K/UR-29
Part 7

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

DRYDEN 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

October 31, 1980

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FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Uranium Resource Evaluation Project

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Oak Ridge, Tennessee

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ABSTRACT

Results of the Dryden project area of the detailed geochemical survey for Trans-Pecos, Texas are reported. Field and laboratory data are presented for 34 groundwater and 78 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.

Three groundwater samples displaying the highest concentration of uranium occur in the southwest corner of the project area. Relatively high concentrations of the variables boron, chloride, potassium, magnesium, strontium, and sulfate are associated with the uranium. Relating the hydrogeochemical data from an area south of the Dryden project area with results from the Dryden project area indicates that samples exhibiting high uranium concentrations in the Dryden area occur in a transitional zone which is between groundwaters with high values of uranium to the west and low values to the east.

Significant soluble uranium concentrations (U-FL) in stream sediments occur in the southeastern corner of the project area. High concentrations of the variables arsenic, calcium, lithium, molybdenum, nickel, phosphorus, selenium, strontium, and vanadium are associated with the area of anomalous uranium. Stream sediment geochemical data from the Dryden project area defines the northern limit of the anomalous uranium trend identified in the south of the Dryden project area. The area of anomalous uranium values corresponds to the area of outcrop of the Lower Boquillas Formation.

DRYDEN 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 reports.

This report on the Dryden project area represents the seventh volume of geochemical data which describes 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 Dryden project area of the Trans-Pecos detailed geochemical survey covers a surface area of approximately 6,058 km^2 (2,340 mi^2). It is outlined on the generalized geologic map of Texas (Figure 2) and is located within the Fort Stockton, Emory Peak, Sonora, and Del Rio 1° x 2° NTMS Quadrangles and includes portions of Pecos, Brewster, and Terrell Counties. The area of detailed sampling covers approximately 528 km^2 (204 mi^2) within the Fort Stockton 1° x 2° NTMS Quadrangle. A generalized geologic map and stratigraphic column listing UREP geologic codes used are given in Figure 3 and Plate 7.

Physiographically, the Dryden project area is located on the western margin of the Edwards Plateau of the Great Plains Province. West of the Pecos River, the plateau is defined as the Stockton High. Characteristically, it is a raised section of Cretaceous limestones exhibiting only minor elevation changes. Intermittent streams have deeply incised the Cretaceous units creating vertical canyon walls. Karst topography is an extensive feature of the region (Thornbury, 1965).

CLIMATE

The Trans-Pecos region of Texas is classified as having an arid, subtropical climate. Vegetation is very sparse due to the extremely high rate of evapotranspiration relative to rainfall. The normal annual precipitation for eastern Trans-Pecos is 30.48 cm (12 in.). The normal annual average temperature is 18°C (64°F).

Rain has its peak season in September, falling as short-lived, intense afternoon thundershowers. The short duration of rainfall and lack of vegetation makes flash floods common in the region (National Oceanic and Atmospheric Administration, 1974).

RELATED STUDIES

Investigations in the Dryden project area have largely been limited to those of the NURE Program. In the spring of 1978, 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). Geochemical parameters associated with uranium included arsenic, molybdenum and selenium. An airborne gamma-ray and magnetic reconnaissance survey conducted by LKB Resources, Inc. including 12,114 line km (7,529 line mi) was flown during the 1978 flying season in the Big Bend region of Texas. Twenty-one preferred anomalies and 20 statistically significant

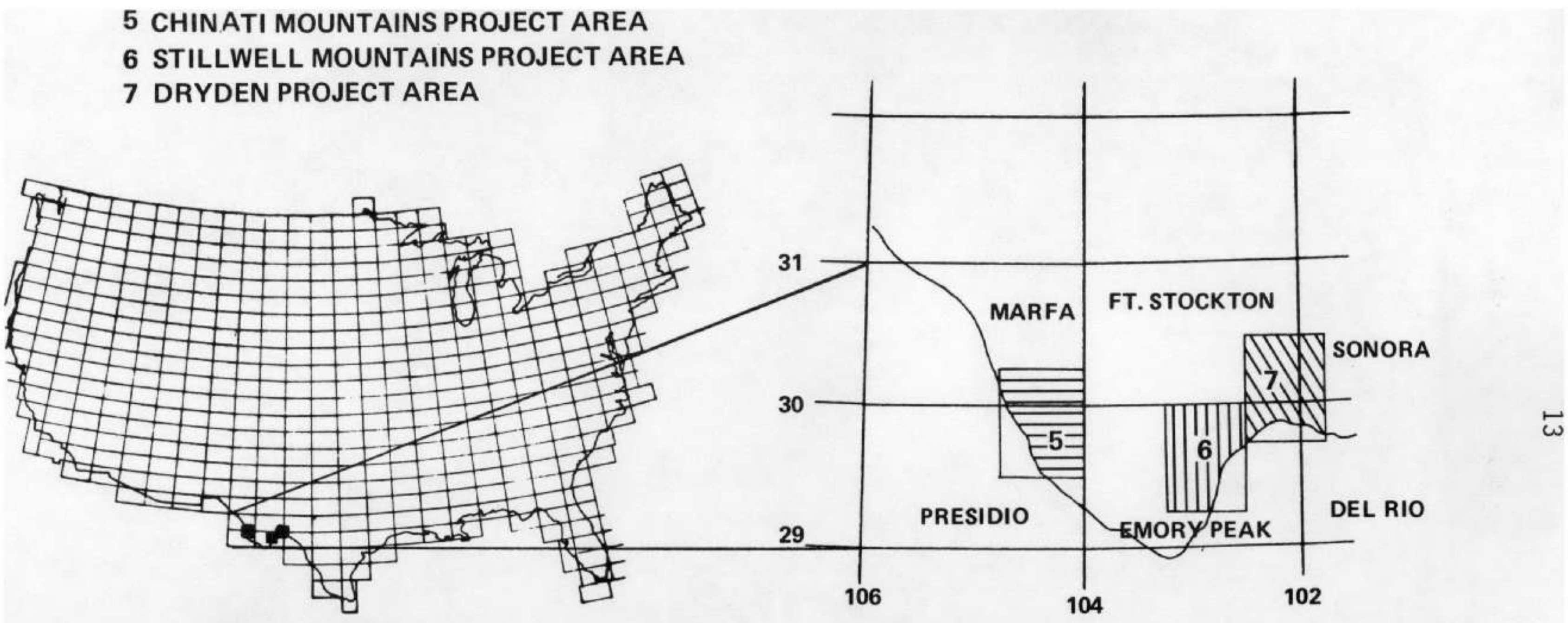

Figure 1

INDEX MAP SHOWING THE MAP BOUNDARIES OF THE DRYDEN PROJECT AREA, (7)
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

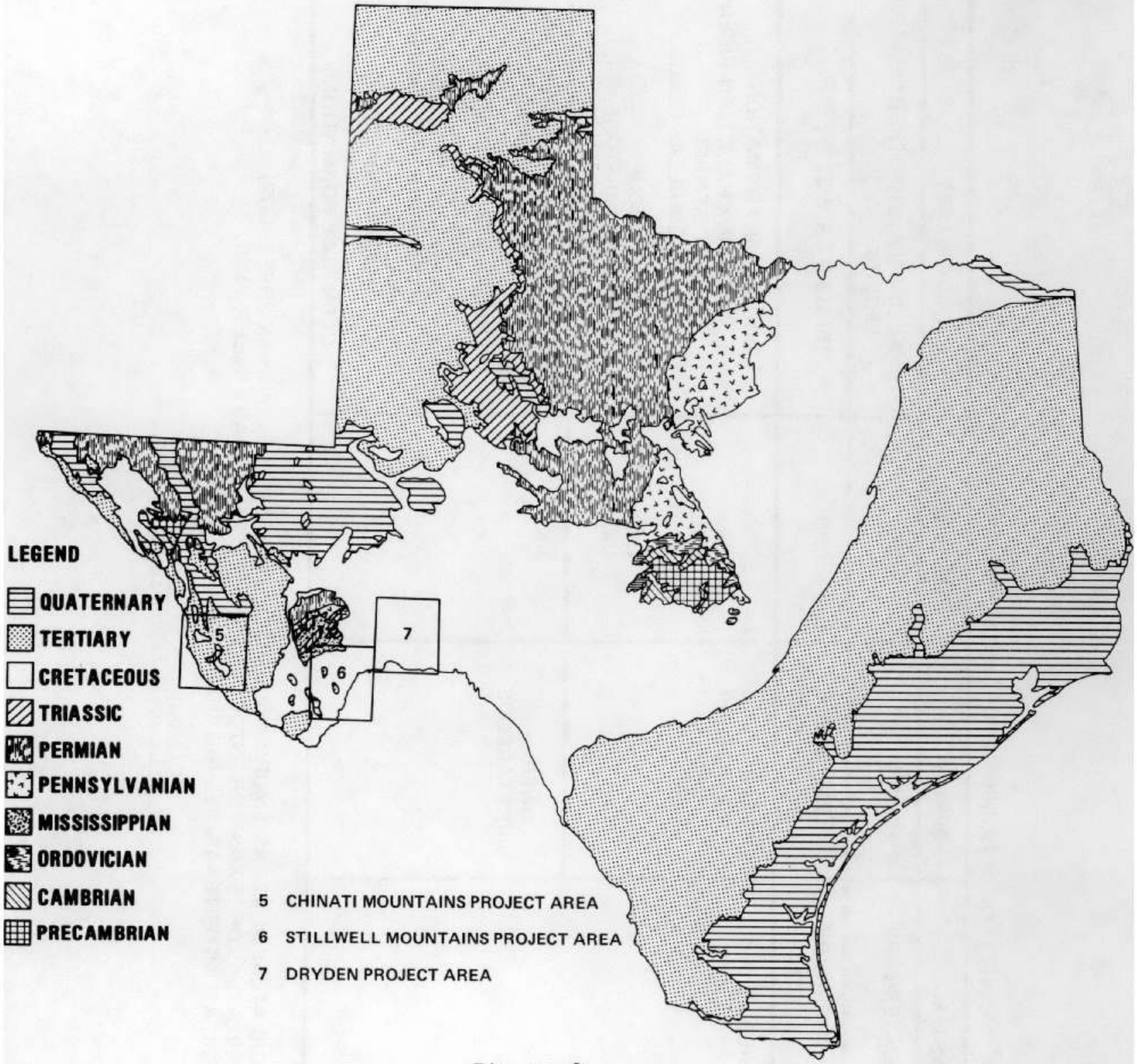

Figure 2

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

DRYDEN PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY

ERA	SYSTEM	SERIES	MAP CODE	GEOLOGIC UNIT
CENOZOIC	QUATERNARY	RECENT	QD	ALLUVIUM AND OTHER QUATERNARY DEPOSITS
	QUATERNARY OR TERTIARY	PLEISTOCENE OR PLIOCENE	QPU	UVALDE GRAVEL
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS		BOQUILLAS FORMATION
			UKA	AUSTIN CHALK (SAN VICENTE)
			UKBO	ERNST MEMBER
				BOQUILLAS FLAGS
			UKW	WASHITA GROUP
			LKLB	BUDA LIMESTONE
				DEL RIO CLAY
		LOWER CRETACEOUS	LKSE	SANTA ELENA LIMESTONE
				SUE PEAKS FORMATION
			LKF	FREDRICKSBURG GROUP
				KIAMICHI FORMATION
				EDWARDS LIMESTONE
				COMANCHE PEAK LIMESTONE
				WALNUT CLAY
				MAXON FORMATION
			LKT	GLEN ROSE FORMATION

SOURCE OF GEOLOGY:
1. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, EMORY PEAK-PRESIDIO SHEET (PRELIMINARY SHEET, 1977).
2. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, FORT STOCKTON SHEET (PRELIMINARY SHEET, 1978).
3. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, DEL RIO SHEET (1977).

LEGEND FOR FIGURE 3

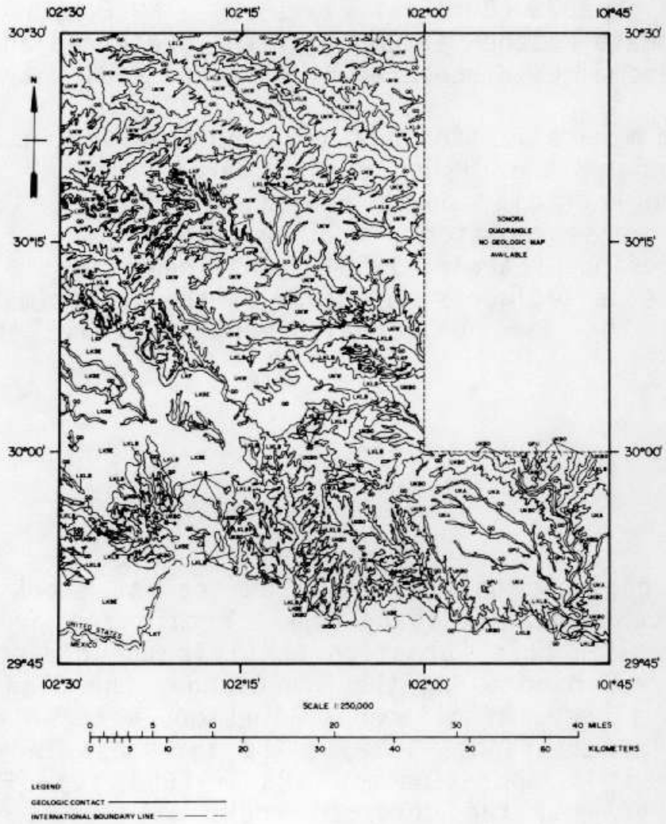

Figure 3

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

eU anomalies were recognized within the project boundaries. The uranium spectral channel displayed local amplitudes over Cretaceous sediments in the eastern portion of the Emory Peak and Fort Stockton 1° x 2° NTMS Quadrangles which exceeded those amplitudes over volcanic terrain in the western portion of the Emory Peak 1° x 2° NTMS Quadrangle (LKB Resources, Inc., 1979). Further investigation of the area was done by UCC-ND personnel in 1979 (Butz, et al, 1979). NURE hydrogeochemical and stream sediment data matched a number of the preferred and statistically significant eU anomalies discovered by airborne radiometrics.

Although uranium mineralization has not been observed within the area of detailed sampling in the Dryden project area, mineralization has been reported at King Mountain, north of McCamey, Texas. Uranium minerals occur as crusts or segregations, filling interstices, or coating cracks in ferruginous residue (Eargle, 1956). This near-surface mineralization occurs in Cretaceous sediments which are of the approximate same age and which represent the same paleoenvironment as those observed in the project area.

GEOLOGY

STRATIGRAPHY

The predominate geologic units exposed on the Ft. Stockton Plateau are of Cretaceous (Comanchean-Gulfian) age. Within the project area, the Lower Cretaceous Glen Rose Formation (LKT) is the oldest exposed unit. Visible as a narrow band along the Rio Grande, the Glen Rose Formation is a dull gray, flaggy, argillaceous limestone with interbedded layers of clay and marl (Cartwright, 1932). Its thickness in the Terrell-Val Verde County area is approximately 183 m (600 ft) (Freeman, 1968). Unconformably overlying the deformed rocks of the Paleozoic Ouachita foldbelt, the Glen Rose Formation thickens southward changing from an arenaceous facies to a massive limestone (King, 1930). The depositional system is interpreted as a shallow 'platform/shelf-margin' environment with a clastic sediment source to the north (Smith, 1970 and Scott and Kidson, 1977).

The Lower Cretaceous (Trinitian) Glen Rose Formation is conformably overlain by the Maxon Formation. The age of this unit is in dispute. It has been correlated to the central Texas Paluxy Formation (Sellards, et al, 1932), but King (1930) and Adkins (1927) prefer placing the Maxon Formation as the lowest formation of the Fredericksburg Group since no fossils of Lower Cretaceous (Trinitian) age exist at the type-locality. For the purposes of this report the Maxon Formation has been included with the Fredericksburg Group (LKF) and is mapped as one unit.

In Terrell County, the Maxon Formation consists of grayish clayey limestones and yellow-brown argillaceous limestones which contain an abundant fossil assemblage with thick to massive bedding and conchoidal fractures. The formation measures approximately 76 m (250 ft) in thickness (Freeman, 1968). The Terrell County Maxon Formation is lithologically different from the type sandstone in the Marathon Basin. This change is related to its paleogeographic position within the "Coastal-Plain" depositional system described by Scott and Kidson (1977), and reflects an increasing distance from the clastic sediment source area.

Overlying the Maxon Formation in the Fredericksburg Group is the Walnut Clay-Comanche Peak Limestone which measures 18 m (60 ft) in total thickness (Freeman, 1968). These sediments are sandy marls and argillaceous, thinly bedded nodular limestones (Adkins, 1927). The depositional environment is considered to be neritic (Sellards, et al, 1932).

Conformably overlying the Walnut Clay-Comanche Peak Limestone is the Edwards Limestone, also included in the Fredericksburg Group. Within the lower portions of the Pecos River, the Edwards Limestone is a light to medium gray, fossiliferous, crystalline limestone with zones of dolomitization (Sellards, et al, 1932 and Freeman, 1968). Its maximum thickness is approximately 122 m (400 ft). The Edwards Limestone in Terrell County is transitional between the reef facies of northern Coahuila, Mexico and the neritic facies of the Fort Stockton area (Sellards, et al, 1932 and Adkins, 1927).

The neritic facies of the Upper Fredericksburg Group (Kiamichi Formation) is a medium gray, fossiliferous, thinly bedded, clayey limestone measuring approximately 15 m (50 ft) in thickness (Freeman, 1968).

Within the area sampled, the Fredericksburg Group is exposed only in the deepest canyons on the Dryden and Dryden NE 7-1/2 min USGS topographic sheets.

The Washita Group (UKW) includes the Sue Peaks Formation and the Santa Elena Limestone (correlative with the central Texas Georgetown Formation) (combined as LKSE) and the Del Rio Clay and Buda Limestone (combined as LKLB). These units comprise approximately 80% of the surface geology within the project boundaries. The Washita Group, as a whole, measures approximately 244 m (800 ft) in thickness in Terrell County. The Washita Group forms the continuation of the Edwards Plateau westward from the Pecos River (Sellards, et al, 1932).

The Santa Elena Limestone is a white, finely textured limestone with nodular structures (Christner and Wheeler, 1918). It is divided into an upper unit of thinly bedded limestones with marly interbeds and a lower unit of hard, massive, rudistid-bearing limestone (Maxwell, et al, 1967). The Santa Elena Limestone in Terrell County is transitional between the Coahuila, Mexico, reef facies and the Fort Stockton neritic facies (Maxwell, et al, 1967 and Adkins, 1927). In Terrell County this unit measures approximately 137 to 183 m (450 to 600 ft) in thickness (Freeman, 1968).

The contact between the Santa Elena Limestone and the overlying Del Rio Clay is unconformable throughout the project area. This contact is transitional, grading from a sharp, even boundary to an erosive displacement of Santa Elena material into the basal Del Rio Clay (Freeman, 1968). The Del Rio Clay itself changes lithology and thickness. The Terrell Arch described by Adkins (1927) is presumably the major cause of these variations.

Four lithologies dominate the Del Rio Clay: limey, silty claystone; laminated well-sorted siltstone; coquina limestone; and a nodular limestone. The following facies descriptions are by Freeman (1968). The limey, silty claystone is a soft, laminated, fossiliferous, green-gray to yellow-gray clay. The laminated, well-sorted siltstone is gray to yellow-brown, with well-sorted quartz clastic grains. Minor amounts of zircon, tourmaline, and glaucophane are present in the well-sorted siltstone. The coquina limestone has a lime matrix facies with minor amounts of clay and fossil beds of Exogyra arietina (sp). The nodular limestone consists of claystone with abundant interbeds of nodular limestone.

Each of the lithologies represents a specific environment relative to the Terrell Arch. Christner and Wheeler (1918) describe the limey, silty claystone exposed at lat. 30°02'50" N. and long. 102°06'10" W. This facies of the Del Rio Clay pinches out to the east between the Santa Elena and Buda Limestones. Near Nichols Ranch (lat. 29°55'00" N. and long. 102°17'30" W.), the Del Rio Clay siltstone facies is exposed as narrow ridges approximately 10 m (33 ft) thick. The environment is described as a shoaled area by virtue of ripple-marked, sand-size material (Christner and Wheeler, 1918). At Prairie Creek (lat. 29°59'00" N. and long. 102°02'30" W.), the nodular limestone facies is exposed and represents deposition very near the land-sea interface (Christner and Wheeler, 1918). The coquina limestone only occurs east of the Terrell Arch near Shumla, Texas (lat. 29°47' N. and long. 101°26' W.) (Freeman, 1968).

