598	48-29.722	-102.887	-3-15-	2.6	2.5	2	0.80	3.5	19	<4	34	990	5700	55
29599	48-29.717	-102.891	-3-15-	0.60	2.3	5	2.2	3.6	19	4	39	720	2800	41
29600	48-29.706	-102.893	-3-15-	2.5	2.1	7	3.3	2.2	20	<4	11	600	2000	40
29601	48-29.702	-102.887	-3-15-	3.4	2.3	5	2.2	2.4	38	<4	25	570	3900	74
29603	48-29.699	-102.882	-3-15-	1.5	1.9	10	5.3	3.5	33	<4	27	450	2800	60
29604	48-29.687	-102.890	-3-15-	1.9	2.0	6	3.0	4.5	27	<4	23	340	1600	40
29605	48-29.690	-102.886	-3-15-	1.5	2.2	5	2.3	3.9	20	<4	21	610	5000	70

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT LONG L TY REP	U (PPM)	U-NT (PPM)	TH (PPM)	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	P (PPM)	TI (PPM)	V (PPM)
29607	48-29.539 -102.841 -3-15-	1.9	2.5	5	2.0	3.5	19	5	23	540	2000	92
29608	48-29.554 -102.858 -3-15-	2.0	2.1	9	4.3	5.5	19	5	32	610	3300	94
29631	48-29.805 -102.949 -3-15-	1.4	1.8	8	4.4	1.7	18	<4	20	430	2500	39
29633	48-29.793 -102.955 -3-15-	1.7	2.0	9	4.5	1.8	18	<4	23	560	3000	43
29634	48-29.787 -102.958 -3-15-	1.7	1.9	7	3.7	1.4	16	<4	22	780	6100	72
29635	48-29.784 -102.978 -3-15-	1.6	1.9	11	5.8	1.5	16	<4	19	580	4400	53
29636	48-29.784 -102.981 -3-15-	1.7	1.8	2	1.1	0.8	15	<4	19	210	1500	31
29642	48-29.523 -102.811 -3-15-	2.0	3.1	10	3.2	3.4	35	<4	20	700	3300	90

APPENDIX C

FIELD FORM AND COMPUTER CODE LIST

APPENDIX C

FIELD FORM AND COMPUTER CODE LIST

LIST OF TABLES

No.	Title	Page
C-1	Computer Code List of Geochemical Variables	C-4
C-2	Oak Ridge Geochemical Sampling Form Showing Field Data Recorded on Microfiche	C-5

Table C-1

COMPUTER CODE LIST OF GEOCHEMICAL VARIABLES

Variable[a]	Code	Variable[a]	Code
Uranium Measured by Fluorometry[b]	U-FL	Scandium	SC
Uranium Measured by Mass Spectrometry[b]	U-MS	Silicon	SI
Uranium Measured by Neutron Activation	U-NT	Strontium	SR
Arsenic	AS	Thorium	TH
Selenium	SE	Titanium	TI
Silver	AG	Vanadium	V
Aluminum	AL	Yttrium	Y
Boron	B	Zinc	ZN
Barium	BA	Zirconium	ZR
Beryllium	BE	Sulfate (ppm)	SO_4
Calcium	CA	Chloride (ppm)	CL
Cerium	CE	Conductivity from Lab (μmhos/cm)	CT-L
Cobalt	CO	Conductivity from Field (μmhos/cm)	CT-F
Chromium	CR	Dissolved Oxygen (ppm)	DO
Copper	CU	Air Temperature (°C)	ATEM
Iron	FE	Water Temperature (°C)	WTEM
Hafnium	HF	pH	PH
Potassium	K	pH Measured by Lo Ion Paper	PH-P
Lanthanum	LA	Total Alkalinity (ppm)	T-AK
Lithium	LI	M-Alkalinity (ppm)	M-AK
Mangesium	MG	P-Alkalinity (ppm)	P-AK
Manganese	MN	Carbonate (ppm)[c]	CB
Molybdenum	MO	Bicarbonate (ppm)[c]	BC
Sodium	NA	Undissociated Carbonic Acid (ppm)[c]	CAB
Niobium	NB	U-NT/U-FL	TU/U
Nickel	NI	U-FL/U-NT	U/TU
Phosphorus	P	TH/U-NT	TH/U
Lead	PB	1,000·U/SP	U/SP
Platinum	PT	1,000·U/B	U/B
		1,000·U/SO	U/SO
		Sodium/Chloride	NA/C
		Log of Sodium/Chloride	LN/C

[a] If natural logarithm of variable is used, L or L- precedes the variable code.

[b] If method is not specified for waters, U-FL is used, except where value is below laboratory detection limit in which case U-MS is substituted if it is available.

[c] These variables were approximated using cubic spline functions to fit the curves in Hem (1970), p. 155.

Table C-2

OAK RIDGE GEOCHEMICAL SAMPLING FORM
SHOWING FIELD DATA RECORDED ON MICROFICHE

OAK RIDGE GEOCHEMICAL SAMPLING FORM

1 | 1 Card Number

GENERAL SITE DATA

Attach Identical Sample Number Here

2 3 4 5 6 7

8 9 10 11 Site Number

12 13 14 15 – 16 17 Map Code

Sample Type

18
- M Stream Sediment
- H Lake Sediment
- S Stream Water
- W Well Water
- P Spring Water
- L Lake Water
- A Bog Water
- B Plant
- F Soil (Use Remarks)
- G Rock
- Ø Other

19 Replicate Letter (A–Z)

Hour		Day		Month		Year	
20	21	22	23	24	25	26	27

28 29 30 Collector's Initials

31 Phase (P, 1, 2, or G)

Field Sheet Status

32
- Ø Original
- C Correction
- V Voiding

Control Sample

33
- A Sediment, High U
- B Sediment, Low U
- C Water, High U
- D Water, Low U
- Ø Other

34 35 36 37 Air Temperature (°C)

Location

Latitude						Longitude					
Deg.		Min.		Sec.		Deg.		Min.		Sec.	
38	39	40	41	42	43	44	45	46	47	48	49	50

51 52 53 54 Surface Geologic Unit Code

Type of Vegetation

55 (Within 1 Km Upstream)
- C Conifer
- & Conifer & Deciduous
- D Deciduous
- B Brush
- G Grass
- M Moss
- L Lichen
- Ø Other