The uppermost unit of the Washita Group is the Buda Limestone. Within the project boundaries, the Buda Limestone rests unconformably on either the Del Rio Clay or the Santa Elena Limestone. The Buda Limestone is divided into three facies. The lower unit is a yellow to gray micritic limestone containing quartz clastic grains and local conglomerates of Del Rio Clay-type material. The middle facies is a light gray, micritic limestone with variable bedding and porcelaneous nodules. The upper facies is similar to the lower except for the lack of a basal conglomerate. The Buda Limestone thickness varies within the project area from 15 m (50 ft) in the northeast to 27 m (90 ft) in the southwest. The depositional environment is shallow-marine, epicontinental with some clastic input from either the north or the west (Freeman, 1968).

A hiatus exists between the Buda Limestone and the Boquillas Formation (Sellards, et al, 1932). The Upper Cretaceous (Gulfian) Boquillas

Formation is divided into the Ernst Member (UKBO) and Austin Chalk (San Vicente Member) (UKA). The Ernst Member includes the Boquillas Flags and three other facies (Maxwell, et al, 1967). The Ernst Member in Terrell County consists of impure limestone beds with interlayers of marl, clay, sand, and shale (Christner and Wheeler, 1918). Four facies exist in the Dryden project area. The basal facies consists of interlayers of calcarenite and shale. The calcarenite contains oolites in a crystalline calcite matrix while the silty shale beds (lat. 29°53' N. and long. 101°50' W.) are black with a petroliferous odor. The facies measure 8 m (26 ft) in thickness. Above the black shales are the flagstone facies (Boquillas Flags) of clastic calcite grains in crystalline calcite and a number of thin bentonite beds. Thickness of the facies is generally 27 m (90 ft). The exception is in the southwest corner of the project area (lat. 20°56'30" N. and long. 102°13'00" W.) where thickness measures 20 m (65 ft) across the fold crest of the Agua Verde Anticline and 37 m (120 ft) east of the fold. The 'ledge' facies consists of pure limestone beds with ammonites and evenly-bedded calcite layers. Thickness measures 8 to 12 m (25 to 40 ft). A very localized laminated facies grades into the overlying Austin Chalk (San Vicente Member). The laminated facies has little pure limestone, high clay content, and an identifying weathered fossil (Hemiaster) zone. Thickness ranges from 12 to 15 m (40 to 50 ft) (Freeman, 1968).

The Austin Chalk (San Vicente Member) (UKA) within the project area predates the Austin Chalk of type locality (Freeman, 1968). In Terrell County, it consists of weathered, thin limestone beds grading westward into more crystalline masses (Sellards, et al, 1932). Maximum thickness in the area is 61 m (200 ft), considerably thinner than the outcrops to the east (Freeman, 1968 and Sellards, et al, 1932). The Austin Chalk represents an epicontinental neritic environment.

Two distinct Quaternary gravels are exposed within the project area. An older Pliocene gravel (QPU) correlative with the Uvalde Gravel has been mapped by Darton (1933) and Freeman (1965). Locally derived limestones and Paleozoic clastics from the Marathon area comprise the bulk composition (Freeman, 1968).

The second gravel (QPU) is of Pleistocene age, representing terrace deposition. Two dominant facies exist. The terrace deposits along the Rio Grande are a composite of local limestone and chert with volcanics from the west. Terrace deposits along tributaries within the project area are accumulations of the Pliocene gravel and locally derived cherts and limestones (Freeman, 1968). The thickest known terrace deposit is in Downie Canyon measuring 69 m (225 ft) (Christner and Wheeler, 1918).

Thin accumulations of alluvium (QD) sit topographically higher than the terrace deposits. The alluvium is yellow-brown, well-sorted silts and poorly sorted gravels (Freeman, 1968).

STRUCTURE

The Dryden project area is located within the Marathon structural salient of the Ouachita mobile foldbelt. All of the major Paleozoic structural features of the foldbelt have subsurface expression within the boundaries of the project area. The Luling Overthrust Front, separating interior zone and frontal zone Ouachita facies units, trends arcuately through the southwest corner of the area. The frontal zone rocks trend approximately NW-SE through the Dryden project area. A thrust sheet zone between frontal zone rocks and foreland facies is located in the subsurface of the northeast corner of the project area (Flawn, et al, 1961).

Prior to the Late Pennsylvanian-Early Permian final diastrophism, the Ouachita Geosyncline (specifically the Marathon salient) received a sediment load of both foreland origin on the north side and hinterland origin to the south. Tectonic subsidence of the basin exceeded sediment influx except for intermittent periods of uplift and accompanying subaerial erosion. Dynamic changes in sediment type accompanied the intermittent periods of tectonism. Subaerial erosion and shallow water conditions (possibly stagnant waters) limited the total thickness of Early Paleozoic rocks.

King (1935) records at least six tectonic events beginning in the Middle Ordovician, representing northward mobilization within the geosyncline. Middle Ordovician-Devonian instability is marked by silicic units (Maravillas Chert and Caballos Novaculite) presumably of volcanic ashfall origin (King, 1961).

Uplift of the geosyncline (southern boundary), precipitated the influx of clastic material from the activated area into the trough. Massive flysch sequences of Mississippian (Tesnus and Haymond) age moved northward into the tectonically deepened trough (Flawn, et al, 1961). Overthrusting in the southeastern part of the geosyncline followed uplift. The earlier Paleozoic (Maravillas and Caballos) formations were brought to the surface, eroded, and redeposited. This crustal movement advanced northwest in tight compressional folds which broke into thrust sheets (King, 1930). In some cases, as in the Dryden area, Ouachita facies rocks were driven over foreland facies (Flawn, et al, 1961).

The end of the 'Marathon Orogenic Epoch' was signaled by heavy clastic influx into the foredeeps forming the Early Permian (Wolfcamp) sedimentary units (Baker and Bowman, 1917 and King, 1961). This Paleozoic framework was then eroded to a fairly flat surface with Permo-Triassic gentle folds. This is defined as the "paleoplain" over which normal marine Lower Cretaceous (Comanchean) units were deposited (Smith, 1970).

The Dryden region is considered to be part of the northward extension of the Cretaceous Tamaulipas Platform of northern Mexico (Smith, 1970).

Encroachment and inundation of the platform by the Mexican Geosyncline sea led to the deposition of the Lower Cretaceous (Comanchean) Glen Rose Formation.

Continued transgression resulted in the deposition of the subsequent Fredericksburg Group within a shallow, open, shelf-type environment (St. John, 1965).

Doming of the Marathon region occurred during deposition of the Santa Elena Limestone and is evidenced by thinning of this unit northward from Big Bend to the Glass Mountains (St. John, 1965).

Multiple structural controls in the Dryden area caused lithological and thickness variations of the Del Rio Clay. Laramide reactivation of the Paleozoic basement within Terrell County formed a structurally high ridge trending approximately NW-SE. Expression of the Terrell Arch (lat. 30°00' N. and long. 101°50' W.) is shown by the Del Rio Clay unit thickness. The broad fold crest extends just east of Dryden to Langtry, Texas. The Del Rio Clay thickens on either side of the crest and extends southward to the shelf edge, the Stuart City Reef (Freeman, 1968 and Maxwell, et al, 1967).

The Terrell Arch effectively created facies variations within the Del Rio Clay with accompanying paleocommunity differences. West of the arch, Del Rio Clay sand content increases, possibly due to erosion of cherty limestones within the domed Marathon region. The probable existence of shoaling conditions on the western edge of the arch is reinforced by the presence of current-aligned arenaceous forams, Haplostiche texanas (sp) (Plummer, 1931 and Christner and Wheeler, 1918). The environment to the east of the arch was deeper water, resulting in micritic facies with a large Exogyra community (Freeman, 1968). Therefore, the Terrell Arch was an effective barrier against easterly transport of sediments.

Outcrop inspection has shown the Lower, Middle, or Upper Del Rio Clay facies to be absent in many locations. The two possible conclusions drawn are:

1. Uplift of the arch occurred early in Del Rio time and was not covered by sediments until Late Del Rio time, or

2. Uplift occurred after deposition of Lower and Middle Del Rio Clay facies which were then eroded prior to upper facies deposition. (Maxwell, et al, 1967 and Lonsdale, et al. 1955).

The stress acting upon the Terrell Arch basement rocks relaxed by the end of Del Rio time, evidenced by the uniform thickness of the Buda Limestone across the fold crest (Freeman, 1968). The arch extends south and east to the Burro Mountains which are part of the Mexican Highlands. Presumably, it is part of the doubly plunging anticline system of the northeastern Mexican foldbelt (Freeman, 1968 and Wall, et al, 1962).

Three anticlines within the southwestern portion of the project area developed from Laramide orogenic movement. These structural features are minor but they indicate that deformation continued past Del Rio time into Early San Vicente time. The Del Rio Clay, Buda Limestone, and Boquillas Formation thin across all three fold axes. All three folds trend subparallel to the western limb of the Terrell Arch (Freeman, 1968). It is unknown why deformation, represented by these folds, continued while tectonic uplift of the Terrell Arch ceased.

Woodbine time marks the boundary between Lower Cretaceous (Comanchean) shallow water limestone deposition and Upper Cretaceous (Gulfian) clastic deposition with regression of the Mesozoic sea (St. John, 1965). Uplift of the Marathon-Terrell area to the present time has been established by stream gradient studies on the older gravel beds of the area. It is believed that since San Vicente time, 1,036 m (3,400 ft) of vertical uplift has occurred (Freeman, 1968).

HYDROLOGY

The major water producing units within the project area are the Glen Rose Formation (LKT), and the Fredericksburg (LKF) and Washita (UKW) Groups. Groundwater is found only in secondary class aquifers within these groups (see Davis and Leggatt, 1965, for definition of secondary class aquifers). Groundwater occurs under both confined and unconfined conditions in joints, cracks, and solution cavities in limestone, and in pore spaces in sandstones, (i.e. the Maxon Formation of the Fredericksburg Group). The rocks of the Glen Rose Formation (LKT) and equivalents yield small quantities of fresh to slightly saline water over a rather large area. The Fredericksburg and Washita Groups furnish small quantities of fresh water in Terrell and eastern Brewster Counties. A large subsurface river within the lower Edwards Limestone at Eight Mile Draw (lat. 30°09'00" N. and long. 102°07'30" W.) was mapped during 1978-79 (Veni, 1980a). The stream channel (Sirion River) is located 150 to 160 m (460 to 490 ft) below land surface and flows approximately S 30°E (Veni, 1980b). Groundwater moves in the same general direction as the slope of the land and the dip of the strata. Alluvium and terrace deposits also represent minor aquifers.

Groundwater is recharged principally by stream runoff, infiltration of precipitation at the surface, and underflow from adjoining areas. Stream runoff from mountainous areas penetrates the gravels in canyons and foothills of valleys. A large amount of recharge occurs at outcrops of jointed limestone. The amount of underflow into this area is unknown, but probably is not large. Groundwater is discharged naturally by springs and underflow to the south and southeast and artificially by wells (Davis and Leggatt, 1965).

SAMPLE COLLECTION

CHRONOLOGY OF THE SURVEY

The Dryden project area was sampled by UCC-ND personnel in February 1980. Laboratory analyses 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 34 groundwater and 78 stream sediment samples was collected during the detailed sampling of the Dryden project area. Well water 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.

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, 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 in the microfiche in Appendix D.

Radiometric data were obtained using a GR-410 Exploranium Geometrics Gamma-Ray Spectrometer and BGS-1SL Scintrex Scintillation Counters. The readings obtained were used in directing sampling toward geologic units with positive anomalous radioactivity.

CONTAMINATION

Precautions were taken to avoid the possibility of collecting contaminated samples. Wells which were affected by any chlorination, water-softening, or filtering devices were not sampled if a sample could not 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 the samplers 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. Visible signs of possible contamination were noted on the field form.

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 (1979). All observed data from all samples are included on microfiche in Appendix D.

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. One groundwater sample (029754) was submitted for reanalysis. The original results were compared to the results from reanalysis. Of the more than 25 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 multielement values. This low error rate for the samples indicates a high level of reliability for the laboratory measurements.

Table 1

DETECTION LIMITS OF VARIABLES DETERMINED IN WATER AND SEDIMENT SAMPLES

Variable	Method	Detection Limits Sediment (ppm)	Detection Limits Water (ppb)
U-FL	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.

Table 2

SUMMARY OF THE MEASUREMENTS CONTROL RESULTS OBTAINED WITH GROUNDWATER SAMPLES FROM THE DRYDEN 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 THE MEASUREMENTS CONTROL RESULTS OBTAINED WITH STREAM SEDIMENT SAMPLES FROM THE DRYDEN 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.

GEOCHEMICAL RESULTS

GEOCHEMICAL DISTRIBUTIONS IN GROUNDWATER

Sample site locations for groundwater collected in the Dryden project area of the Trans-Pecos detailed geochemical survey are shown on Plate 1. Areal distribution plots 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 4. 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 uranium:specific conductance ratio, silver, calcium, boron, potassium, magnesium, strontium, sulfate, and chloride are listed in Table A-3. The figures in Appendix A present log frequency, lognormal probability, percentile and areal distribution plots for these same variables and the 1,000·uranium:boron, and 1,000·uranium:sulfate ratios, barium, lithium, manganese, molybdenum, and sodium.

The correlation matrix for groundwater geochemistry of the Dryden project area is presented in Table A-2; however, due to the limited number of groundwater samples, Table A-2 has not been used to interpret hydrogeochemistry. Discussion of groundwater geochemistry is given on a sample by sample basis, using the areal distribution plots as a guide to interpretation.

The three samples displaying the highest values for uranium occur in the southwestern corner of the project area. Producing horizons for these groundwater samples are unknown. However, the wells produce from below the Lower - Upper Cretaceous (Comanchean - Gulfian) boundary; the presumed stratigraphic sequence displaying above background radioactive readings (LKB Resources, Inc., 1979). Sample 029711 (lat. 30°06' N. and long. 102°14' W.) has the highest uranium value in the project area (6.42 ppb). Sample 029648 (lat. 30°04' N. and long. 102°11' W.) has 5.05 ppb uranium, and Sample 029644 (lat. 30°05' N. and long. 102°11' W.) has 4.99 ppb uranium. The specific conductance values for these three samples are 536, 450, and 470 µmhos/cm, respectively.

These three samples display relatively high uranium:specific conductance ratio values (Figure A-3b) and high boron (Figure A-7b), chloride (Figure A-17b), potassium (Figure A-10b), magnesium (Figure A-12b), strontium (Figure A-16b), and sulfate (Figure A-18b) values. Sample 029711 displays the highest observed value for magnesium (26.2 ppm) and the lowest value for barium (28.0 ppb) (Figure A-8b).

The areal distribution plots for calcium (Figure A-9b) and manganese (Figure A-13b) indicate that concentrations of these elements with the three high uranium values are relatively low.

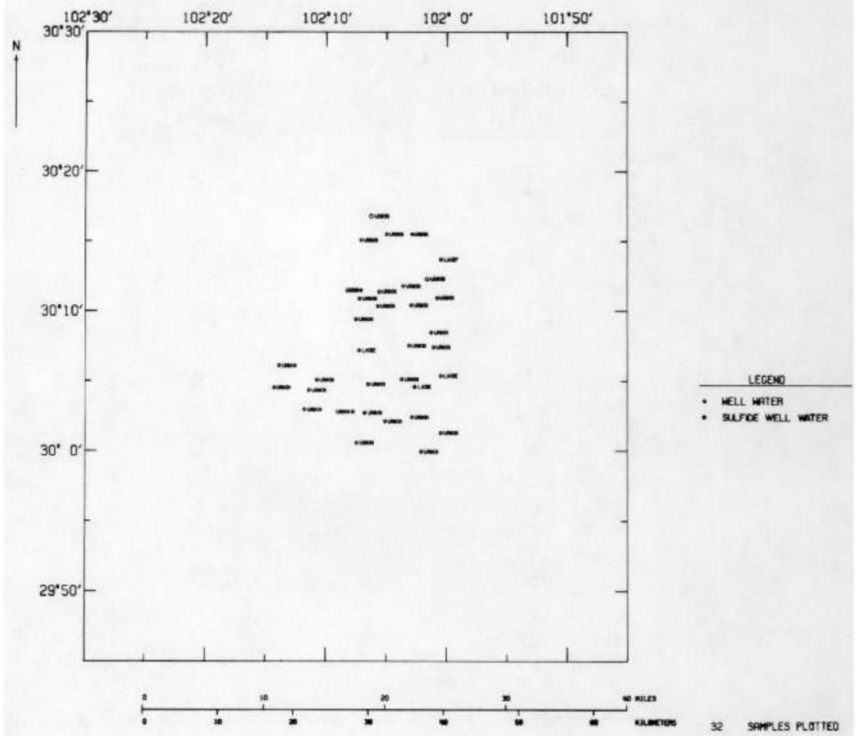

Figure 4

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

Table 4

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

Geologic Unit Code[a]	No. of Groundwater Sample	No. of Sediment Samples	No. of Radiometric Samples
QD	3	5	0
UKBO	3	1	0
UKW	21	54	4
LKLB	7	14	4
LKSE	0	0	0
LKF	0	4	4
Total	34	78	12

[a]See Figure 3 for unit names.

When relating the hydrogeochemical data for the Terrell project area to that of the Dryden project area, it appears that high uranium concentrations in the Dryden area are part of a transitional zone between high uranium values to the west (in the Terrell project area) and low values to the east. Relatively low values for lithium (Figure A-11b), sodium (Figure A-15b), and specific conductance and high values for magnesium do correspond between the two project areas. However, for samples with anomalously high uranium, the sulfate values in the Terrell project area are relatively low, while in the Dryden project area, the values are high. To delineate this trend, further study would be required west of the Dryden project area.

Three of the lowest uranium values are displayed by Samples 029754 (<0.20 ppb), 029774 (0.22 ppb), and 029762 (0.39 ppb). These samples were obtained from unknown geologic units. Specific conductance values for these samples are 866, 492, and 460 μmhos/cm, respectively.

Sample 029754 (lat. 30°03' N. and long. 102°07' W.) displays relatively high values for many of the measured variables, i.e., boron (183 ppb) (Figure A-7b), potassium (7.2 ppm) (Figure A-10b), lithium (151 ppb) (Figure A-11b), sodium (74.4 ppm), (Figure A-15b), strontium (16,794 ppb) (Figure A-16b), chloride (82 ppm) (Figure A-17b), and sulfate (64 ppm) (Figure A-18b). The association of these variables probably indicates a carbonate/saline influence upon the geochemistry of the groundwater represented by this sample.

Areal distribution plots for uranium:specific conductance (Figure A-3b), uranium:boron (Figure A-4b), and uranium:sulfate (Figure A-5b) ratios, and for calcium (Figure A-9b) indicate that values for these variables are lowest for Sample 029754 which represents a converted oil test well. Molybdenum (Figure A-14b) is also low for this sample. Sample 029774 (lat. 30°11' N. and long. 102°01' W.) has a high dissolved solids content in that it displays high values for boron (Figure A-7b), lithium (Figure A-11b), magnesium (Figure A-12b), manganese (Figure A-13b), sodium (Figure A-15b), strontium (Figure A-16b), and sulfate (Figure A-18b). Areal distribution plots for the uranium:specific conductance (Figure A-3b), uranium:boron (Figure A-4b), and uranium:sulfate (Figure A-5b) ratios, and for barium (Figure A-8b) and molybdenum (Figure A-14b) indicate that values for these variables are relatively low for this sample.

Sample 029762 (lat. 30°10' N. and long. 102°06' W.) displays high values for lithium (Figure A-11b), magnesium (Figure A-12b), strontium (Figure A-16b), and sulfate (Figure A-18b). Areal distribution plots for the uranium:specific conductance (Figure A-3b), uranium:boron (Figure A-4b), and uranium:sulfate (Figure A-5b) ratios and for molybdenum (Figure A-14b) indicate values for these variables are relatively low for this sample.