Density of Vegetation

56 (Within 1 Km Upstream)
- B Barren
- S Sparse
- M Moderate
- D Dense
- V Very Dense

Local Relief

57 (Within 1 Km Upstream)
- F Flat (<2m)
- L Low (2–15m)
- G Gentle (15–60m)
- M Moderate (60–300m)
- H High (>300m)
- Ø Other

Weather

58
- C Calm
- P Lt Wind
- V Windy
- R V. Windy
- S Gale

59
- C Clear
- L Pt Cldy
- W Overcst
- V Rainy
- G Snowy

Classes of Contaminants

60
- N None
- M Mining (Use Remarks)
- A Agriculture
- F Oil Field
- I Industry
- S Sewage
- P Power Plant
- U Urban
- Ø Other

Average Stream Velocity (m/sec)

61 62 63
N = No Visible Movement
P = Stagnant Pool

64 65 66 Water Width (m)

67 68 69 Average Depth (m)

Water Level

70
- D Dry
- P Pools
- L Low

70
- N Normal
- H High
- F Flood

Dominant Bed Material

71
- B Boulder
- C Cobble
- P Pebble
- S Sand
- T Silt
- Y Clay
- N None (Use Remarks)

Sample Color (Except Plants)

Adj			Noun	
72	73	74	75	76

- V V Lt
- L Light
- M Medium
- D Dark
- CL Clear
- WH White
- YL Yellow
- OR Orange
- PK Pink
- RD Red
- GN Green
- BU Blue
- BN Brown
- GY Gray
- BK Black
- OT Other

Odor of Sampled Material

77
- N None
- S H_2S
- Ø Other

Results Request

78
- R (Use Remarks)

1 | 2 Card Number

PLANT SAMPLE

18 19 Number of Plants Sampled (Number of grabs for moss)

20 21 22 Trunk Diameter (m) (1 m above ground)

23 24 25 Plant Height (m) (Average of Plants Sampled)

Name of Tree, Deciduous

26
- R Alto Verde
- A Ash
- B Beech
- I Birch
- D Box Elder
- F Cherry
- N Cottonwood
- E Elm
- H Hackberry
- C Hickory
- W Huisache
- L Live Oak

26
- U Locust
- P Maple
- M Mesquite
- K Oak, Other
- V Olive
- Y Poplar
- S Sycamore
- T Salt Cedar
- G Walnut
- X Willow
- Ø Other

Name of Tree, Conifer

27
- A N. Wh. Cedar
- C Cedar, Other
- F Fir
- H Hemlock
- J Juniper

27
- L Larch
- P Pine
- S Spruce
- Ø Other

Name of Bush

28
- A Alder
- B Blueberry
- P Pussy Willow

28
- W Witch Hazel
- Y Yew
- Ø Other

Name of Moss

29
- P Peat
- S Sphagnum (live)
- Ø Other

Algae

30
- G Blue-Green
- B Brown
- Ø Other

UCN-11882
(1 6-77)

Table C-2, Continued

OAK RIDGE GEOCHEMICAL SAMPLING FORM SHOWING FIELD DATA RECORDED ON MICROFICHE

STREAM OR LAKE SEDIMENT

Sample Condition (31)
- D Dry
- W Wet

Sample Treatment (32)
- N None
- S Sieved
- Ø Other

33 34 Number of Grabs

35 36 % Organic Material (Field Estimate)

GENERAL WATER SAMPLES

Water Sample Treatment (37)
- N None
- F Filtered Only
- C Acidified Only
- A Acidified and Filtered
- Ø Other

Depth of Visibility (m)
38 39 40 C = Clear

41 42 43 44 45 Conductivity (μmhos/cm)

46 47 48 Dissolved O_2 (ppm)

49 50 51 Temperature (°C)

52 53 54 pH

55 P pH by Lo-Ion Paper

56 57 58 59 Total Alkalinity (ppm)

60 61 62 63 P Alkalinity (ppm)

64 65 66 67 M Alkalinity (ppm)

Appearance of Water (68)
- C Clear
- M Murky
- A Algal
- Ø Other

69 70 71 72 73 Discharge (liters/min)

74 75 76 77 Identification of Producing Horizon (Geologic Unit Code)

Confidence of Producing Horizon Identification (78)
- H High Degree
- R Probable
- S Possible

Source of Producing Horizon Identification (79)
- P Publication
- W Owner
- U User
- G Geologic Inference
- Ø Other

1 3 Card Number

WELL WATER

Type of Well (18)
- D Drilled
- P Drive Point
- G Dug
- U Unknown
- Ø Other

Power Classification (19)
- A Artesian Flow
- E Electric
- G Gasoline
- W Wind
- H Hand
- Ø Other

Casing (20)
- N None (Below Water Table)
- S Steel
- G Galvanized
- P Plastic
- U Unknown
- Ø Other

Pipe Composition (21)
- F Steel
- Z Galvanized
- C Copper
- P Plastic
- U Unknown
- Ø Other

Sample Location
22 23 24 Meters from Well Head; H = Holding Tank (Use Remarks)

Where Sample Taken With Respect To Pressure Tank (25)
- B Before
- A After
- N No Pressure Tank
- F From Pressure Tank (Use Remarks)

Use of Well (26)
- M Municipal
- H Household
- S Stock
- I Irrigation
- A All of above
- X H and S
- Y H and I
- Z S and I
- N None
- Ø Other

Frequency of Pumping (27)
- C Constant (hourly)
- F Frequent (daily)
- I Infrequent (weekly)
- R Rare (no recent use)

Depth to top of Producing Horizon
28 29 30 31 (Meters)

Confidence of Producing Depth (32)
- H High
- R Probable
- S Possible

Source of Producing Depth Information (33)
- P Publication
- W Owner
- U User
- G Geologic Inference
- Ø Other

Total Well Depth
34 35 36 37 (Meters)

Confidence of Total Depth (38)
- H High
- R Probable
- S Possible

Source of Total Depth Information (39)
- P Publications
- W Owner
- U User
- G Geologic Inference
- Ø Other

LAKE WATER

Type of Lake (55)
- N Natural
- M Manmade

Lake Area
56 57 58 59 (sq km)

REMARKS (Card 4)

Table C-2, Continued

OAK RIDGE GEOCHEMICAL SAMPLING FORM
SHOWING FIELD DATA RECORDED ON MICROFICHE

OAK RIDGE GEOCHEMICAL SAMPLING FORM

FIELD DATA SUPPLEMENT

Attach Identical Sample Number Here

1	2	3	4	5	6

Sequence Number

7
1

Procedure Number

8	9

Results for Procedure 31

16	17	18	19	20

Total Gamma - Scintillometer (counts/minute)

Results for Procedures 34-41

16	17	18	19	20
			•	

Variables and Procedures are listed below

Results for Procedure 32 Gamma Spectrometer

16	17	18	19	20	
					TOTAL COUNTS (CPM)
22	23	24	25	26	
			•		e POTASSIUM (%)
28	29	30	31	32	
					POTASSIUM (CPM)
34	35	36	37	38	
			•		e URANIUM (ppm)
40	41	42	43	44	
					URANIUM (CPM)
46	47	48	49	50	
			•		e THORIUM (ppm)
52	53	54	55	56	
					THORIUM (CPM)

Note To Sampler: Blocks 16-20 Not Used Should Be Marked Out.

DO NOT KEYPUNCH

Procedures 34—41

34 Uranium (ppb)
35 Fluoride (ppm)
36 Nitrate (ppm)
37 Sulphate (ppm)
38 Phosphate (ppm)
39 Ferrous Iron (ppm)
40 Total Iron (ppm)
41 Turbidity (% T)

Readings made in Counts per ____________

VARIABLE	READING		BACKGROUND		RESULTS
	ACTUAL	CPM	ACTUAL	CPM	
TOTAL COUNTS					
POTASSIUM					
URANIUM					
THORIUM					

UCN-11992A
(1 3-79)

APPENDIX D

MICROFICHE OF FIELD AND LABORATORY DATA

APPENDIX D

MICROFICHE OF FIELD AND LABORATORY DATA

CONTENTS

Laboratory Data	Page
Groundwater (W) and Radiometric	1-9
Stream Sediment (M)	10-24

Field Data	
Page 1	26-125

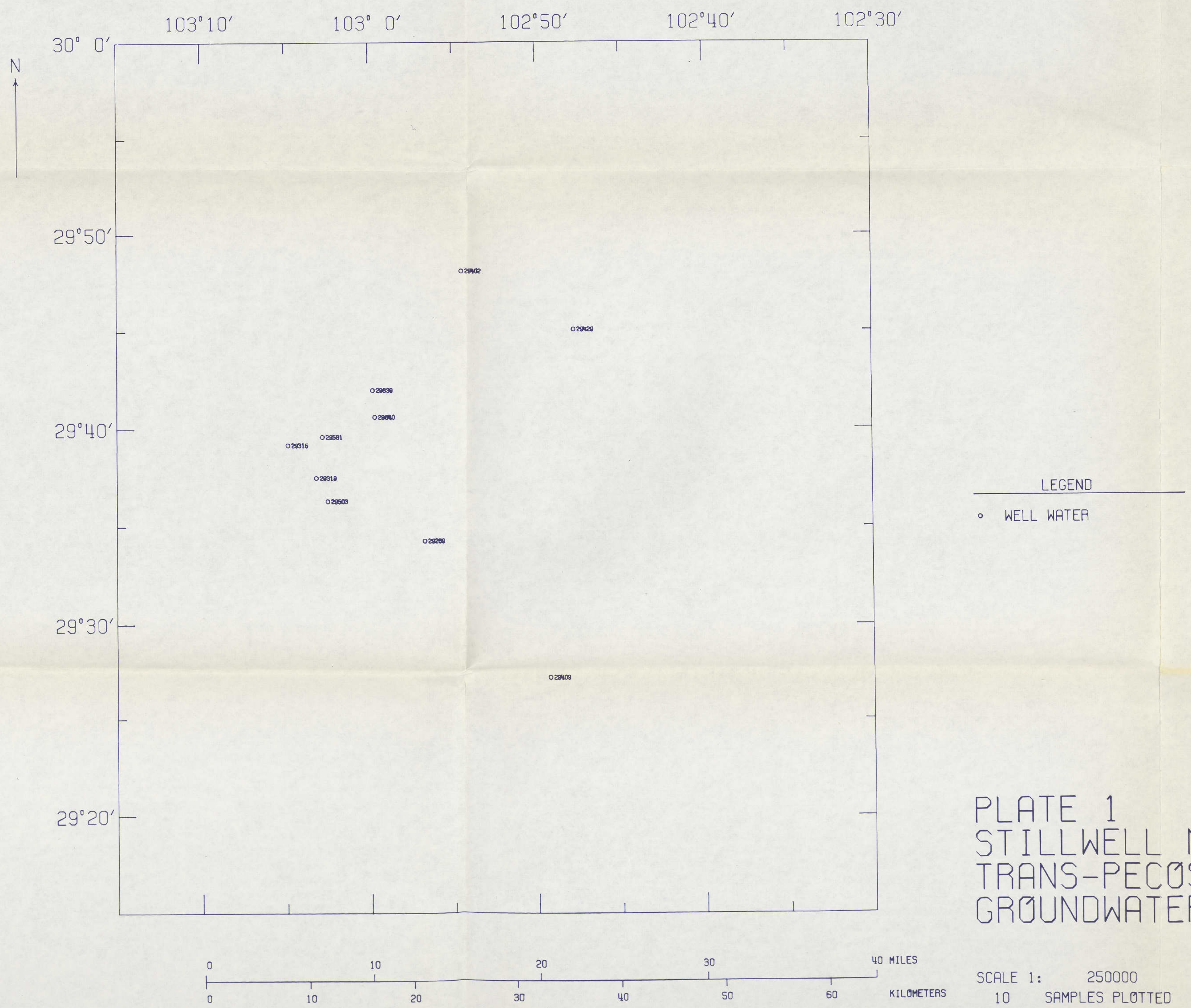


PLATE 1
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
GROUNDWATER SAMPLE LOCATION MAP