A number of samples displays relatively high values for base and precious metal elements [i.e., silver (Figure A-6b)]; however the uranium values of these samples are average for the Dryden project area.

Summary of Groundwater Data

Three samples collected from the southwestern corner of the Dryden project area display the highest values for uranium. Areal distribution plots for the uranium:specific conductance ratio, boron, chloride, potassium, magnesium, strontium, and sulfate indicate that values for these variables are relatively high for these three samples. When relating the hydrogeochemical data for the Terrell project area to that of the Dryden project area, it appears that high uranium concentrations in the Dryden area are part of a transitional zone between high uranium values to the west (in the Terrell project area) and low values to the east. Due to their position, the Dryden groundwater samples exhibiting high uranium values have high concentrations in a different suite of variables than in the Terrell project area. Additional sampling west of the Dryden project area may help in defining northward continuations of hydrogeochemical trends.

Producing horizons for the three high uranium values are unknown. They are presumed to be below the Lower-Upper Cretaceous (Comanchean-Gulfian) contact (LKLB/UKBO), which is considered the stratigraphic sequence displaying anomalous radioactive readings designated by the aerial reconnaissance survey (LKB Resources, Inc., 1979).

GEOCHEMICAL DISTRIBUTION IN STREAM SEDIMENTS

Sample site locations from which stream sediment samples were collected in the Dryden project area are shown on Plate 4. Symbol plots for hot-acid-soluble uranium determined by fluorometric analysis (U-FL), and thorium are presented on Plates 5 and 6, and Figures B-1b and B-4b, respectively. Stream sediment data used to generate tables and figures in Appendix B include all samples collected for the Trans-Pecos detailed geochemical survey in the Dryden project area. Table 3 presents the number of sediment samples collected from each of the major stratigraphic units in the project area.

Observed data for the variables soluble uranium, total uranium by neutron activation (U-NT), the U-FL:U-NT ratio, thorium, Th:U-NT ratio, arsenic, lithium, molybdenum, nickel, strontium, 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 variables as well as for barium, calcium, copper, potassium, magnesium, manganese, sodium, phosphorus, scandium, selenium, titanium, and zirconium. Data for all sediment samples are included on microfiche in Appendix D.

Uranium

The areal distribution plots for U-FL and U-NT (Plate 5 and Figures B-1b and B-2b, respectively) and percentile plots (Figures B-1a and B-2a, respectively) indicate that concentrations ≅87th percentile (>2.57 ppm) for U-FL and ≅94 percentile (>2.8 ppm) for U-NT occur in the southeast corner of the project area (lat. 30°00' to 30°05' N. and long. 102°00' to 102°07' W.). This area of high uranium values is dominated by the Del Rio Clay-Buda Limestone (LKLB) and the Lower Boquillas Formation (UKBO).

The anomalous concentrations of uranium, located in the southeastern corner of the Dryden project area, represent the northern extension of the anomalous area of uranium concentrations outlined in the Terrell project area (Butz, et al, 1979). Within the Terrell project area, the area of anomalous concentrations (U-FL >2.57 ppm, U-NT >3.35 ppm) is present east of long. 102°10' W. and extends from the Rio Grande north into the Dryden project area. The northern limit of this anomalous uranium trend coincides with the northern limit of the Lower Boquillas Formation (UKBO).

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

The U-FL:U-NT ratio (Figure B-3b) for the Dryden samples indicates that the uranium present in the southeastern corner of the project area is of a soluble (mobile) type. The anomalous region within the Terrell project area has a similar characteristic.

The correlation matrix (Table B-2) indicates significant positive Spearman and Pearson correlations (≧0.30) between the natural log of U-FL and the natural logs of U-FL:U-NT (shown as LUTU) and U-NT. Significant negative correlations (≦-0.25) are indicated between the natural log of U-FL and the natural logs of barium, sodium, and manganese. Significant positive Spearman and Pearson correlations exist between the natural log of U-NT and the natural logs of U-FL, arsenic, strontium, lithium, vanadium, nickel, phosphorus, zinc, and iron.

Thorium

The major rock types in the Dryden project area are limestones and clays. The calculated average thorium concentrations for these two rock types are 1.1 and 13.1 ppm, respectively (Rogers and Adams, 1969). The north-central section of the project area (lat. 30°13' N. and long. 102°06' W.) has the highest values for thorium (>11.0 ppm). Values in the southeastern corner of the project area are >3.0 and <13.0 ppm. The rock types in the Dryden project area are not expected to have high thorium values since thorium does not fit well into the carbonate lattice, nor is thorium easily soluble or capable of being incorporated in clays in distal depositional environments. Because of the difference in geochemical mobility in the secondary environment, thorium probably does not follow uranium in this geologic environment. Data from the Terrell project area substantiate this in that thorium values are low throughout the project area, with the highest values occurring west of the established anomalous uranium area.

The correlation matrix (Table B-3) indicates a significant positive correlation (a Spearman and Pearson correlation coefficient ≧0.30) between the natural log of thorium and the natural logs of the thorium: U-NT ratio and cerium. Significant positive Pearson correlations exist between the natural log of thorium and the natural log of cobalt.

Figure B-5b, an areal distribution plot for the thorium:U-NT ratio, can be used to delineate those areas which may have been depleted or enriched in uranium relative to thorium. Values of the thorium:uranium ratio for sedimentary rocks vary from 1.0 for carbonates to 3.4 to 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 (≦1.80 for example) might indicate uranium enrichment with respect to thorium.

Within the Dryden project area, samples located in the southeastern corner (corresponding to the area of high uranium values) have the lowest thorium:uranium ratios. The percentile plot for the thorium:U-NT ratio (Figure B-5a) indicates that the lowest values occur in sediment samples derived from the Del Rio Clay-Buda Limestone (LKLB) and the Lower Boquillas Formation (UKBO). Although values for the thorium: uranium ratio would be expected to be higher in this area (due to the greater clay quantity in the LKLB), values are below average for the rock-type which suggests possible uranium enrichment relative to thorium in the southeastern corner of the Dryden project area. Thorium:uranium ratios increase northward within the Dryden project area.

Related Variables

The variables defined as being associated with the area of anomalous uranium values in the Terrell project area include arsenic, calcium, molybdenum, nickel, strontium, phosphorus, selenium, copper, and vanadium. Elements having a negative association with the anomalous area include potassium, magnesium, manganese, sodium, and titanium (Butz, et al, 1979).

The variables associated with the high uranium values in the Dryden project area (defined as the southeastern corner) include arsenic (Figure B-6b), calcium (Figure B-8b), lithium (Figure B-11b), molybdenum (Figure B-14b), nickel (Figure B-16b), phosphorus (Figure B-17b), selenium (Figure B-19b), strontium (Figure B-20b), and vanadium (Figure B-22b). Variables which have relatively low values within the area of high uranium values include potassium (Figure B-10b), magnesium (Figure B-12b), sodium (Figure B-15b), manganese (Figure B-13b), and titanium (Figure B-21b).

The association of minor and trace elements such as arsenic, selenium, molybdenum, vanadium, nickel, and strontium 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). The element correspondence between the Terrell project area and the Dryden project area demonstrates that the anomalous area in the Dryden project area represents the northern extension of the anomalous uranium area defined in the Terrell project area.

For each of the above mentioned elements, the percentile plots indicate that the Del Rio Clay-Buda Limestone (LKLB) and the Lower Boquillas Formation (UKBO) are the formations which contain the anomalous concentrations of the uranium-related variables. Examination of the areal distribution plots for these elements in conjunction with the geologic map of the area (Figure 3 and Plate 7) indicates that the area displaying anomalous concentrations of uranium and associated minor and trace elements closely approximate the outcrop pattern of the Lower Boquillas Formation (UKBO). The aerial radiometric survey for the Big Bend area (LKB Resources, Inc., 1979) indicates that the preferred uranium anomalies defined in both the Dryden and Terrell project areas are associated with the contact between the Del Rio Clay and the Lower Boquillas Formation.

A second geochemical boundary exists in the Dryden project area north of the area where anomalous uranium values were found. This boundary (trending east-west at approximately lat. 30°07' N.) is defined by the variables U-NT (≧2.30 ppm) (Figure B-2b); barium (≧400.00 ppm) (Figure B-7b); copper (≧12.0 ppm) (Figure B-9b); potassium (≧0.86%) (Figure B-10b); magnesium (≧0.51%) (Figure B-12b); sodium (≧0.30%) (Figure B-15b); nickel (≧16.0 ppm) (Figure B-16b); phosphorus (≧600 ppm) (Figure B-17b); scandium (≧5.0 ppm) (Figure B-18b); titanium (≧1,900.0 ppm) (Figure B-21b); and zirconium (≧60.0 ppm) (Figure B-23b).

This geochemical boundary reflects the location of the Terrell Arch in the Dryden project area. Cristner and Wheeler (1918) and Freeman (1968) have noted the areal extent of the Del Rio Clay in Terrell County. From the Rio Grande (lat. 29°46' N. and long. 101°53' W.), the Del Rio Clay is exposed west and south of an arcuate line trending north and west through Watkins Siding (lat. 29°59' N. and long. 101°56' W.) to the

Kerr Ranch Headquarters (lat. 30°07'35" N. and long. 102°06'30" W.) south of Eight Mile Draw. The extent of the Del Rio Clay outcrop closely approximates the geochemical front described by the above mentioned elements. The absence of the Del Rio Clay north of this line represents the influence of the Terrell Arch within the Dryden project area.

Summary of Stream Sediment Data

Stream sediment samples exhibiting anomalous concentrations of uranium in the Dryden project area also contain anomalous concentrations of the common uranium-related variables arsenic, calcium, lithium, molybdenum, nickel, phosphorus, selenium, strontium, and vanadium. Samples exhibiting these anomalous values occur in the southeastern corner of the Dryden project area and are considered to be the northern extension of the anomalous uranium trend defined in the Terrell project area. In both areas, the above background concentrations of uranium correspond areally to the area of outcrop of the Lower Boquillas Formation (UKBO).

A second geochemical boundary is defined by minor and trace elements (trending east-west at lat. 30°07' N.) within the Dryden project area. This line approximates the northern limit of outcrop of the Del Rio Clay (LKLB). Both the geological extent of the Del Rio Clay and the stream sediment geochemistry (for elements U-NT, barium, copper, potassium, magnesium, sodium, nickel, phosphorus, scandium, titanium, and zirconium) define the position of the western side of the Terrell Arch.

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APPENDIX A

GROUNDWATER

APPENDIX A

GROUNDWATER

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Table A-1

STATISTICAL SUMMARY FOR GROUNDWATER OF THE DRYDEN 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	33	1	<0.20	<0.20	6.42	3.15	3.21	3.50	1.222	0.388	1.01	0.67	0.98	0.96
SP	34			291	893	488	463	550	121.1	0.2	6.17	0.22	6.16	0.25
U/SP	34			0.12	11.97	6.64	6.54	8.04	3.071	0.462	1.65	0.96	1.75	1.00
U/B	34			0.55	77.80	42.74	44.44	47.58	17.973	0.421	3.50	1.03	3.60	1.04
U/SO	34			1.56	884.00	215.32	191.92	244.71	153.920	0.715	4.99	1.24	5.07	1.35
AG	19	15	<2	<2	25	9	3	<2	6.3	0.7	2.00	0.73		
AL	5	29	<10	<10	13	11	<10	<10	1.4	0.1	2.39	0.13		
AS	6	28	<0.5	<0.5	1.0	0.7	<0.5	<0.5	0.18	0.26	-0.38	0.25		
B	34			38	183	78	75	82	25.6	0.3	4.32	0.29	4.31	0.28
BA	34			28	129	52	46	42	21.3	0.4	3.90	0.36	3.89	0.37
BE	0	34	<1	<1	<1		<1	<1						
CA	34			38.8	86.0	53.3	51.3	55.3	9.67	0.18	3.96	0.17	3.96	0.19
CO	12	22	<2	<2	5	3	<2	<2	1.3	0.4	1.05	0.41		
CR	7	27	<4	<4	8	5	<4	<4	1.3	0.2	1.72	0.22		
CU	12	22	<2	<2	7	3	<2	<2	1.5	0.5	1.01	0.41		
FE	0	34	<10	<10	<10		<10	<10						
K	34			0.7	7.2	2.0	1.8	1.2	1.17	0.60	0.56	0.48	0.54	0.46
LI	34			6	151	17	13	13	24.6	1.4	2.60	0.59	2.55	0.57
MG	34			9.4	26.2	17.9	19.3	21.8	4.96	0.28	2.84	0.30	2.85	0.30
MN	27	7	<2	<2	37	9	<2	<2	9.1	0.9	1.81	1.00		
MO	21	13	<4	<4	19	9	6	<4	4.4	0.5	2.16	0.43		
NA	34			2.7	74.4	13.6	11.1	9.7	11.75	0.87	2.43	0.56	2.41	0.52
NI	14	20	<4	<4	16	7	<4	<4	3.8	0.5	1.90	0.48		
P	1	33	<40	<40	41	41	<40	<40	0.0	0.0	3.71	0.0		
SC	0	34	<1	<1	<1		<1	<1						
SE	7	27	<0.2	<0.2	0.4	0.3	<0.2	<0.2	0.09	0.31	-1.30	0.32		
SI	34			3.4	10.0	6.9	7.0	7.4	1.21	0.17	1.92	0.19	1.93	0.17
SR	34			165	16794	1012	397	403	2806.2	2.8	6.24	0.80	6.17	0.60
TI	0	34	<2	<2	<2		<2	<2						
V	9	25	<4	<4	8	5	<4	<4	1.5	0.3	1.70	0.27		
Y	11	23	<1	<1	2	1	<1	<1	0.3	0.3	0.06	0.21		
ZN	34			7	557	145	103	25	138.4	1.0	4.41	1.23	4.43	1.27
ZR	15	19	<2	<2	11	4	<2	<2	2.6	0.6	1.37	0.51		
T-AK	34			132	278	206	200	218	29.6	0.1	5.32	0.15	5.32	0.16
M-AK	34			123	271	203	200	180	30.3	0.1	5.30	0.15	5.31	0.17
P-AK	34			0	11	0	0	0	2.7	3.4				
CL	27	7	<10	<10	82	17	12	15	14.0	0.8	2.71	0.45	2.50	0.53
NA/C	34			0.54	2.22	0.99	0.83	0.77	0.350	0.353	-0.06	0.30	-0.07	0.30
PH	34			5.7	8.3	7.5	7.5	7.5	0.52	0.07				
SO4	33	1	<5	<5	64	20	16	12	12.1	0.6	2.89	0.49	2.85	0.59

NOTE: Refer to Table 1, Page 27 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table A-2

CORRELATION MATRIX FOR GROUNDWATER OF THE DRYDEN PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

	L-U	LUSP	LU/B	LUSO	L-CU	LN/C	L-CA	L-MG	PH	L-B	L-NA
L-U	1.00 (33)										
LUSP	0.96*** 0.84*** (33)	1.00 (34)									
LU/B	0.95*** 0.62*** (33)	0.96*** 0.65*** (34)	1.00 (34)								
LUSO	0.84*** 0.37** (33)	0.89*** 0.36** (34)	0.95*** 0.60*** (34)	1.00 (34)							
L-CU	-0.61@ -0.64@ (12)	-0.46@ -0.52@ (12)	-0.44@ -0.37@ (12)	-0.46@ -0.41@ (12)	1.00 (12)						
LN/C	-0.42** -0.28 (33)	-0.31* -0.36** (34)	-0.29* -0.22 (34)	-0.30* -0.17 (34)	0.32@ 0.38@ (12)	1.00 (34)					
L-CA	-0.11 -0.45*** (33)	0.12 -0.36** (34)	0.26 0.07 (34)	0.38** 0.36** (34)	0.22@ 0.36@ (12)	-0.20 -0.09 (34)	1.00 (34)				
L-MG	-0.06 0.34* (33)	-0.18 0.17 (34)	-0.28 -0.01 (34)	-0.38** -0.26 (34)	-0.13@ -0.24@ (12)	0.34* 0.33* (34)	-0.74*** -0.74*** (34)	1.00 (34)			
PH	-0.11 0.00 (33)	-0.13 0.01 (34)	-0.22 -0.34** (34)	-0.22 -0.38** (34)	-0.24@ -0.26@ (12)	0.23 0.27 (34)	-0.36** -0.55*** (34)	0.46*** 0.49*** (34)	1.00 (34)		
L-B	-0.16 0.05 (33)	-0.52*** -0.11 (34)	-0.67*** -0.68*** (34)	-0.68*** -0.52*** (34)	-0.04@ 0.03@ (12)	0.14 0.04 (34)	-0.54*** -0.46*** (34)	0.42** 0.40** (34)	0.34** 0.42** (34)	1.00 (34)	
L-NA	-0.16 0.11 (33)	-0.55*** -0.10 (34)	-0.67*** -0.60*** (34)	-0.72*** -0.54*** (34)	-0.27@ -0.23@ (12)	0.12 0.03 (34)	-0.53*** -0.39** (34)	0.34* 0.32* (34)	0.26 0.34* (34)	0.94*** 0.91*** (34)	1.00 (34)
L-LI	-0.49*** -0.09 (33)	-0.76*** -0.21 (34)	-0.85*** -0.65*** (34)	-0.84*** -0.55*** (34)	0.22@ 0.18@ (12)	0.33* 0.46*** (34)	-0.53*** -0.52*** (34)	0.50*** 0.55*** (34)	0.37** 0.54*** (34)	0.85*** 0.84*** (34)	0.83*** 0.76*** (34)
L-SR	-0.35** 0.03 (33)	-0.72*** -0.13 (34)	-0.80*** -0.52*** (34)	-0.81*** -0.54*** (34)	0.02@ 0.20@ (12)	0.27 0.39** (34)	-0.60*** -0.62*** (34)	0.60*** 0.71*** (34)	0.37** 0.58*** (34)	0.87*** 0.82*** (34)	0.83*** 0.70*** (34)
LSO4	-0.36** 0.05 (32)	-0.55*** -0.01 (33)	-0.64*** -0.25 (33)	-0.80*** -0.60*** (33)	-0.07@ -0.08@ (12)	-0.01 -0.01 (33)	-0.53*** -0.52*** (33)	0.52*** 0.44*** (33)	0.21 0.30* (33)	0.70*** 0.54*** (33)	0.73*** 0.64*** (33)
L-CL	0.26 0.24 (26)	-0.43** 0.01 (27)	-0.48** -0.23 (27)	-0.47** -0.23 (27)	-0.41@ -0.33@ (10)	-0.22 -0.27 (27)	-0.26 -0.13 (27)	0.26 0.19 (27)	0.20 0.09 (27)	0.79*** 0.68*** (27)	0.88*** 0.79*** (27)
L-SP	-0.02 -0.00 (33)	-0.52*** -0.51*** (34)	-0.40** -0.25 (34)	-0.32* -0.12 (34)	-0.02@ -0.05@ (12)	0.15 0.07 (34)	-0.02 0.08 (34)	0.05 0.03 (34)	-0.03 -0.06 (34)	0.44*** 0.28 (34)	0.48*** 0.31* (34)
L-MO	-0.23 -0.14 (20)	0.42* 0.25 (21)	0.40* 0.16 (21)	0.45** 0.35 (21)	-0.48@ -0.42@ (8)	0.15 0.03 (21)	0.29 0.19 (21)	-0.15 -0.21 (21)	0.28 0.27 (21)	-0.47** -0.40* (21)	-0.54** -0.38* (21)
L-BA	0.19 -0.01 (33)	-0.01 -0.22 (34)	0.07 -0.12 (34)	0.16 0.19 (34)	0.18@ 0.09@ (12)	0.25 0.17 (34)	0.02 0.06 (34)	-0.09 -0.05 (34)	0.09 0.05 (34)	-0.05 -0.07 (34)	-0.13 -0.27 (34)
L-SI	0.35** -0.04 (33)	0.29* 0.03 (34)	0.35** 0.03 (34)	0.48*** 0.46*** (34)	0.00@ -0.15@ (12)	-0.19 -0.30* (34)	0.39** 0.34* (34)	-0.39** -0.40** (34)	-0.12 -0.12 (34)	-0.18 -0.22 (34)	-0.22 -0.40** (34)
L-K	-0.41** -0.33* (33)	-0.58*** -0.28 (34)	-0.60*** -0.17 (34)	-0.57*** -0.25 (34)	0.20@ 0.21@ (12)	0.25 0.35** (34)	-0.23 -0.24 (34)	0.56*** 0.54*** (34)	0.38** 0.37** (34)	0.34** 0.16 (34)	0.19 -0.03 (34)
LTAK	-0.19 -0.29* (33)	-0.19 -0.37** (34)	-0.11 -0.00 (34)	-0.02 0.20 (34)	0.34@ 0.14@ (12)	0.20 0.29* (34)	0.29* 0.20 (34)	0.25 0.25 (34)	0.02 0.04 (34)	-0.19 -0.20 (34)	-0.33* -0.38** (34)
L-AG	0.45* 0.06 (19)	0.39* 0.08 (19)	0.48** 0.19 (19)	0.41* -0.01 (19)	0.49@ 0.46@ (6)	-0.07 -0.06 (19)	0.16 0.03 (19)	-0.42* -0.44* (19)	0.08 0.19 (19)	-0.34 -0.35 (19)	-0.20 -0.19 (19)
L-MN	-0.33 -0.28 (26)	-0.21 -0.12 (27)	-0.25 -0.35* (27)	-0.24 -0.16 (27)	-0.05@ -0.19@ (8)	-0.11 -0.10 (27)	0.10 0.02 (27)	0.11 -0.04 (27)	0.32 0.26 (27)	0.10 0.10 (27)	0.05 0.07 (27)
L-SE	-0.72@ -0.57@ (7)	-0.84@ -0.76@ (7)	-0.04@ -0.06@ (7)	0.48@ 0.26@ (7)	-1.00@ -1.00@ (4)	-0.39@ -0.26@ (7)	0.54@ 0.53@ (7)	-0.45@ -0.45@ (7)	0.28@ 0.12@ (7)	-0.56@ -0.60@ (7)	-0.55@ -0.42@ (7)

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-LI	L-SR	LSO4	L-CL	L-SP	L-NO	L-BA	L-SI	L-K	LTAK	L-AG	L-MN	L-SE
L-LI	1.00 (34)												
L-SR	0.96*** 0.92*** (34)	1.00 (34)											
LSO4	0.69*** 0.52*** (33)	0.74*** 0.58*** (33)	1.00 (33)										
L-CL	0.62*** 0.31 (27)	0.70*** 0.40** (27)	0.55*** 0.43** (27)	1.00 (27)									
L-SP	0.43** 0.20 (34)	0.49*** 0.23 (34)	0.22 0.05 (33)	0.48** 0.27 (27)	1.00 (34)								
L-NO	-0.48** -0.34 (21)	-0.51** -0.33 (21)	-0.47** -0.43* (21)	-0.31 0.01 (16)	-0.56*** -0.46** (21)	1.00 (21)							
L-BA	-0.02 -0.04 (34)	-0.02 -0.04 (34)	-0.39** -0.44*** (33)	-0.02 -0.13 (27)	0.32* 0.34** (34)	-0.15 -0.10 (21)	1.00 (34)						
L-SI	-0.37** -0.39** (34)	-0.35** -0.40** (34)	-0.54*** -0.68*** (33)	0.05 -0.06 (27)	0.15 -0.04 (34)	-0.04 0.25 (21)	0.49*** 0.57*** (34)	1.00 (34)					
L-K	0.63*** 0.38** (34)	0.66*** 0.48*** (34)	0.50*** 0.29 (33)	0.34* -0.06 (27)	0.18 -0.06 (34)	-0.22 -0.08 (21)	0.06 -0.00 (34)	-0.38** -0.32* (34)	1.00 (34)				
LTAK	0.01 -0.08 (34)	0.03 0.02 (34)	-0.18 -0.31* (33)	0.05 -0.17 (27)	0.07 0.06 (34)	0.23 0.07 (21)	0.24 0.31* (34)	0.03 0.06 (34)	0.51*** 0.60*** (34)	1.00 (34)			
L-AG	-0.47** -0.37 (19)	-0.45* -0.35 (19)	-0.25 -0.14 (19)	0.05 -0.08 (15)	0.08 -0.02 (19)	0.22@ 0.25@ (12)	-0.00 -0.17 (19)	0.03 0.05 (19)	-0.43* -0.34 (19)	-0.25 -0.18 (19)	1.00 (19)		
L-MN	0.11 0.05 (27)	0.06 0.06 (27)	-0.01 -0.01 (26)	-0.02 -0.00 (20)	-0.18 -0.12 (27)	0.33 0.33 (17)	-0.15 -0.18 (27)	-0.35* -0.26 (27)	0.24 0.23 (27)	0.44** 0.34* (27)	-0.24 -0.15 (17)	1.00 (27)	
L-SE	-0.52@ -0.41@ (7)	-0.67@ -0.62@ (7)	-0.52@ -0.57@ (6)	-0.13@ -0.23@ (6)	0.58@ 0.50@ (7)	0.95@ 1.00@ (3)	0.30@ 0.0 @ (7)	0.18@ 0.17@ (7)	0.12@ 0.04@ (7)	0.50@ 0.51@ (7)	0.95@ 0.87@ (3)	-0.13@ -0.14@ (6)	1.00 (7)