SCALE 1: 250000
10 SAMPLES PLOTTED

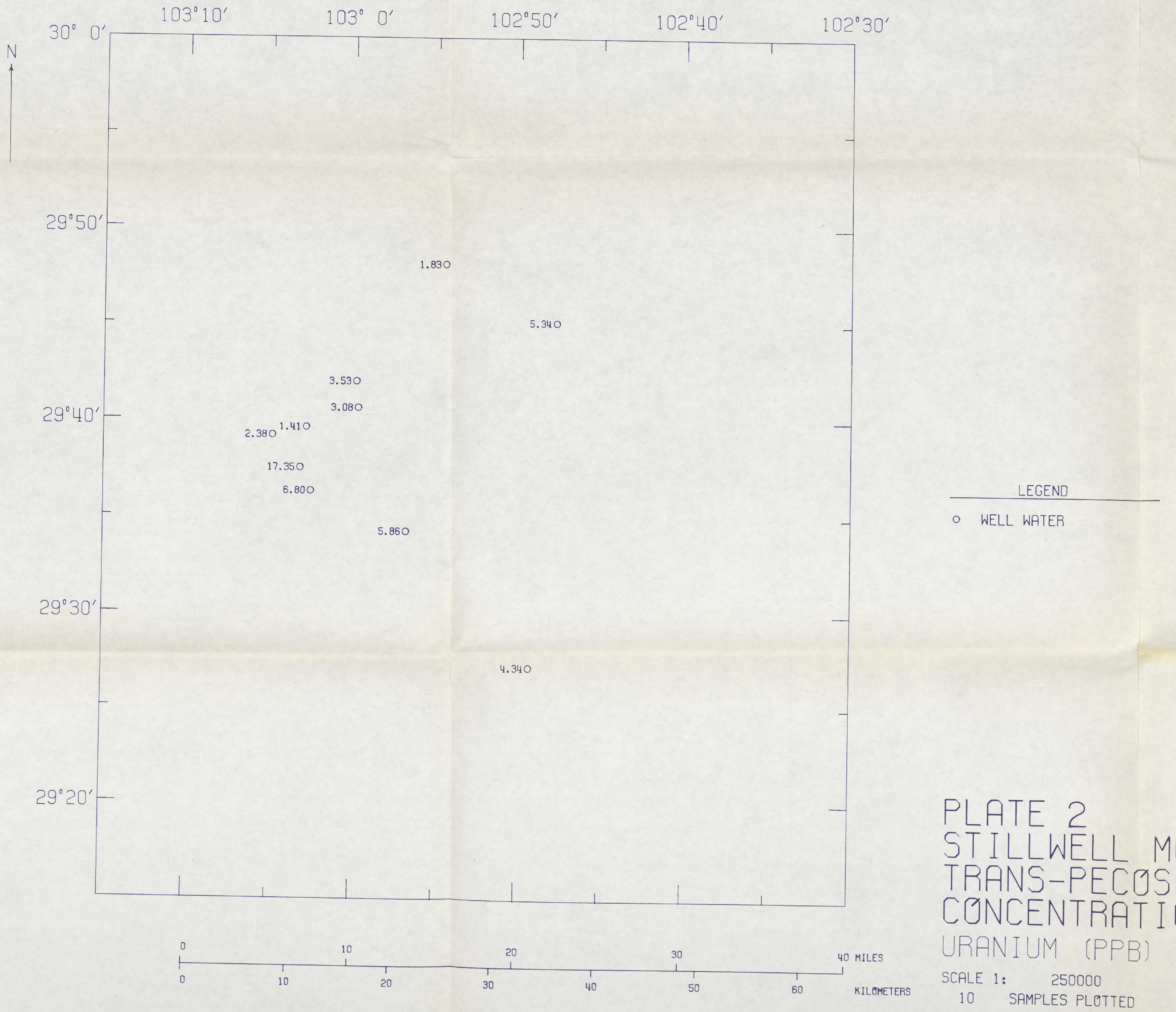


PLATE 2
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
CONCENTRATION MAP GROUNDWATER
URANIUM (PPB)
SCALE 1: 250000
10 SAMPLES PLOTTED