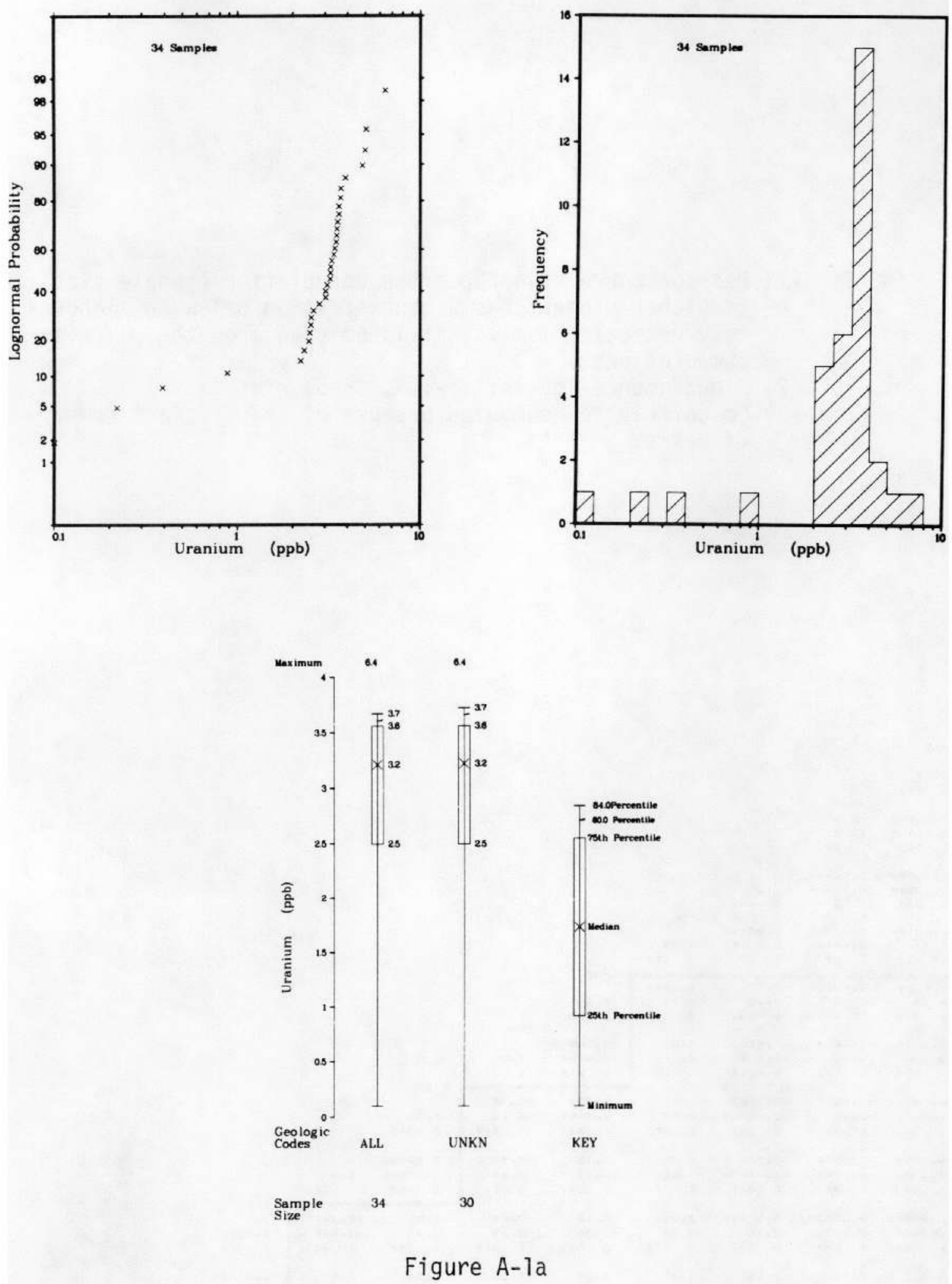


Figure A-1a

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

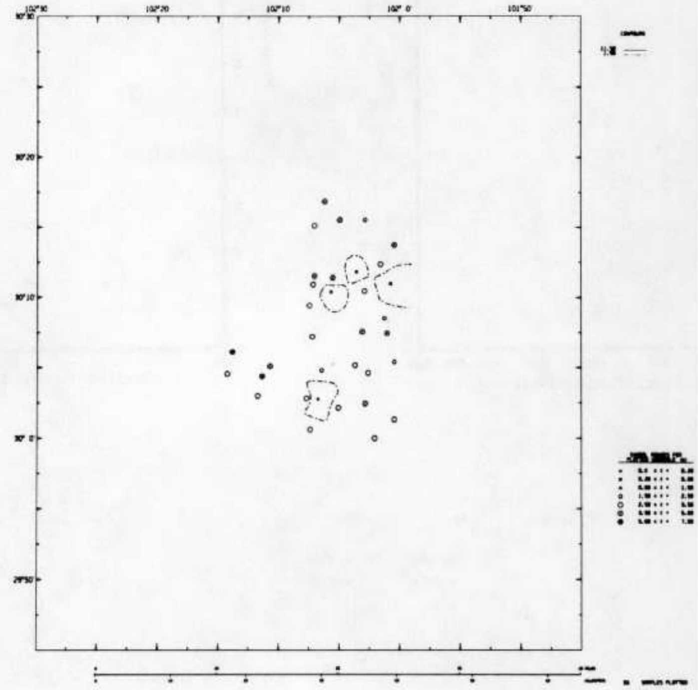


Figure A-1b

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

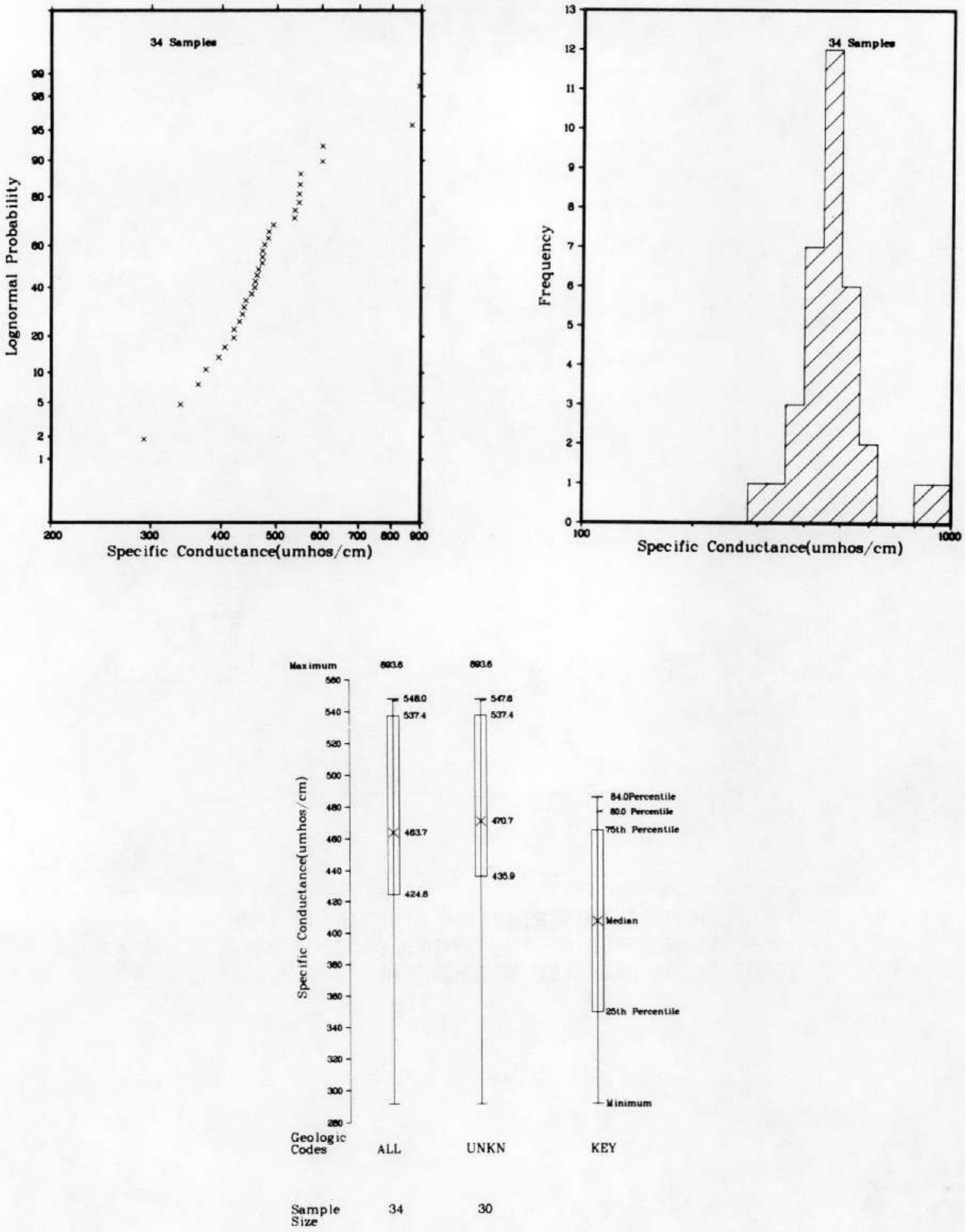


Figure A-2a

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

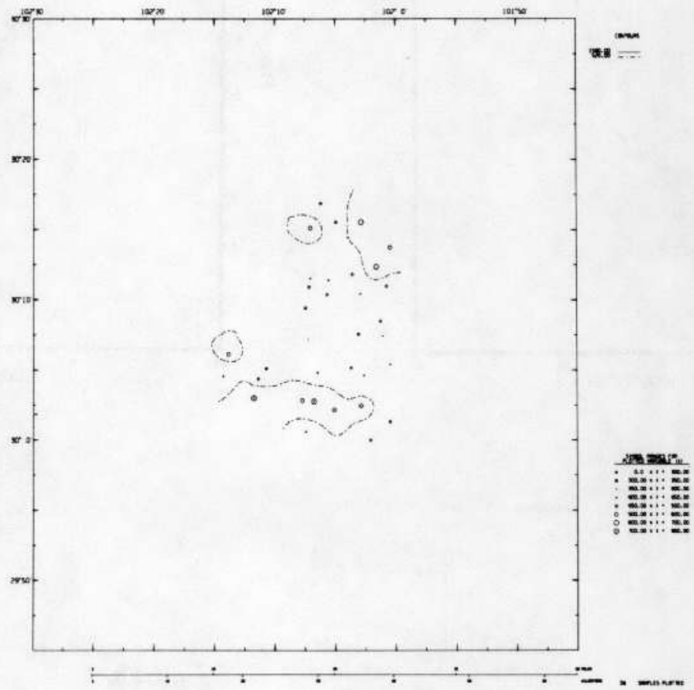


Figure A-2b

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

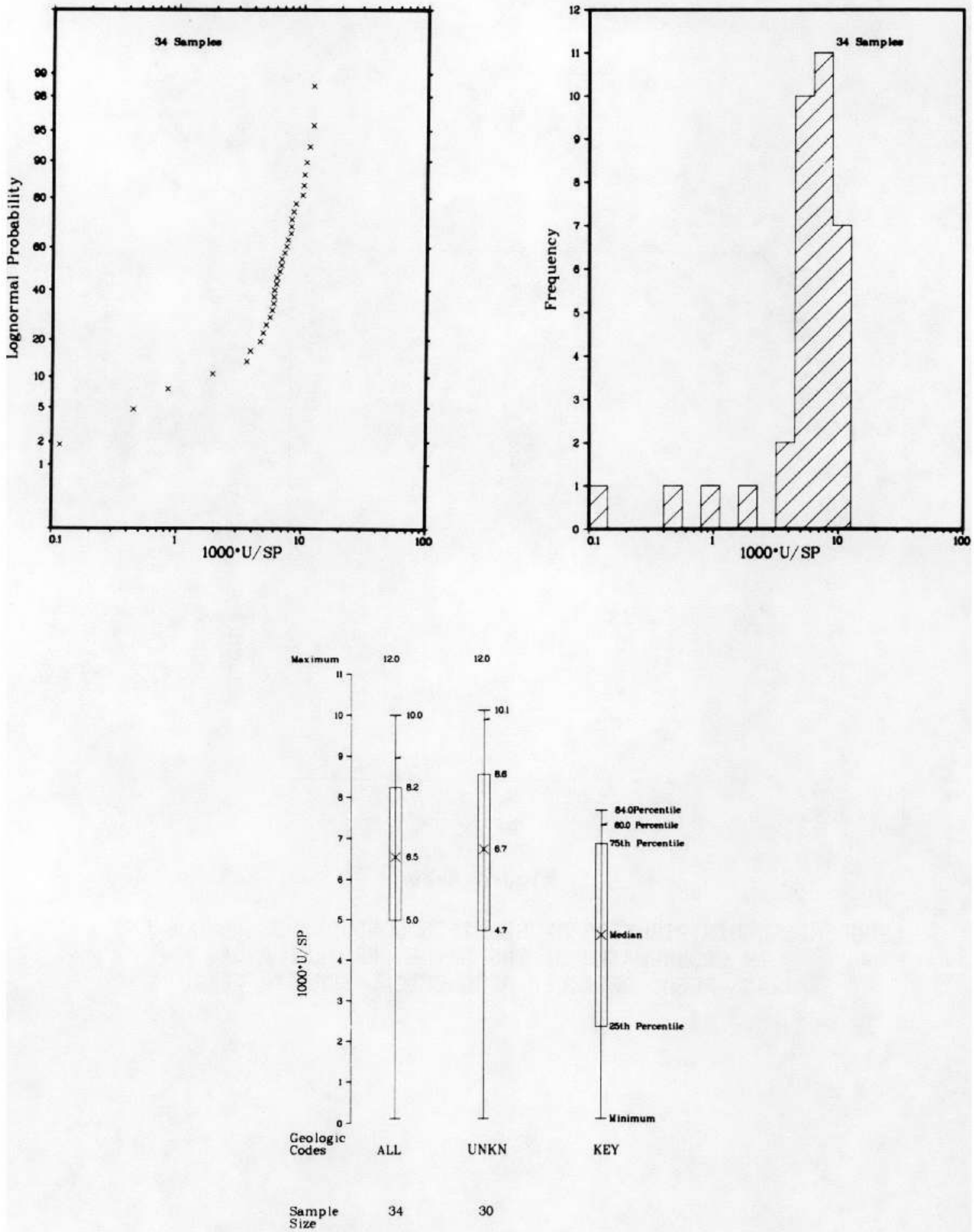


Figure A-3a

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

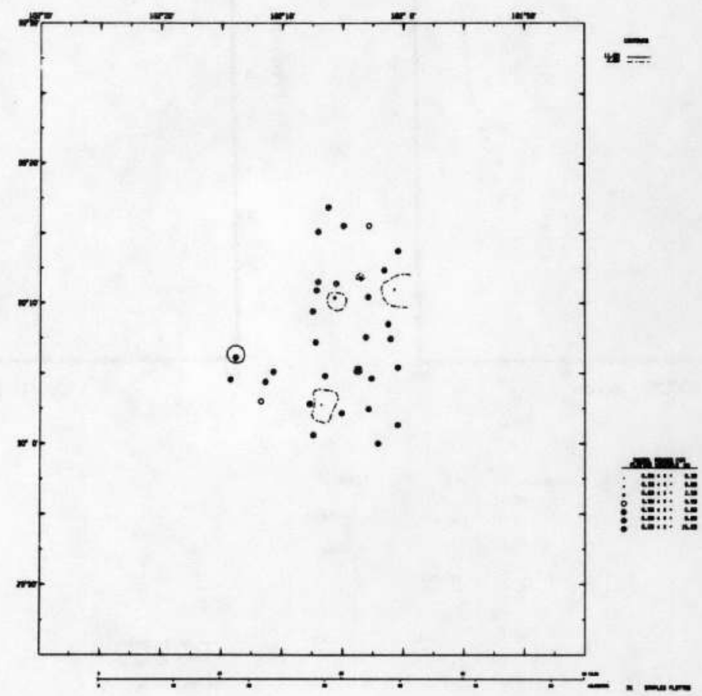


Figure A-3b

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

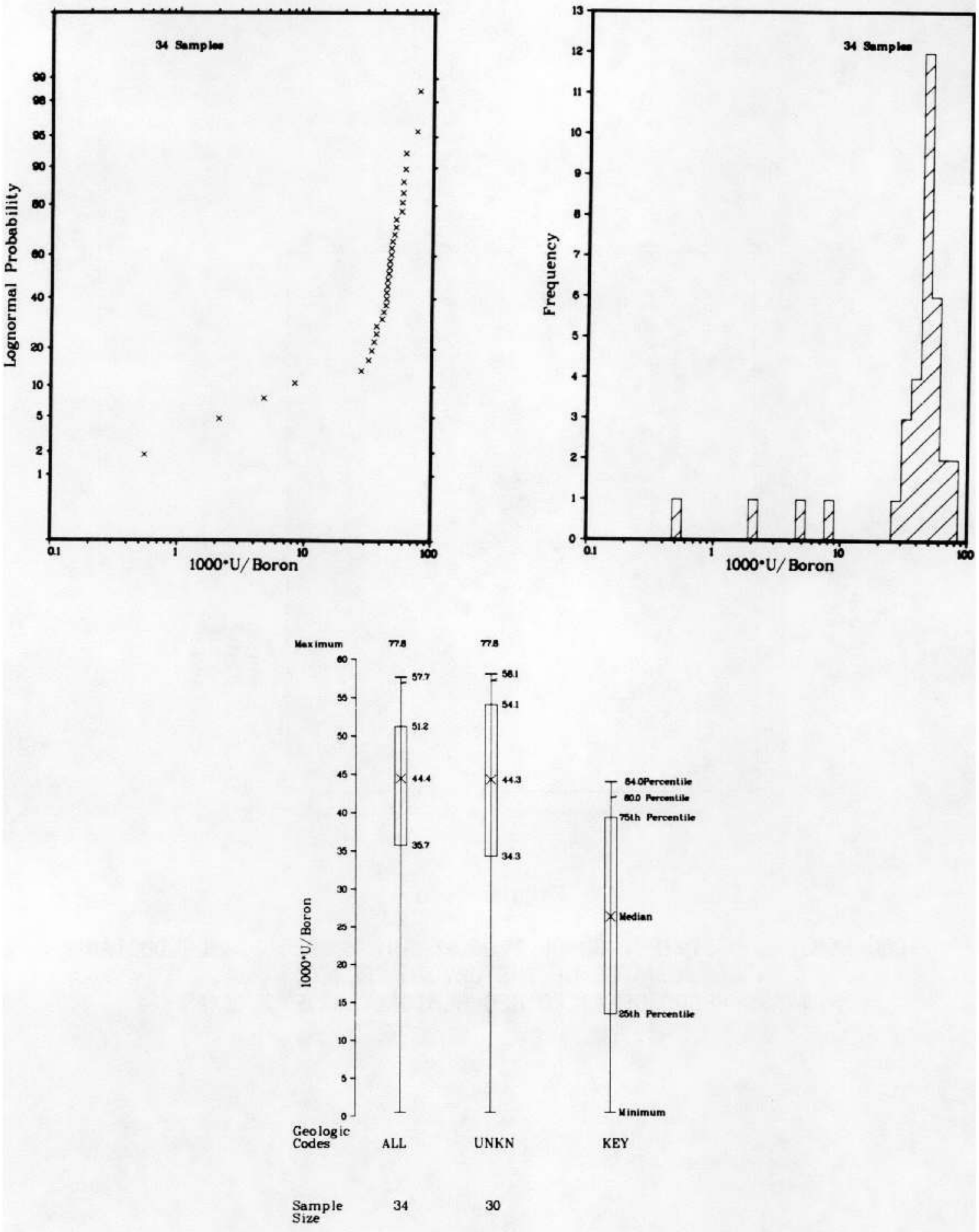


Figure A-4a

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

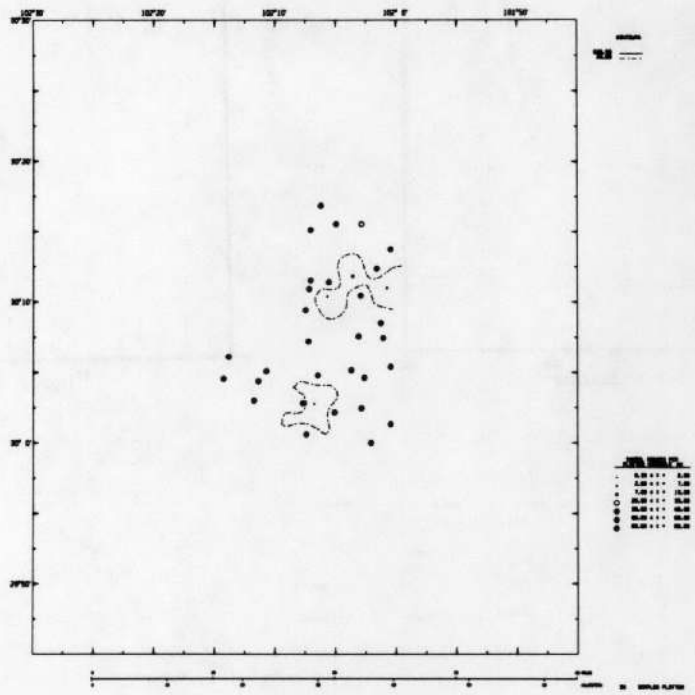
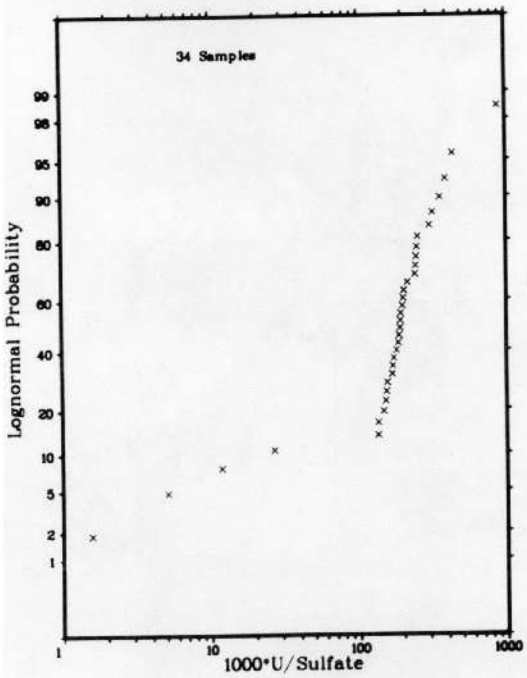
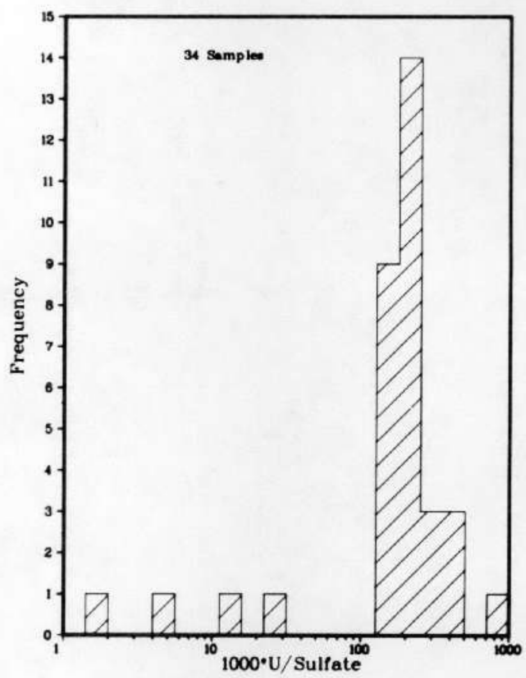


Figure A-4b

GEOCHEMICAL DISTRIBUTION OF 1,000·URANIUM/BORON IN GROUNDWATER OF THE DRYDEN PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS





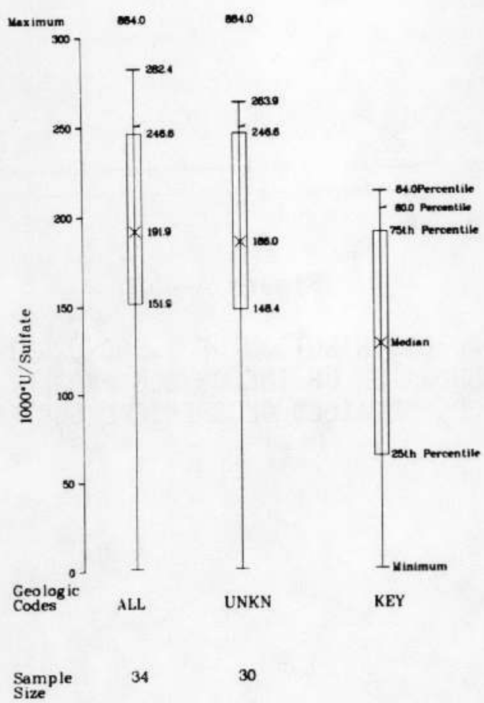


Figure A-5a

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

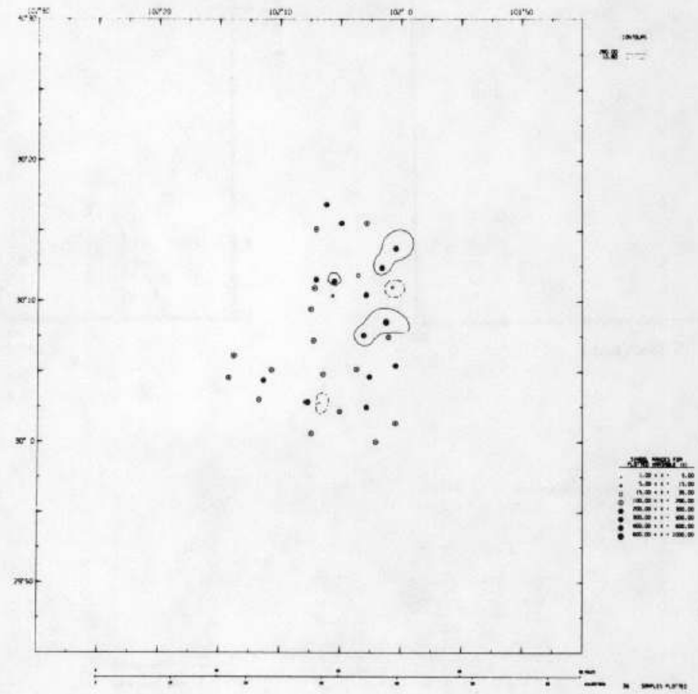
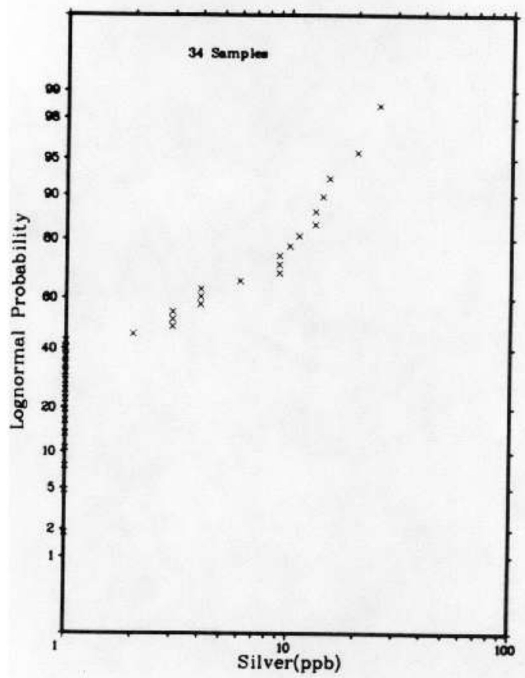
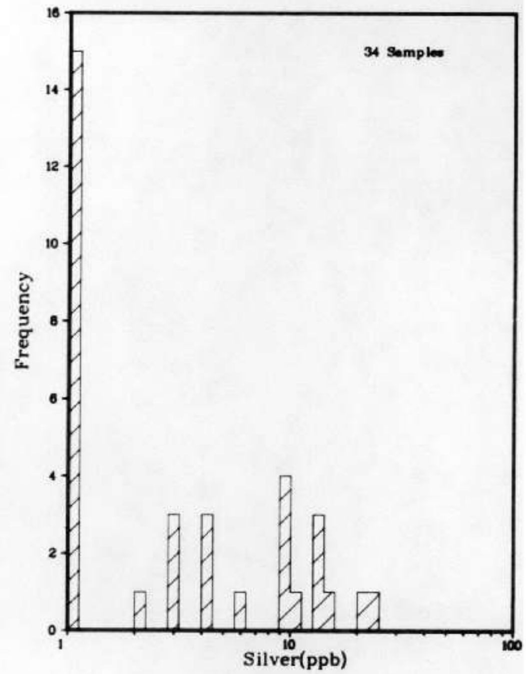


Figure A-5b

GEOCHEMICAL DISTRIBUTION OF 1,000·URANIUM/SULFATE IN GROUNDWATER OF THE DRYDEN PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS





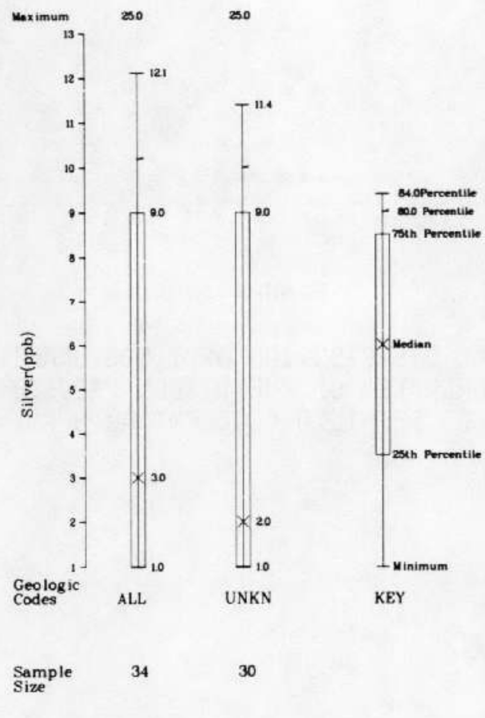


Figure A-6a

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

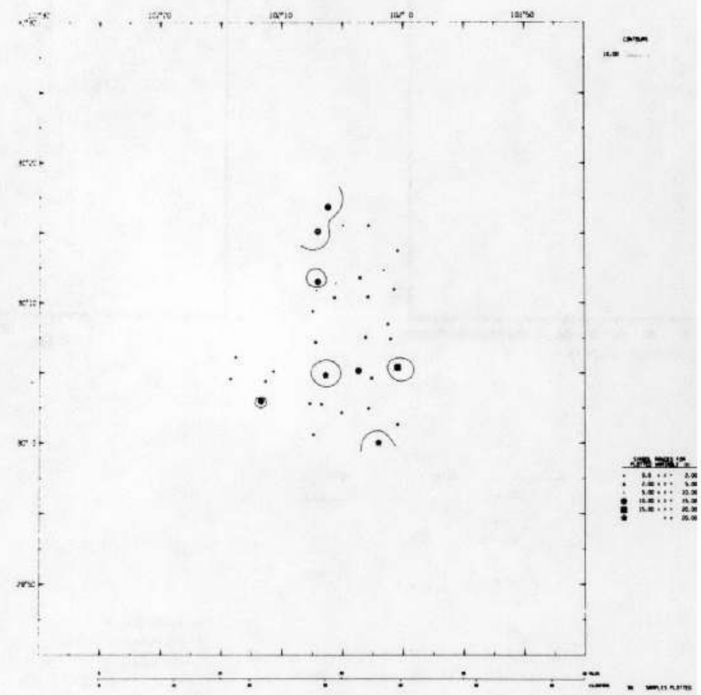


Figure A-6b

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

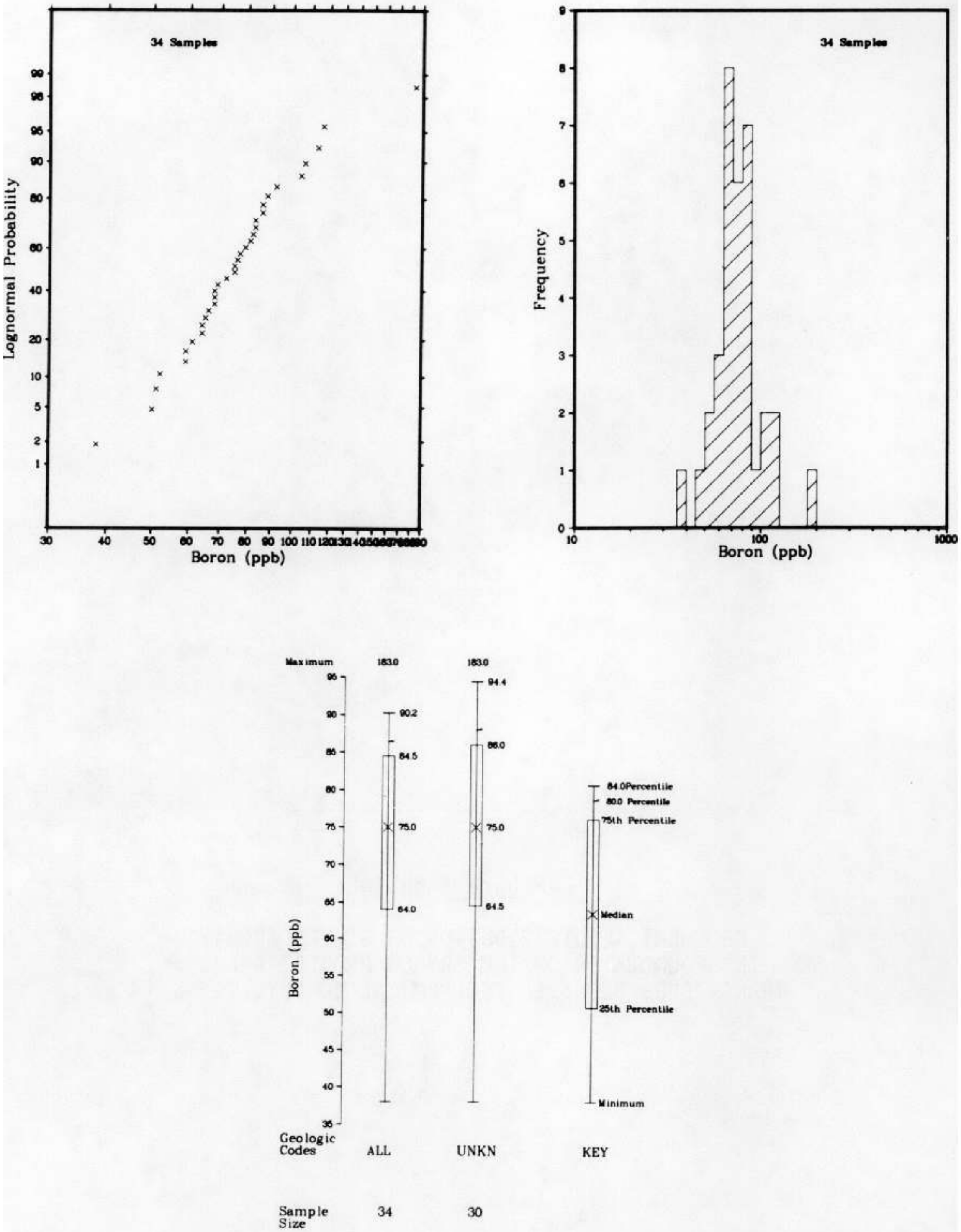


Figure A-7a

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

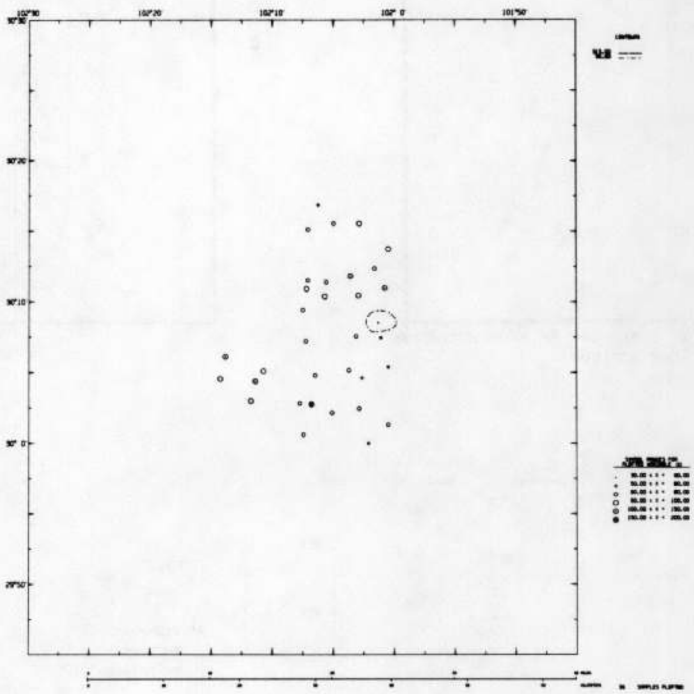


Figure A-7b

GEOCHEMICAL DISTRIBUTION OF BORON (PPB)
IN GROUNDWATER OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

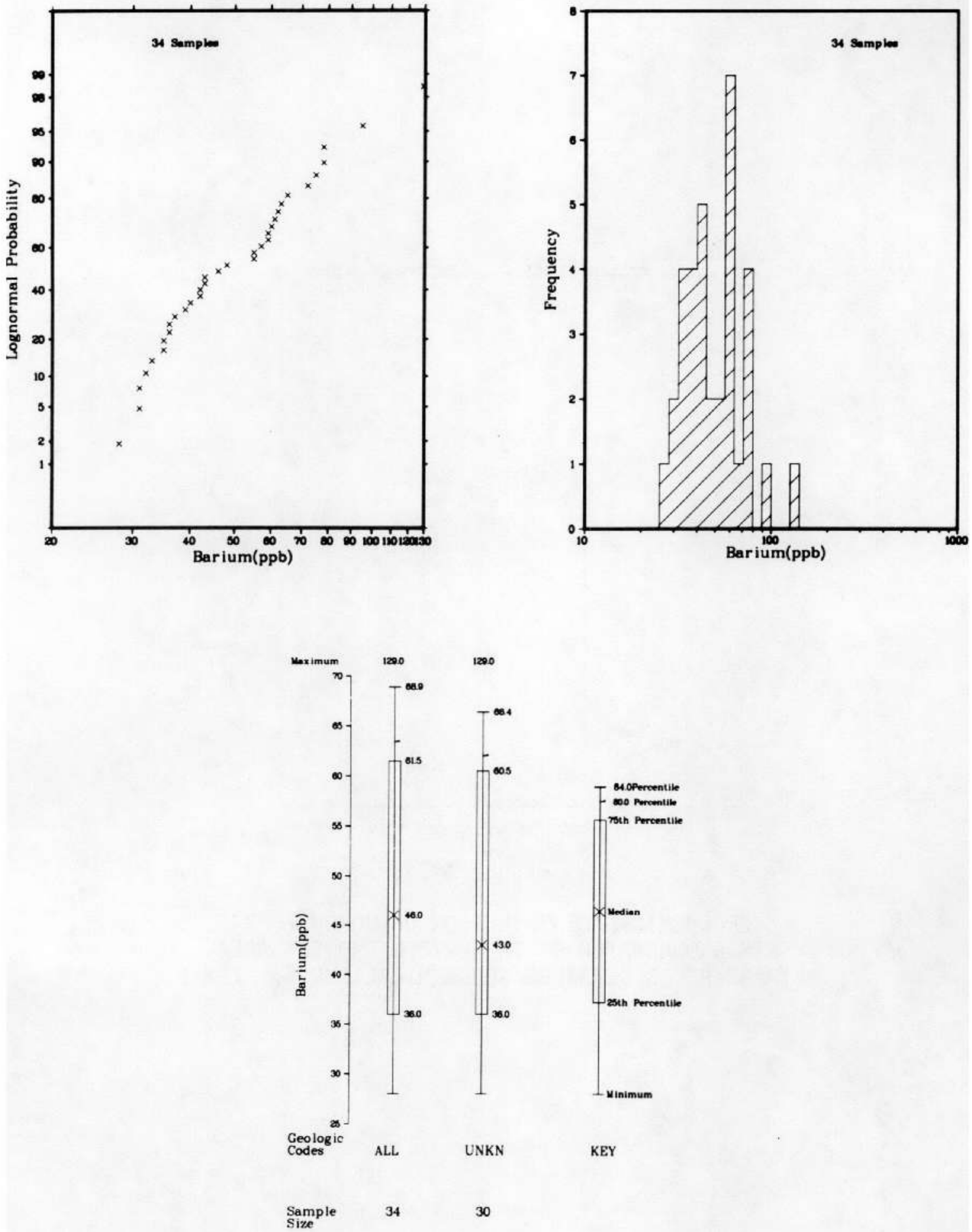


Figure A-8a

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

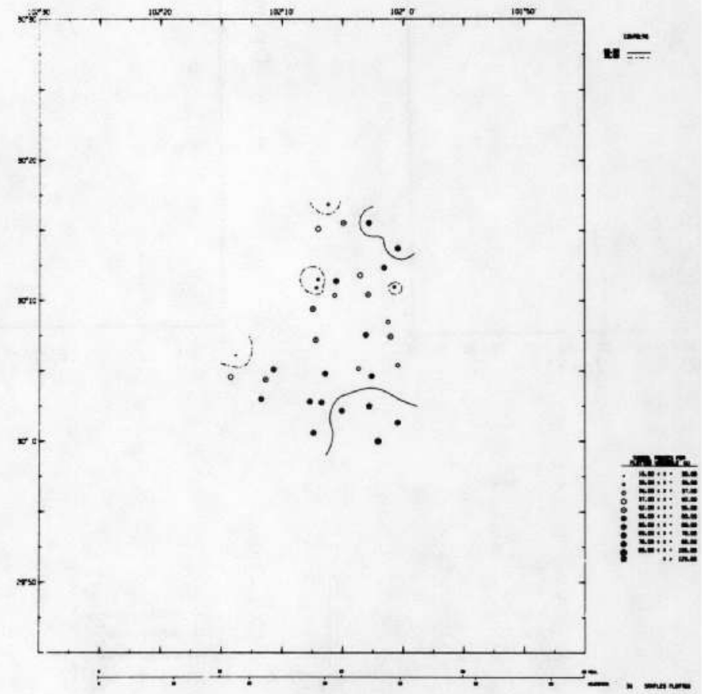


Figure A-8b

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

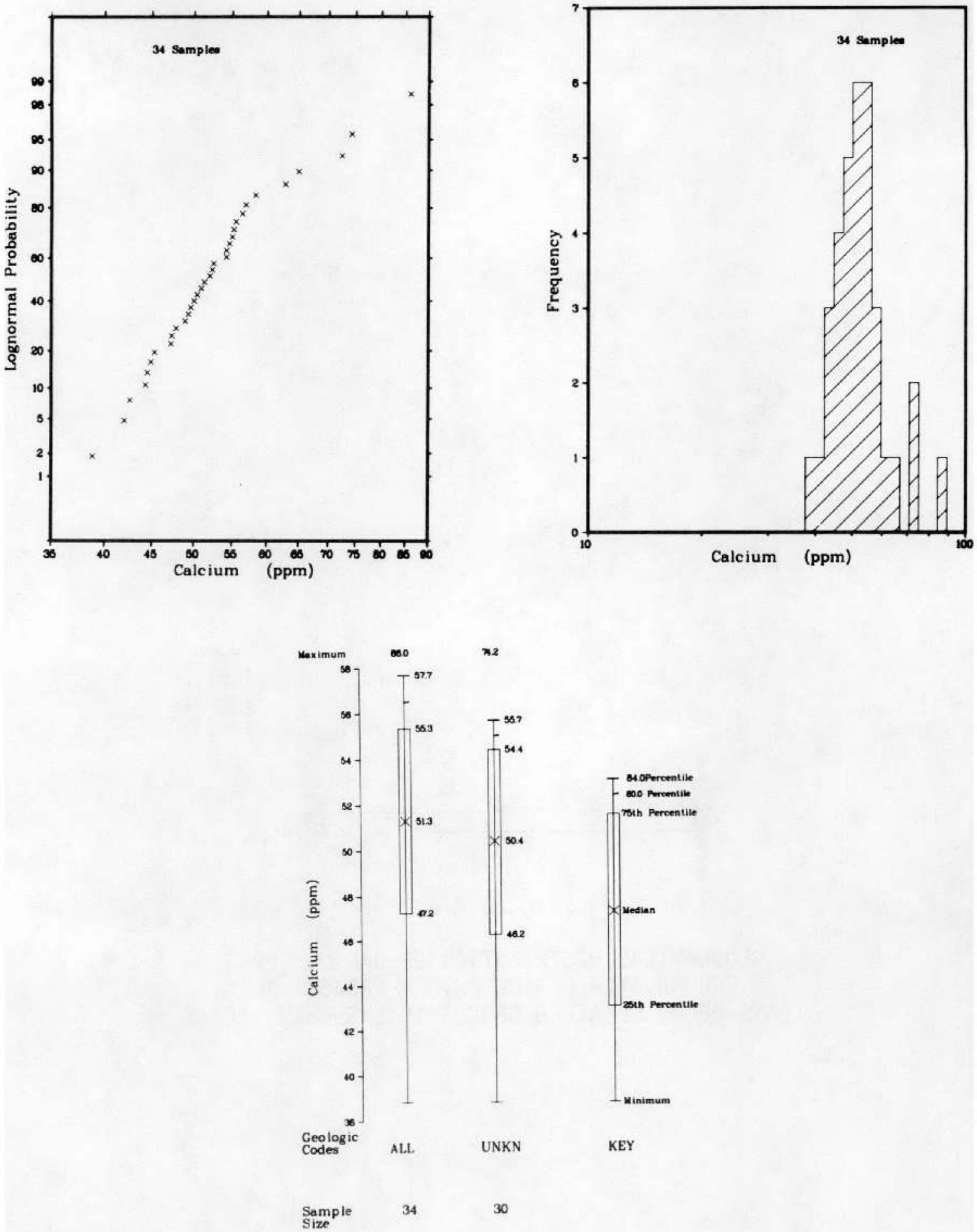


Figure A-9a

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

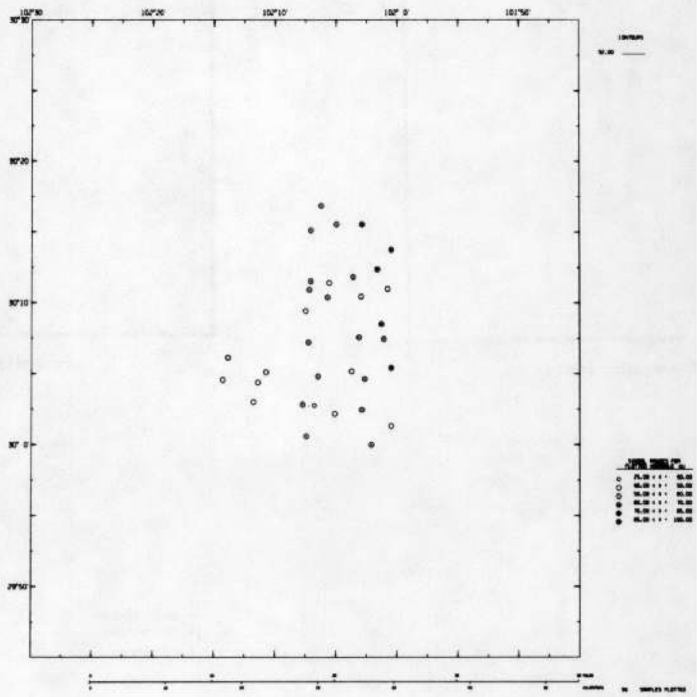


Figure A-9b

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

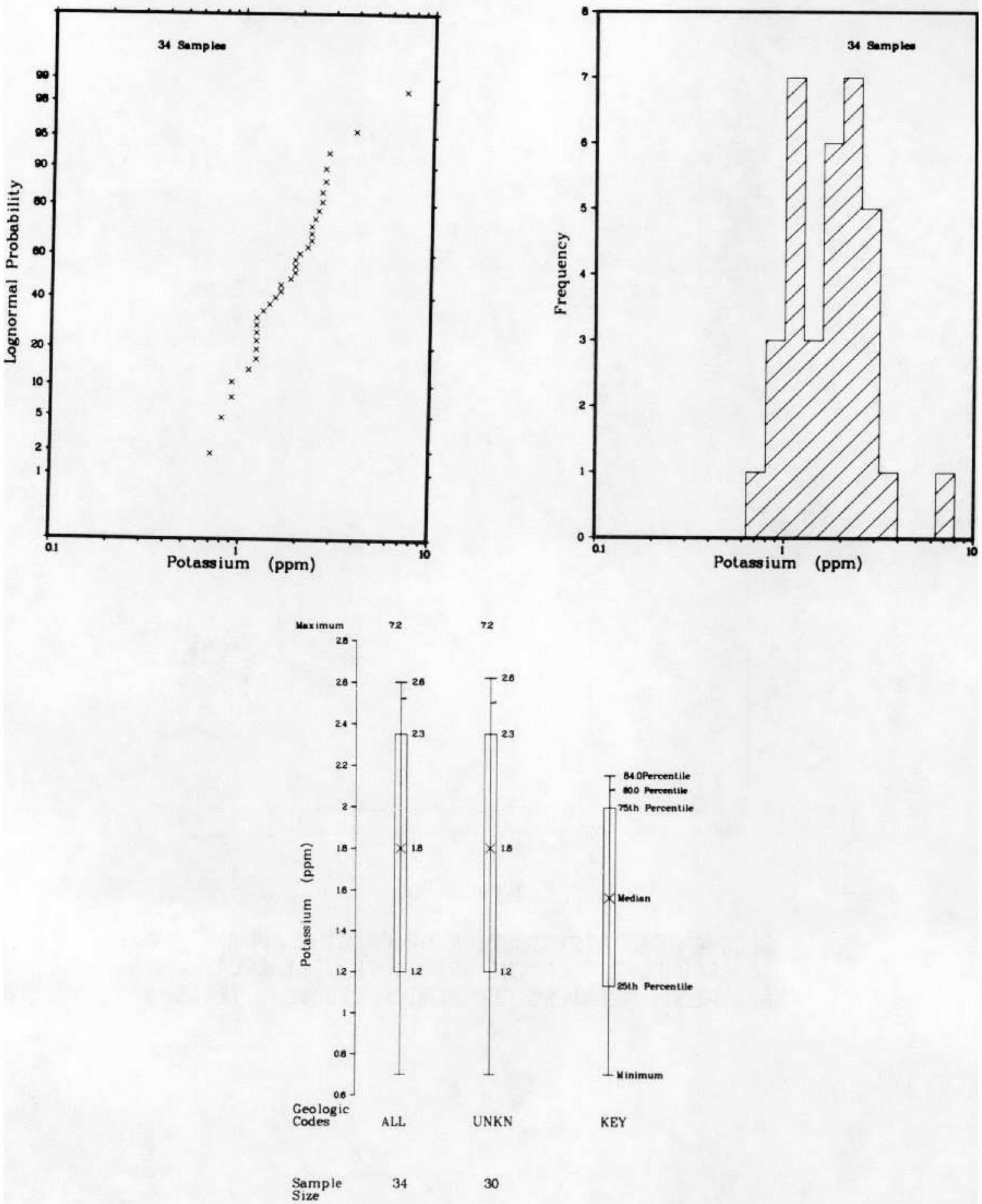


Figure A-10a

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

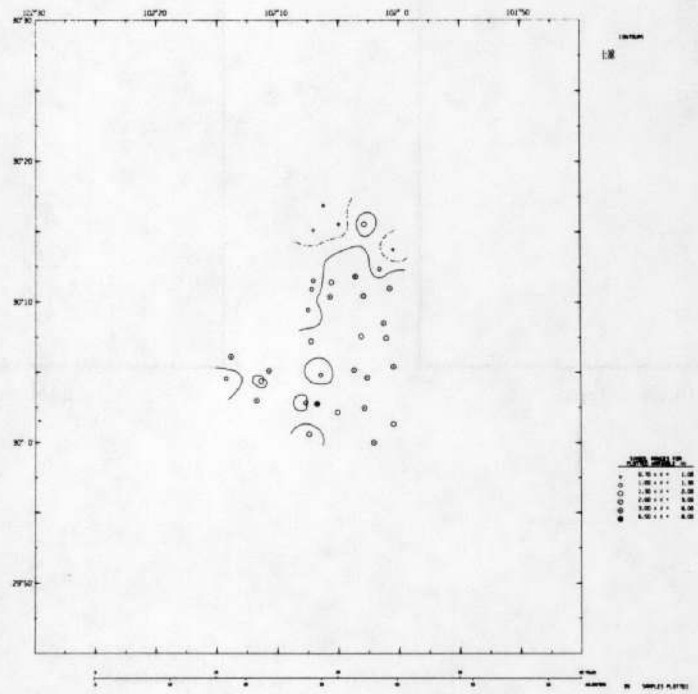