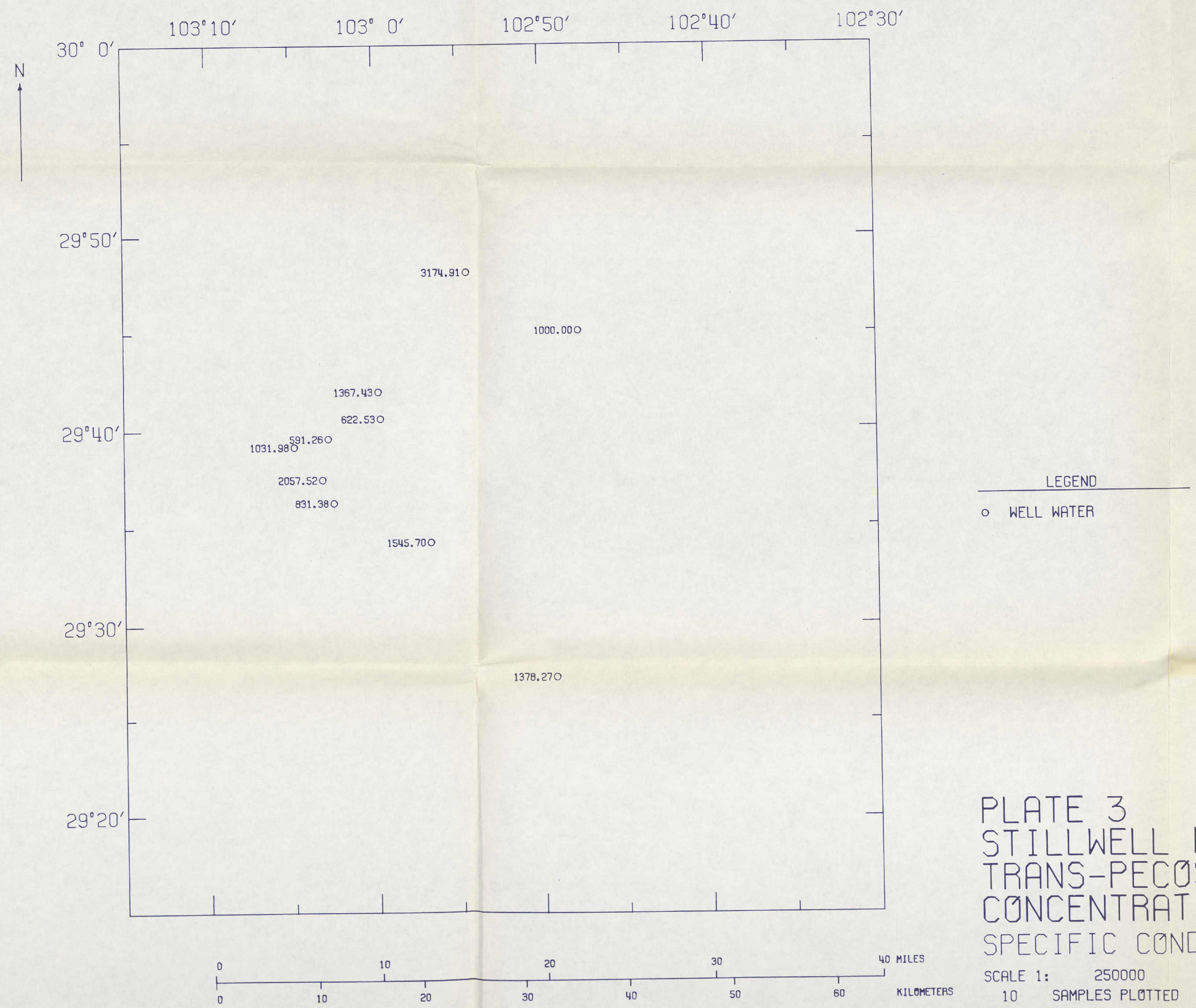
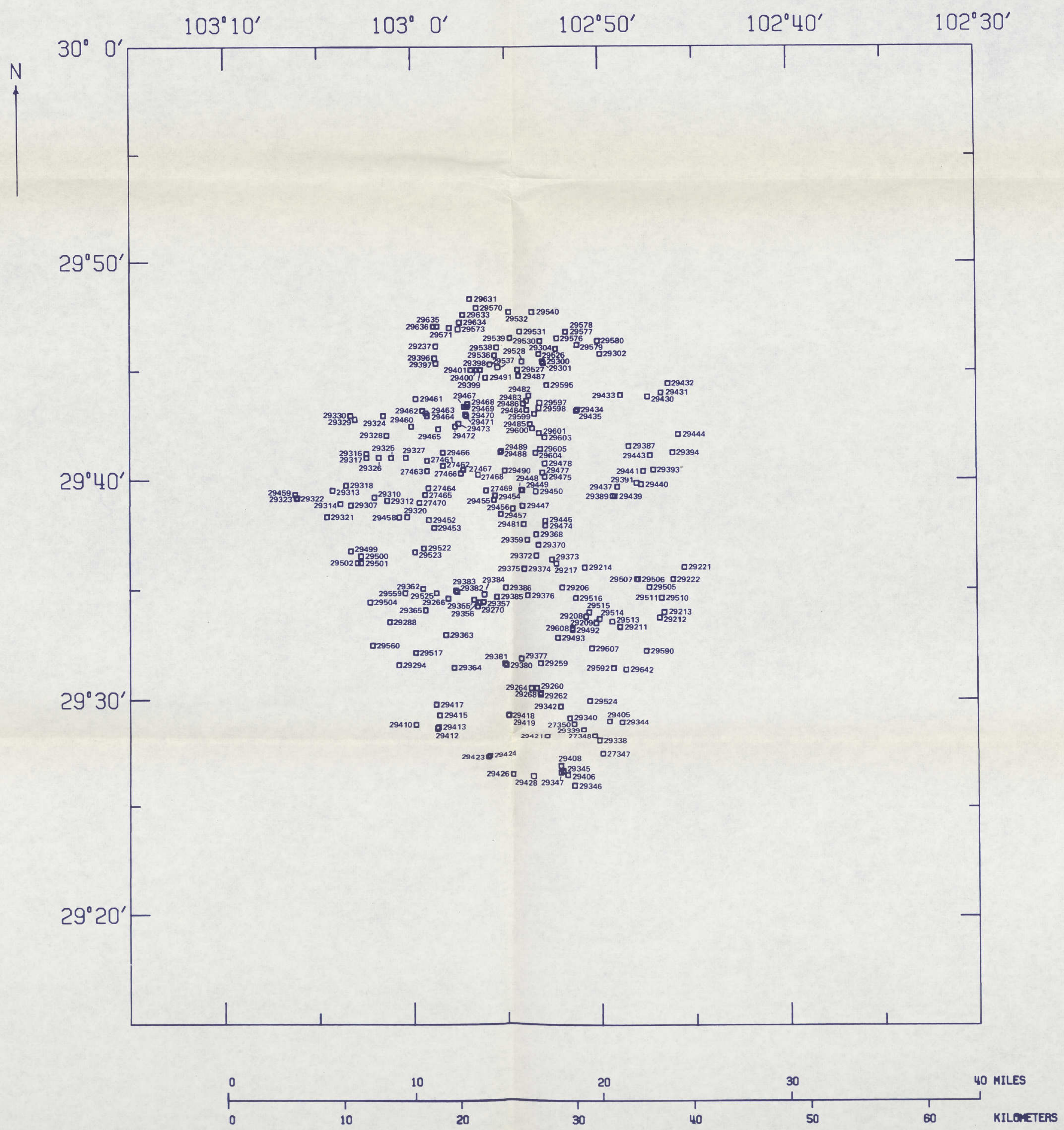


PLATE 3
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
CONCENTRATION MAP GROUNDWATER
SPECIFIC CONDUCTANCE (UMHOS/CM)