Figure A-10b

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

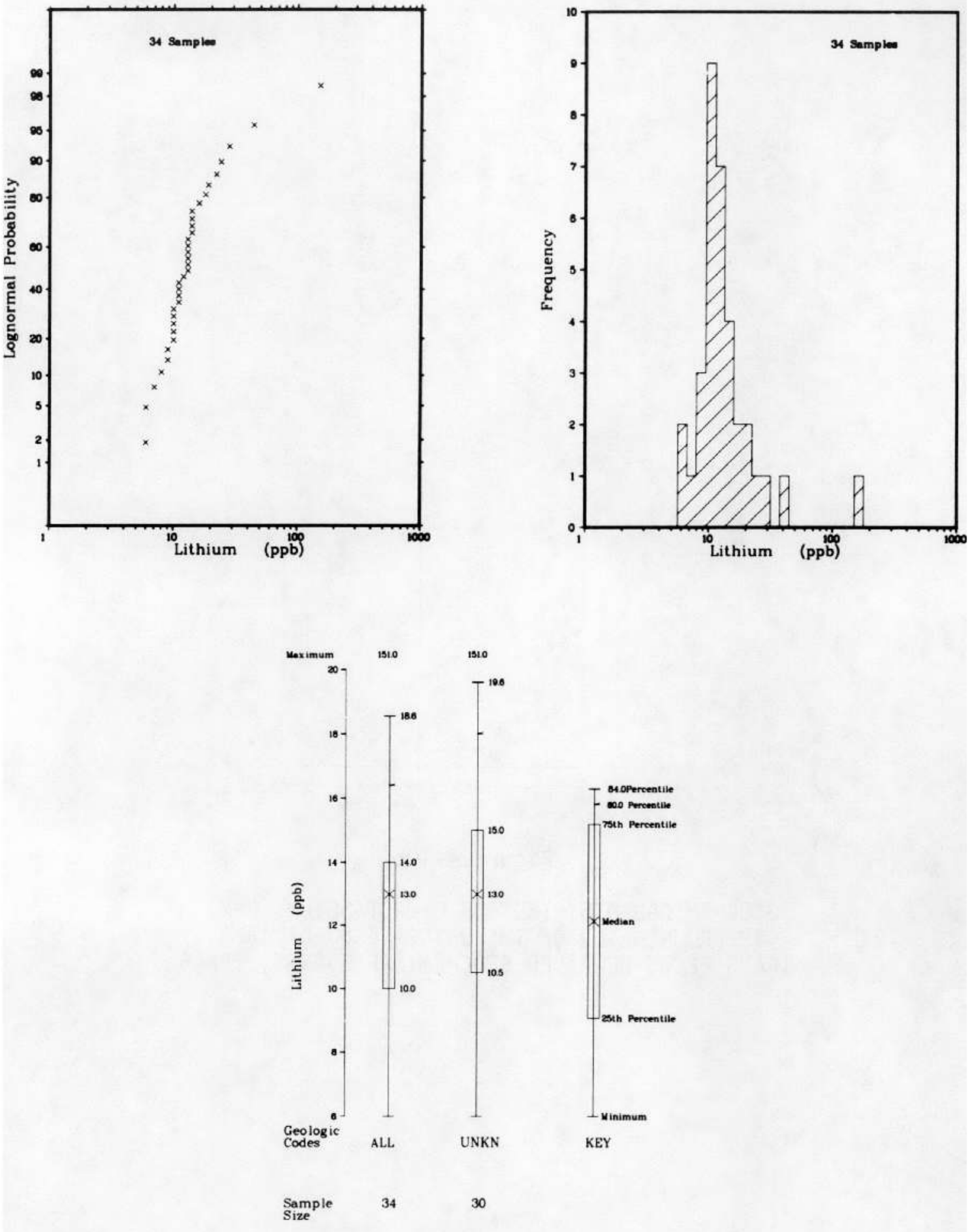


Figure A-11a

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

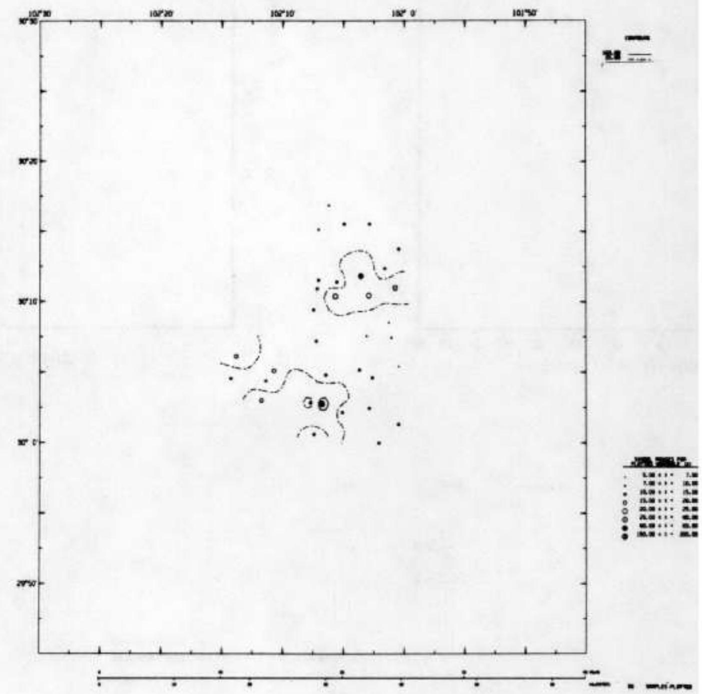


Figure A-11b

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

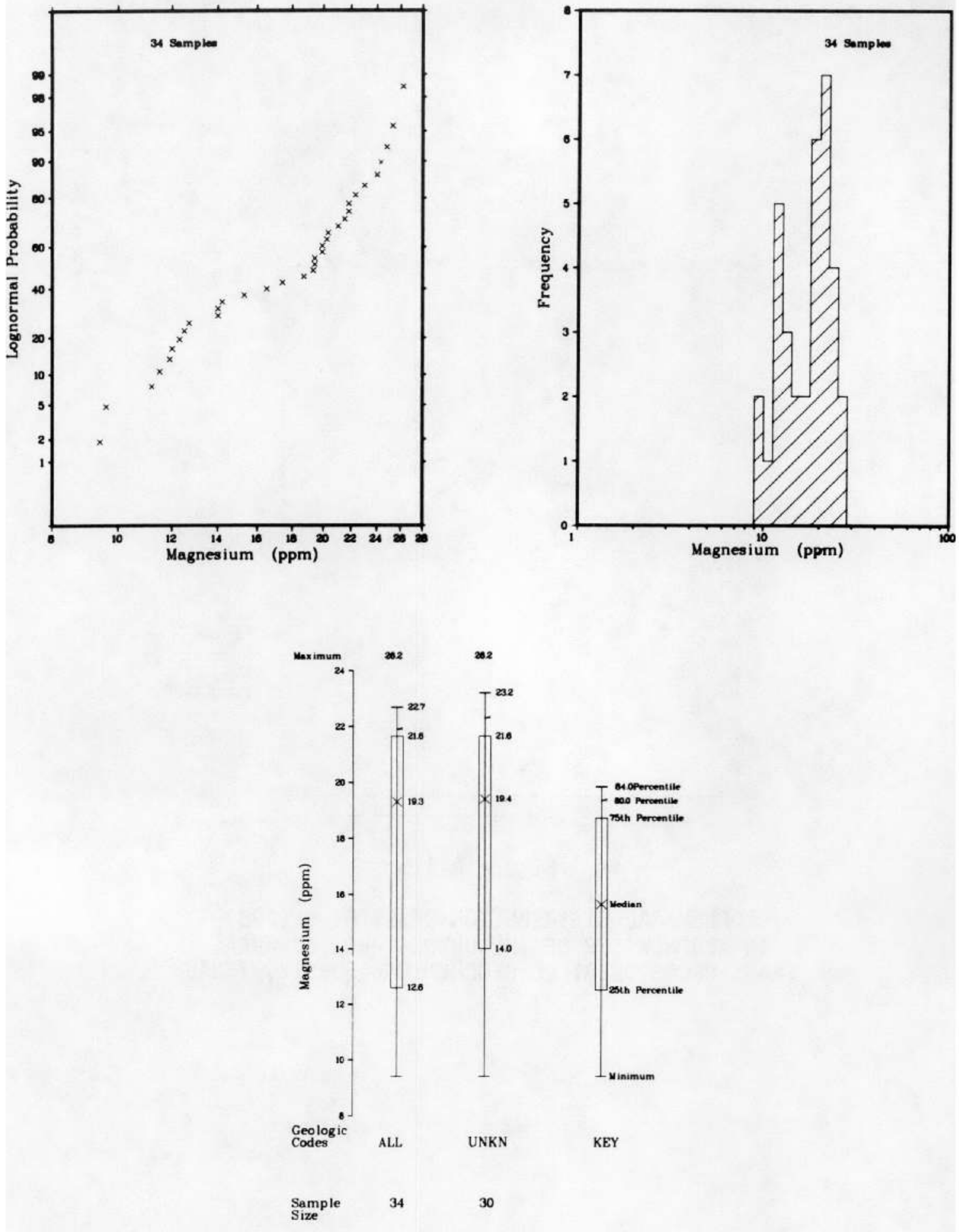


Figure A-12a

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

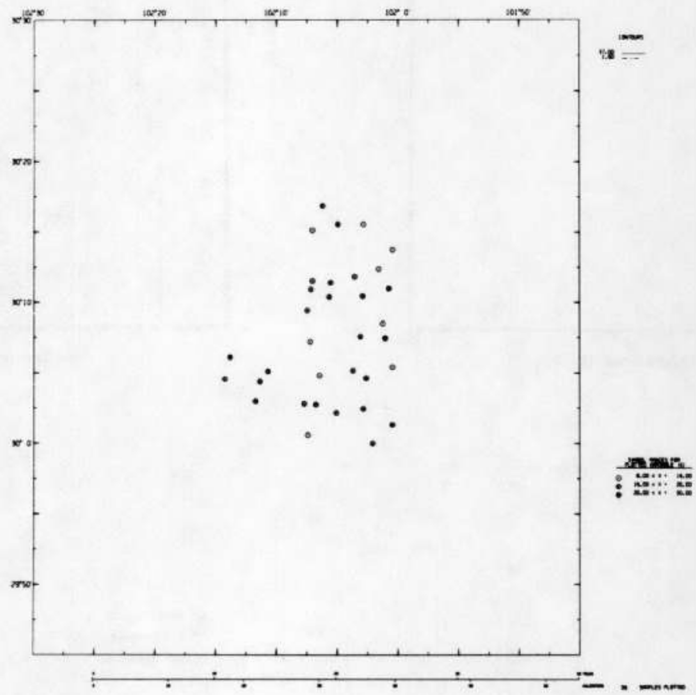


Figure A-12b

GEOCHEMICAL DISTRIBUTION OF MAGNESIUM (PPM)
IN GROUNDWATER OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

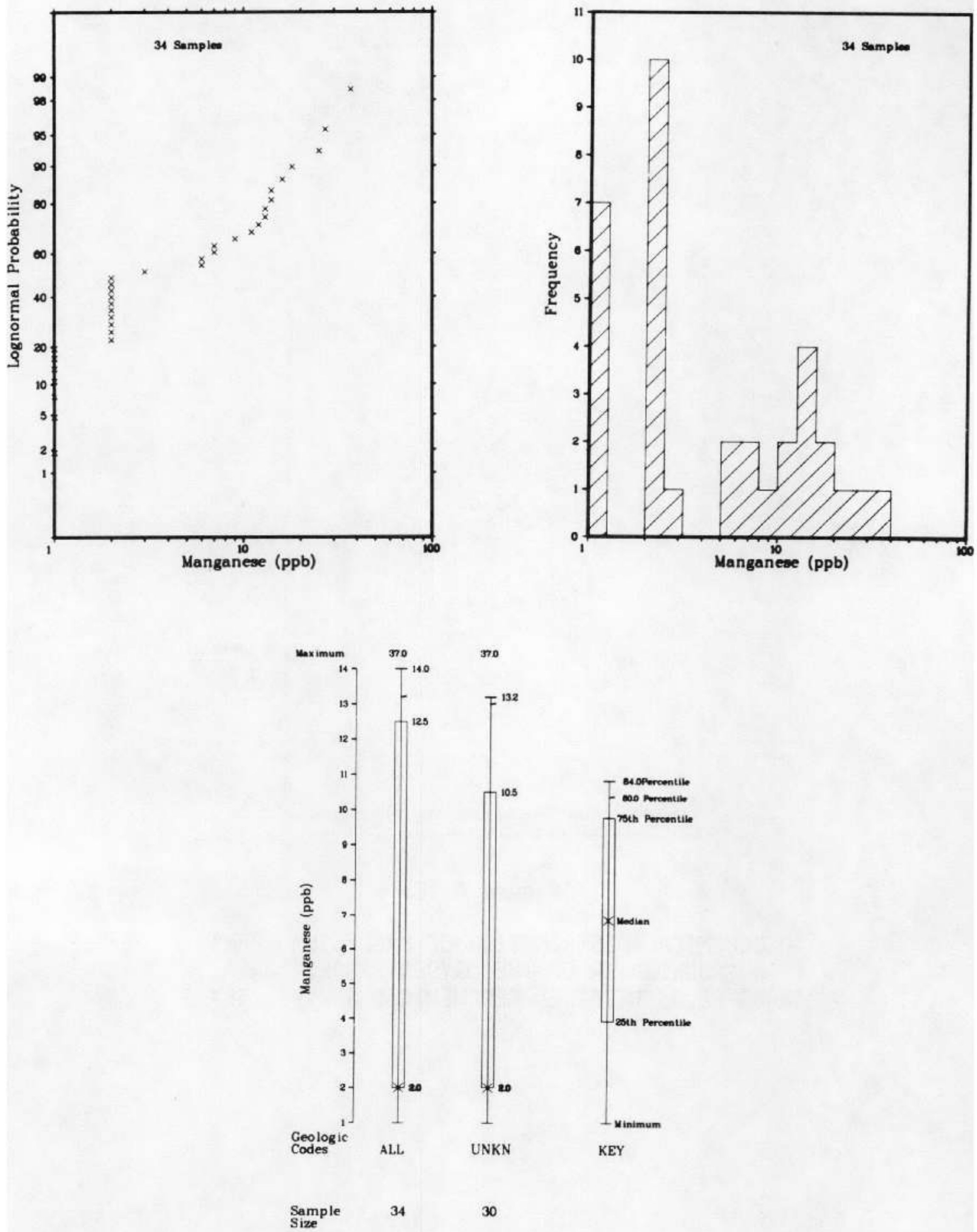


Figure A-13a

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

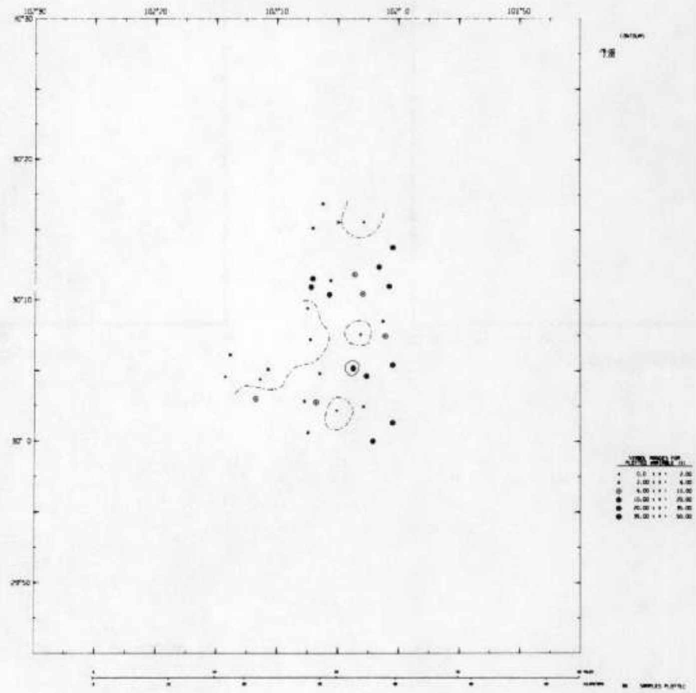


Figure A-13b

GEOCHEMICAL DISTRIBUTION OF MANGANESE (PPB)
IN GROUNDWATER OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

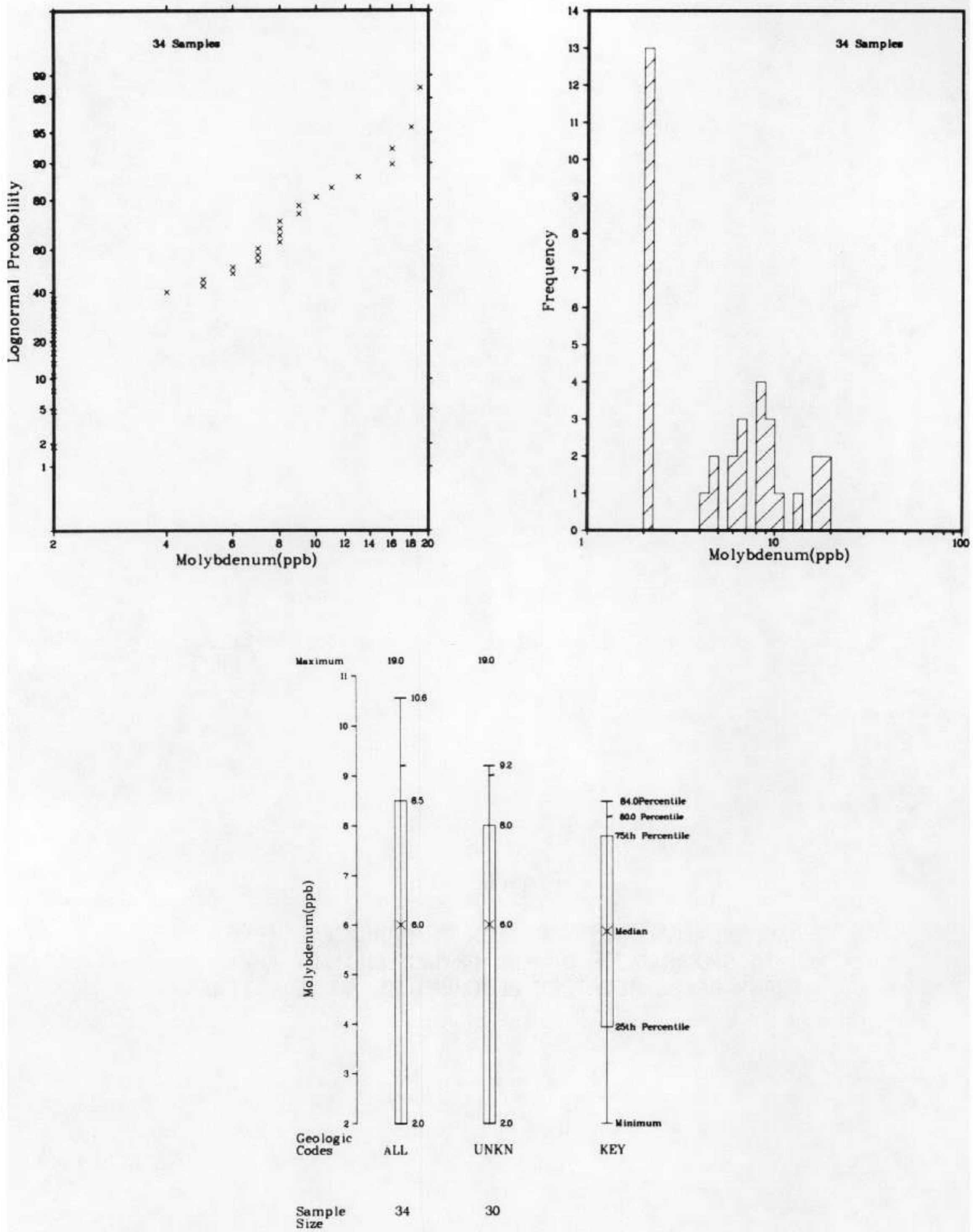


Figure A-14a

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

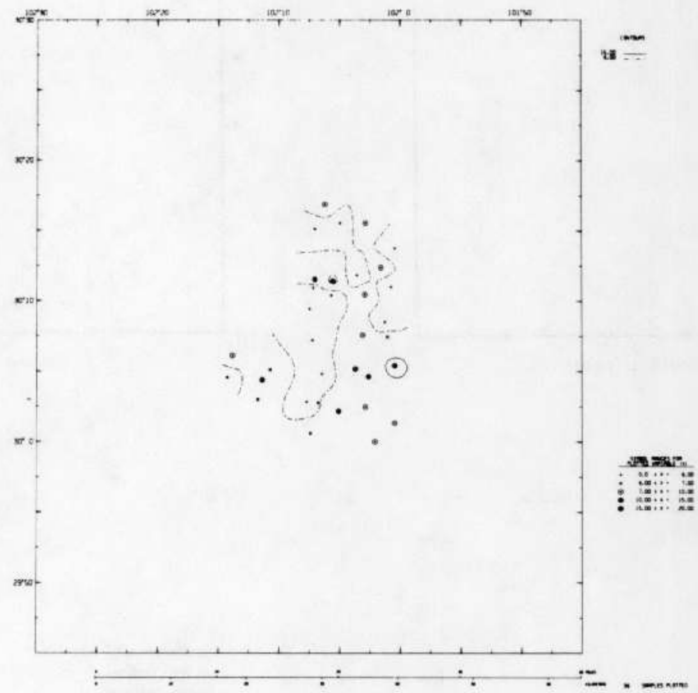
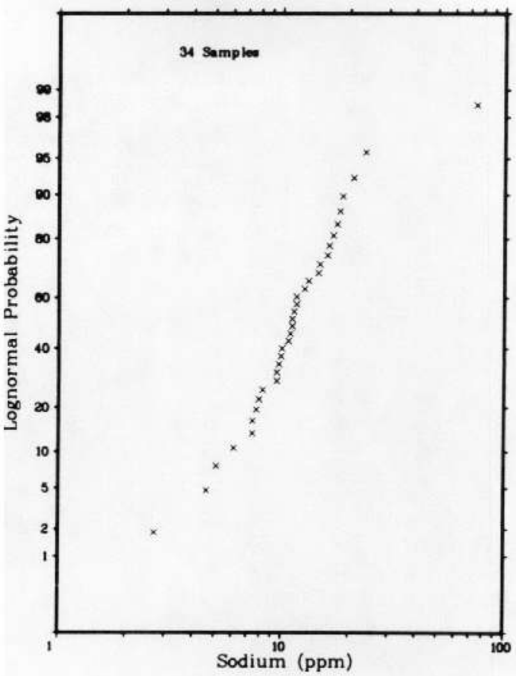
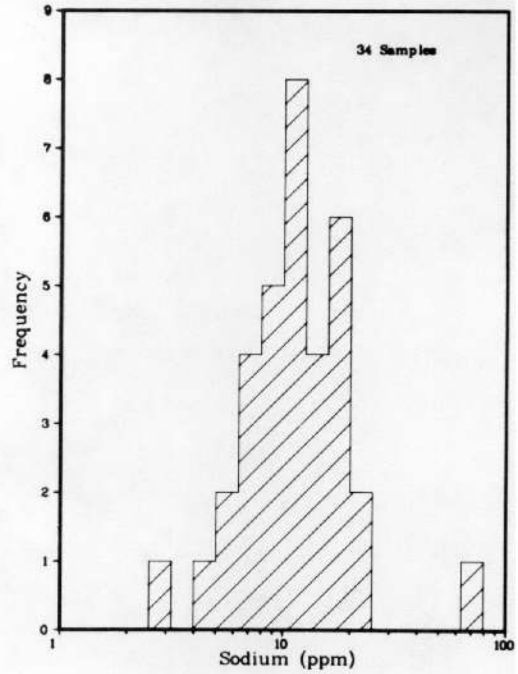