SCALE 1: 250000
10 SAMPLES PLOTTED



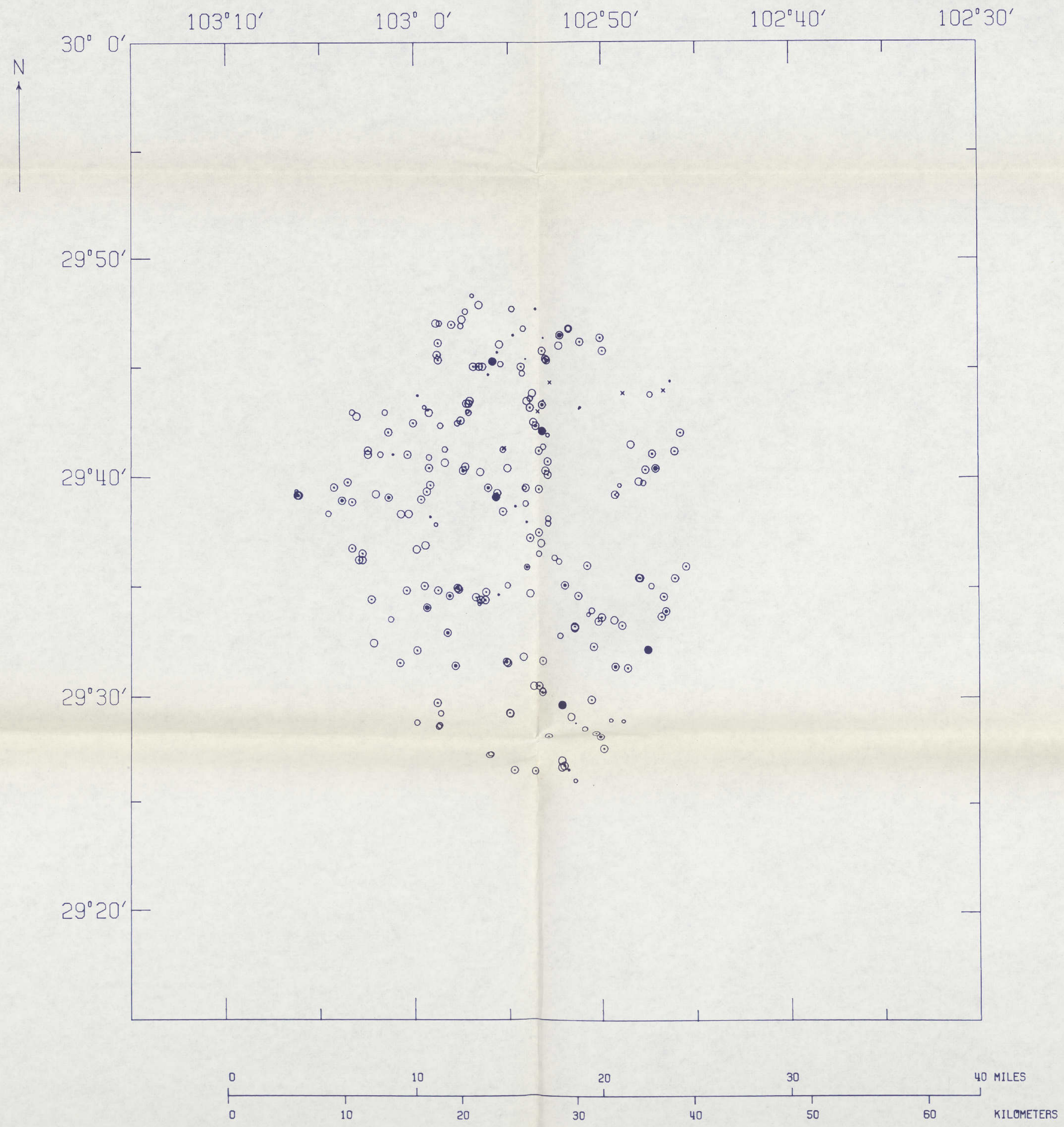
LEGEND

▫ STREAM SEDIMENT

PLATE 4
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
STREAM SEDIMENT SAMPLE LOCATION MAP

SCALE 1: 250000

228 SAMPLES PLOTTED



SYMBOL RANGES FOR PLOTTED VARIABLE (X)

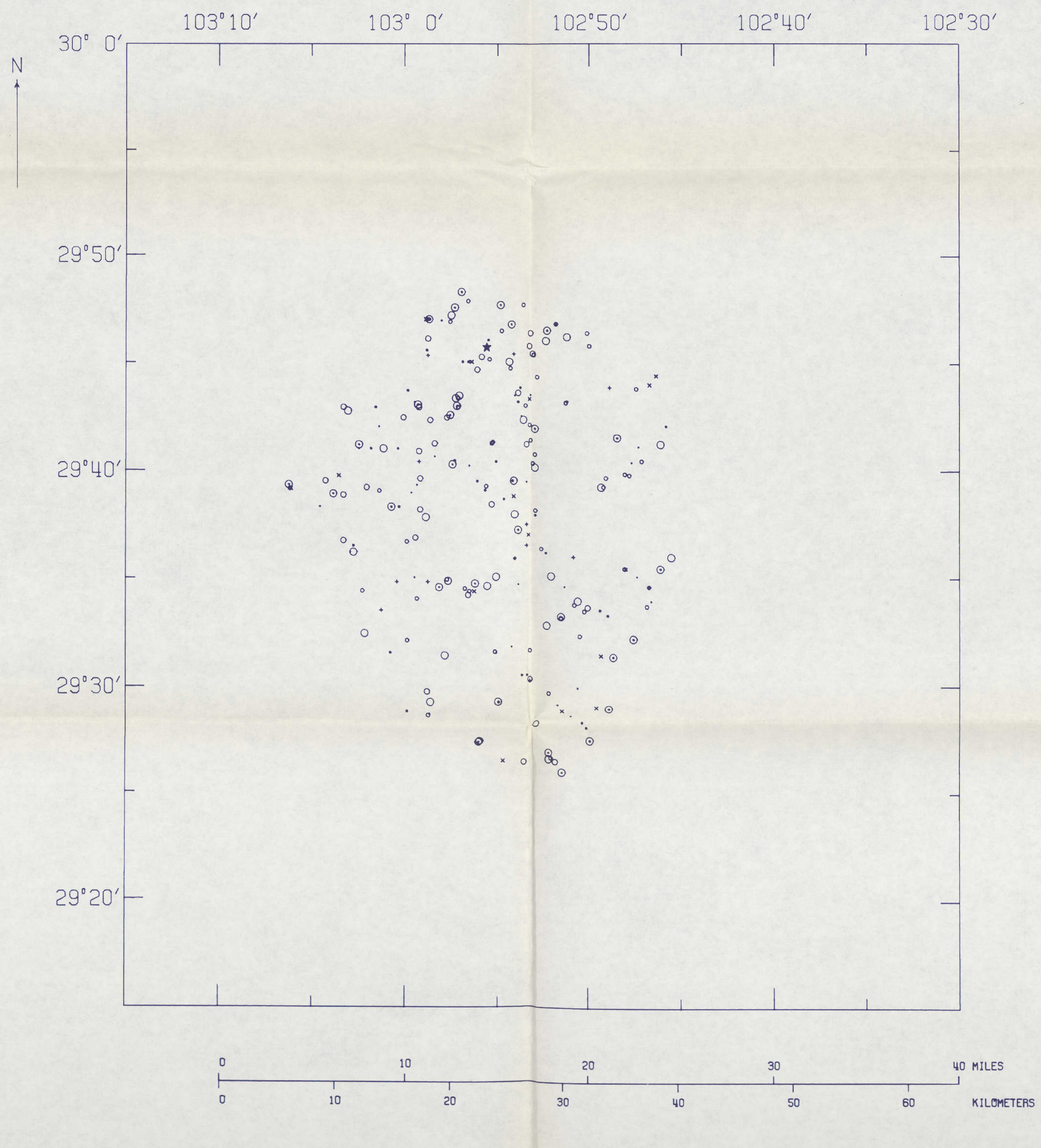
0.25 ≤ X < 1.00
1.00 ≤ X < 1.20
1.20 ≤ X < 1.35
1.35 ≤ X < 1.50
1.50 ≤ X < 1.70
1.70 ≤ X < 1.90
1.90 ≤ X < 2.15
2.15 ≤ X < 2.45
2.45 ≤ X < 2.70
2.70 ≤ X < 3.00
3.00 ≤ X < 3.40
3.40 ≤ X < 4.00

PLATE 5
STILLWELL MØUNTAINS PRØJECT AREA
TRANS-PECØS DETAILED GEØCHEMICAL SURVEY
SYMBØL PLØT STREAM SEDIMENT

URANIUM (PPM)

SCALE 1: 250000

228 SAMPLES PLØTTED

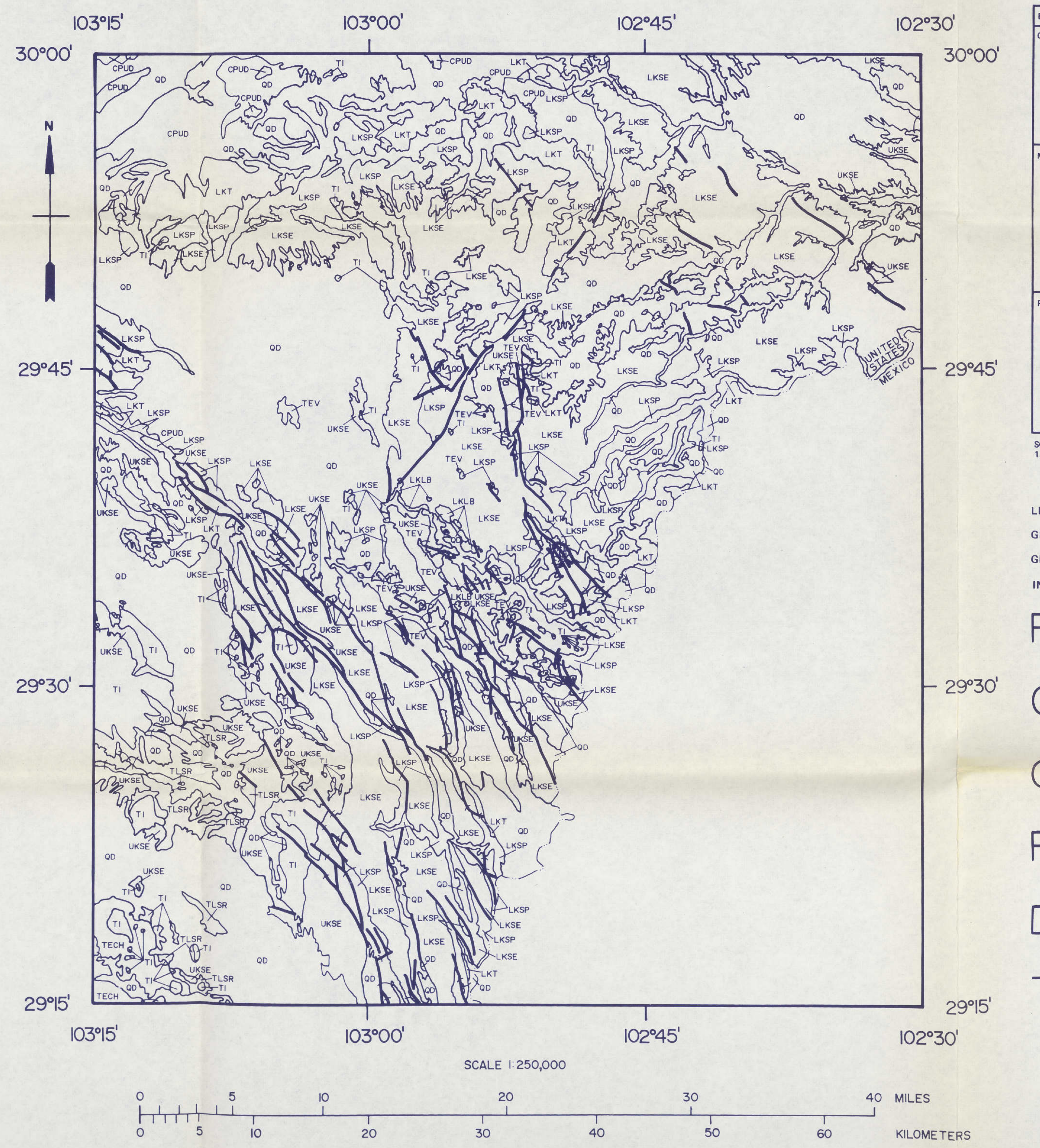


SYMBOL RANGES FOR PLOTTED VARIABLE (X)

0.0 ≤ X <	2.00
2.00 ≤ X <	3.00
3.00 ≤ X <	4.00
4.00 ≤ X <	5.00
5.00 ≤ X <	6.00
6.00 ≤ X <	7.00
7.00 ≤ X <	8.00
8.00 ≤ X <	10.00
10.00 ≤ X <	11.00
11.00 ≤ X <	13.00
X ≥	23.00

PLATE 6
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
SYMBOL PLOT STREAM SEDIMENT
THORIUM (PPM)

SCALE 1: 250000
227 SAMPLES PLOTTED



STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY

ERA	SYSTEM	SERIES	MAP CODE	GEOLOGIC UNIT
CENOZOIC	QUATERNARY	RECENT	QD	ALLUVIUM AND OTHER QUATERNARY DEPOSITS
	TERTIARY		TEV	EXTRUSIVE IGNEOUS ROCKS
			TI	INTRUSIVE IGNEOUS ROCKS
		OLIGOCENE/EOCENE	TECH	SOUTH RIM FORMATION CHISOS FORMATION
		EOCENE	TLSR	CANOE FORMATION HANNOLD HILL FORMATION BLACK PEAKS FORMATION
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS	UKSE	JAVELINA FORMATION AGUJA FORMATION PEN FORMATION BOQUILLAS FORMATION
		LOWER CRETACEOUS	LKLB	BUDA LIMESTONE DEL RIO CLAY
			LKSE	SANTA ELENA LIMESTONE
			LKSP	SUE PEAKS FORMATION DEL CARMEN LIMESTONE TELEPHONE CANYON FORMATION (UNDIVIDED)
			LKT	GLEN ROSE FORMATION
PALEOZOIC	PENNSYLVANIAN	LOWER PENNSYLVANIAN	CPUD	TESNUS FORMATION
	MISSISSIPPIAN AND DEVONIAN			CABALLOS NOVACULITE
	ORDOVICIAN	UPPER ORDOVICIAN		MARAVILLAS FORMATION
		MIDDLE ORDOVICIAN		FORT PENN FORMATION
	CAMBRIAN	UPPER CAMBRIAN		DAGGER FLATT SANDSTONE

SOURCE OF GEOLOGY:
1. BARNES, V. E.; GEOLOGIC ATLAS OF TEXAS, EMORY PEAK-PRESIDIO SHEET (PRELIMINARY SHEET, 1977).

LEGEND

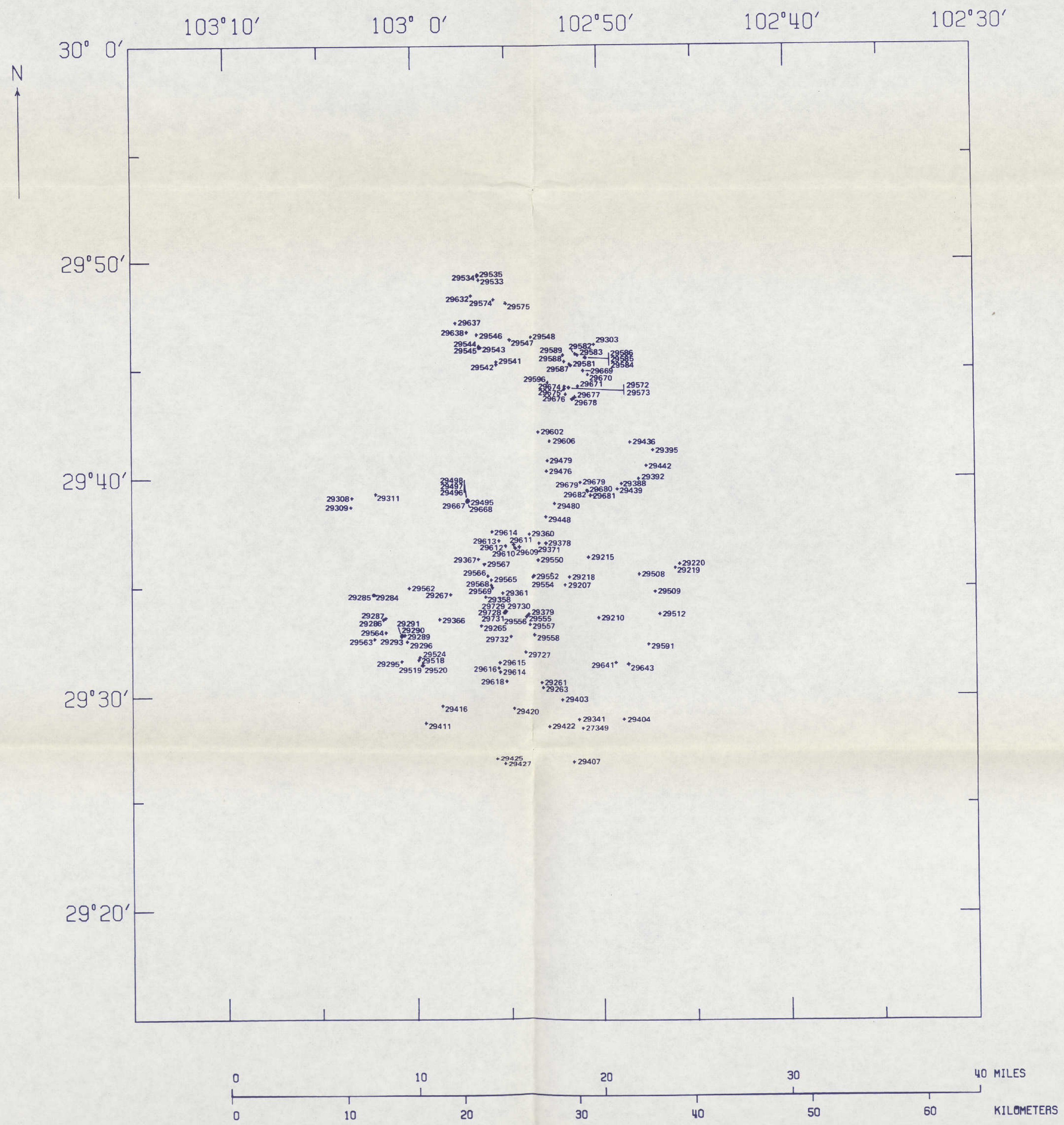
GEOLOGIC CONTACT

GEOLOGIC FAULT

INTERNATIONAL BOUNDARY LINE

PLATE 7

GENERALIZED GEOLOGIC MAP OF THE STILLWELL MOUNTAINS PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS



LEGEND

+ SOIL, ROCK, AND OTHER

PLATE 8
STILLWELL MOUNTAINS PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
RADIOMETRIC SAMPLE LOCATION MAP

SCALE 1: 250000

144 SAMPLES PLOTTED