Figure A-14b

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





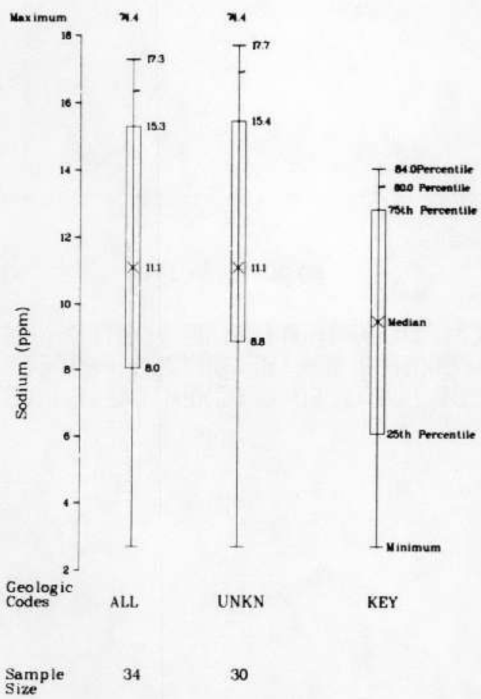


Figure A-15a

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

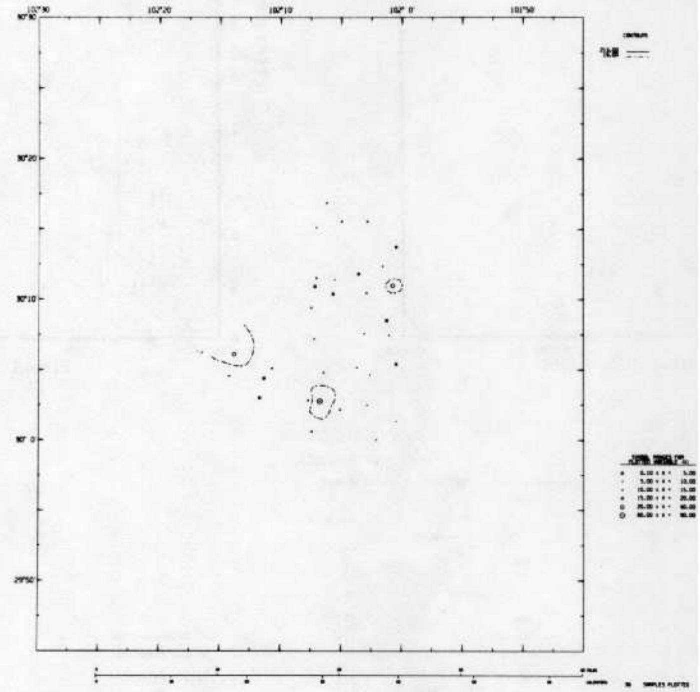


Figure A-15b

GEOCHEMICAL DISTRIBUTION OF SODIUM (PPM,
IN GROUNDWATER OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

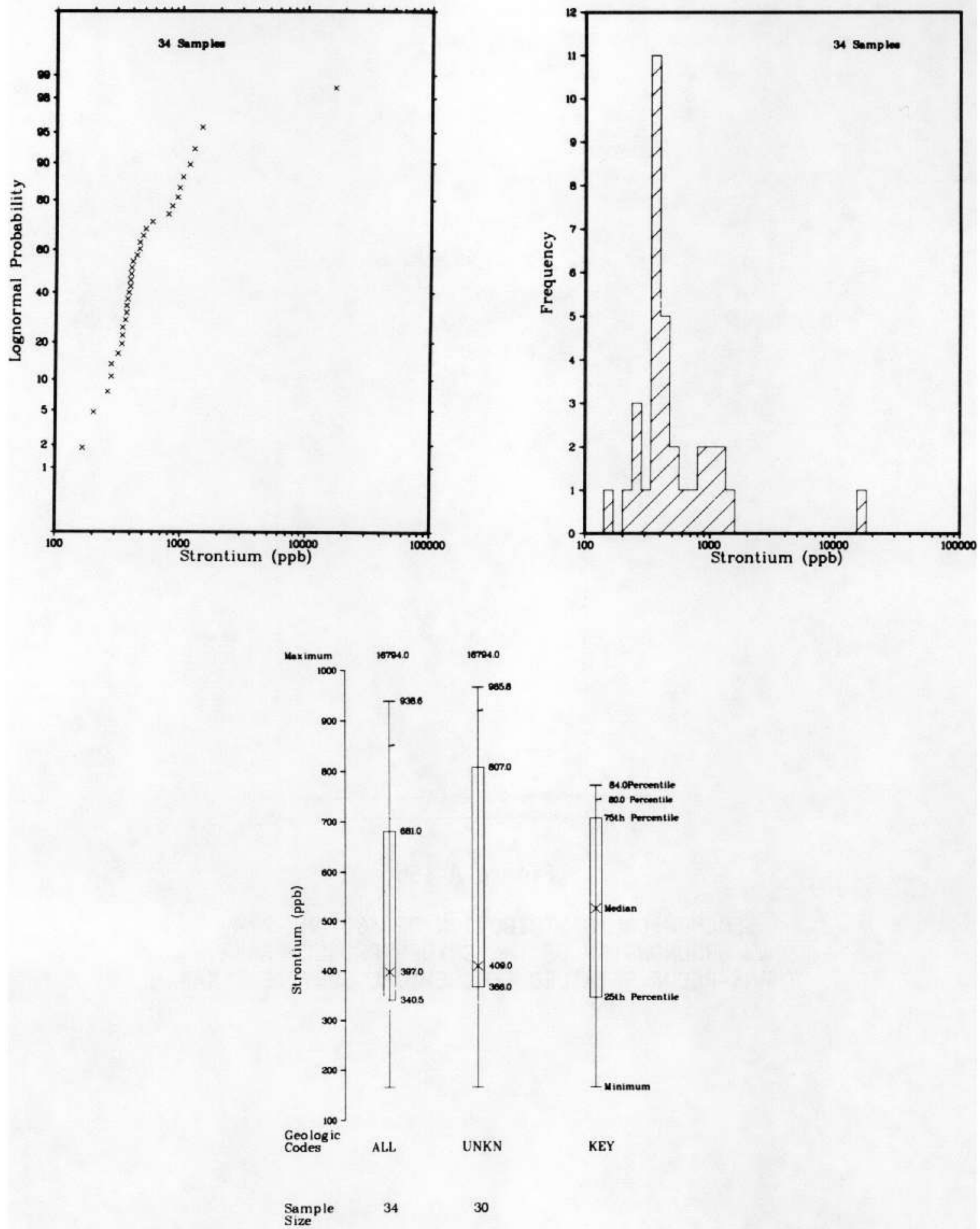


Figure A-16a

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

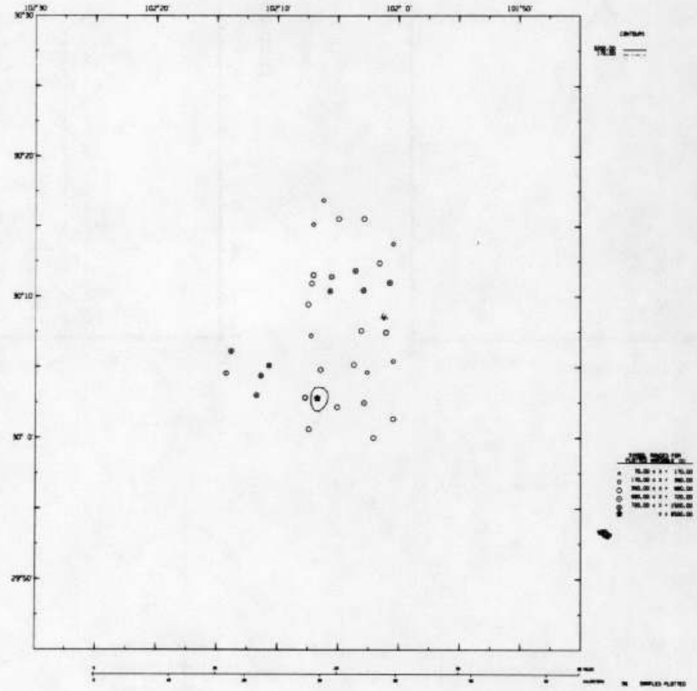


Figure A-16b

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

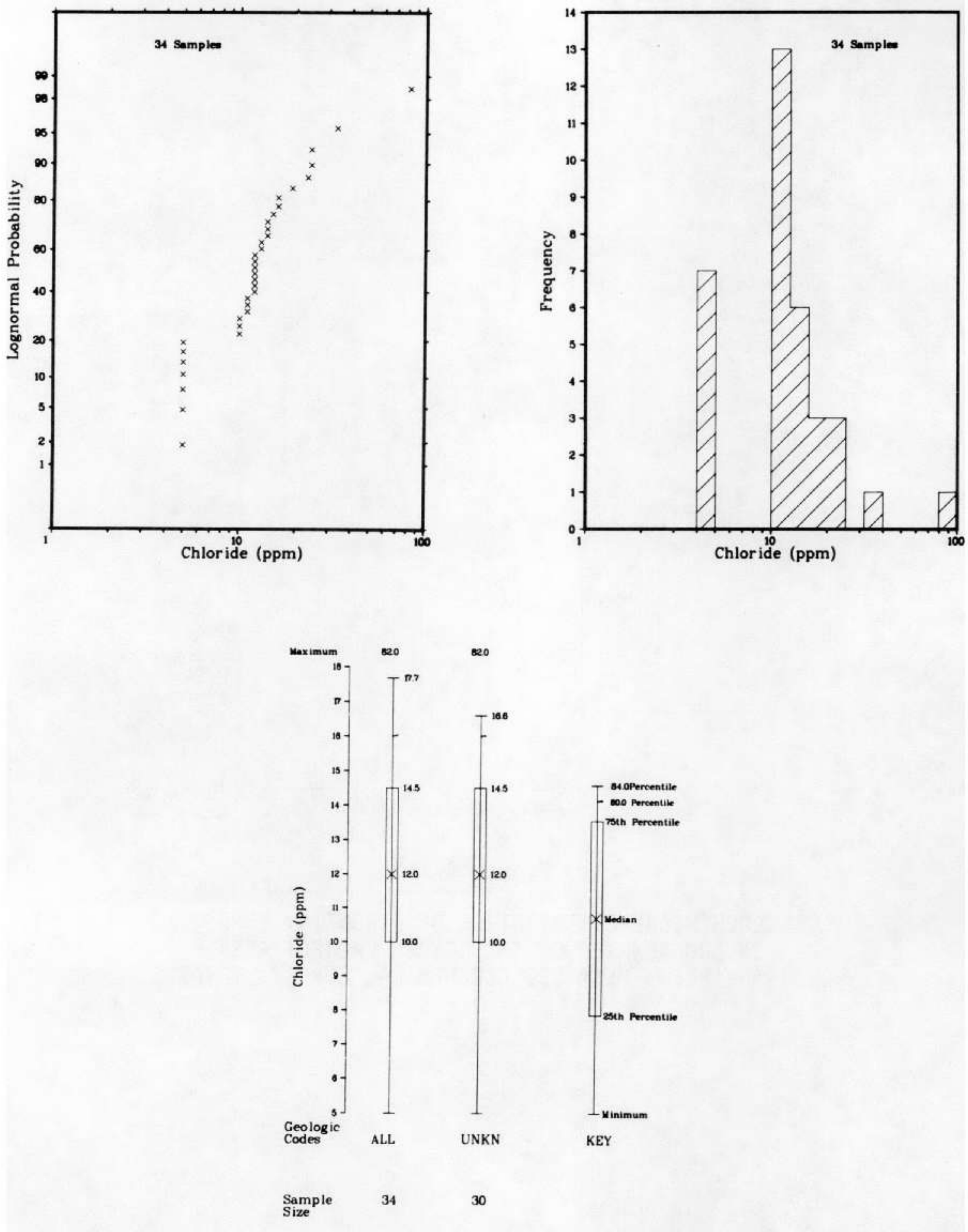


Figure A-17a

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

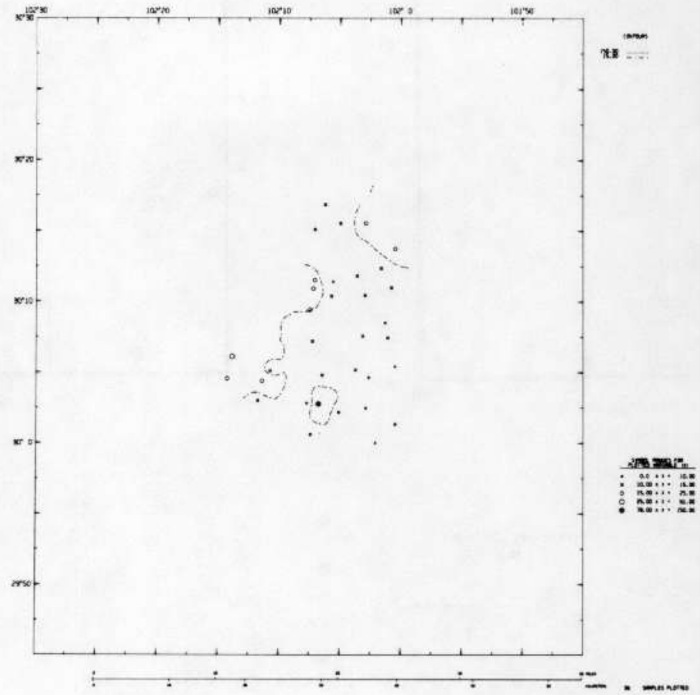


Figure A-17b

GEOCHEMICAL DISTRIBUTION OF CHLORIDE (PPM)
IN GROUNDWATER OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

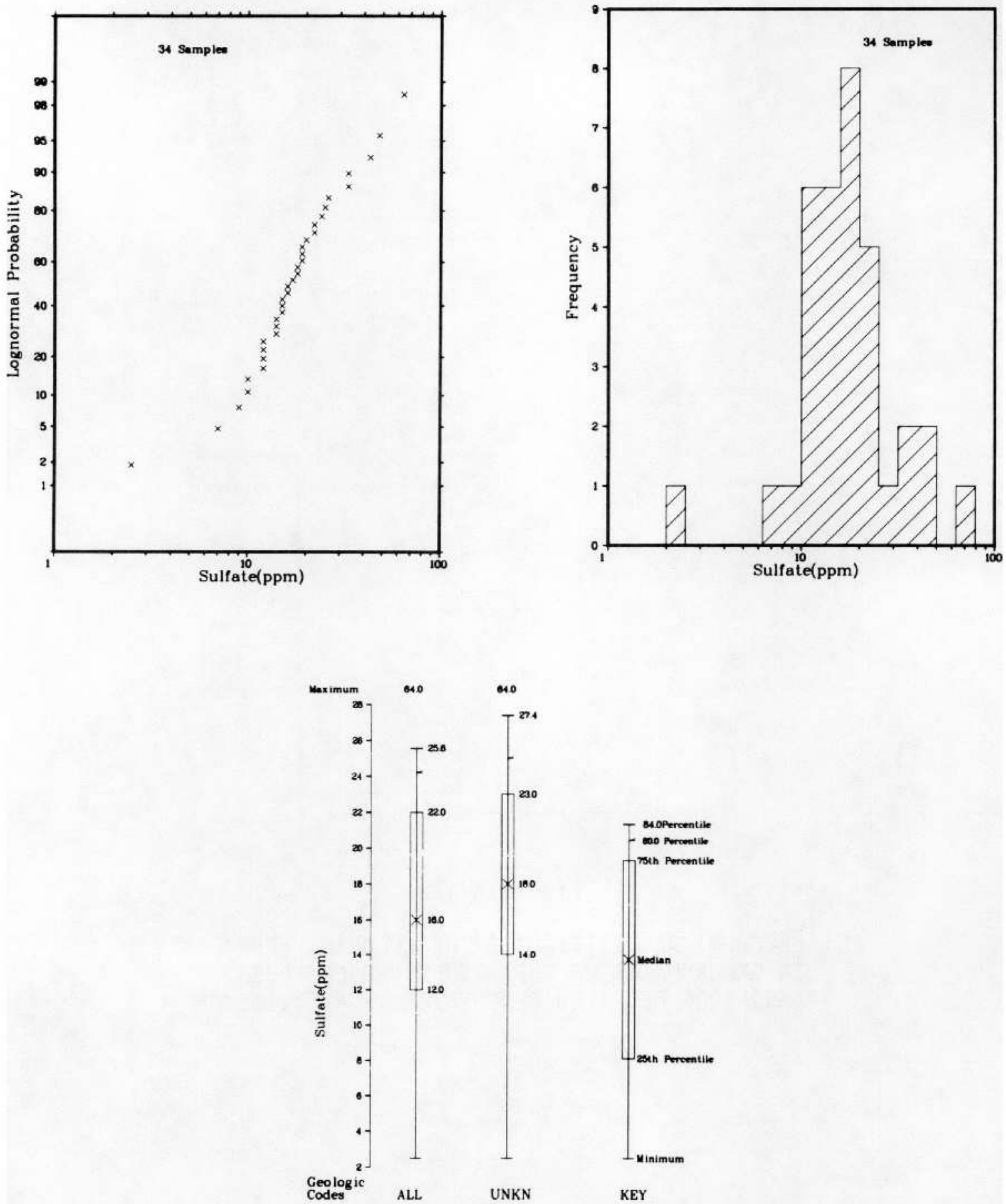


Figure A-18a

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

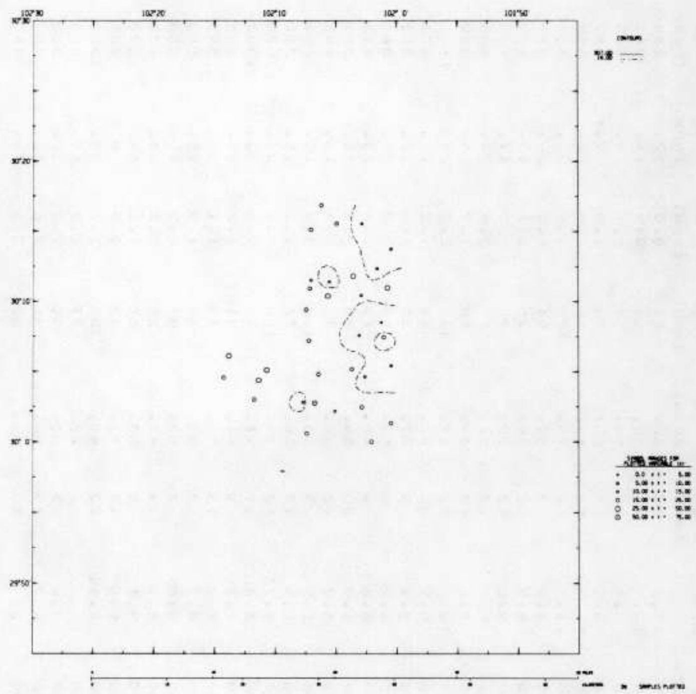


Figure A-18b

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

Table A-3

PARTIAL DATA LISTING FOR GROUNDWATER OF THE DRYDEN 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)	B (PPB)	K (PPM)	MG (PPM)	SR (PPB)	SO4 (PPM)	CL (PPM)
29620	48-30.252	-102.118	-3-03-	3.0	550	5.5	13	52.	64	0.9	12.	280	20	12
29622	48-30.259	-102.083	-3-03-	4.8	470	10.	6	55.	65	0.9	14.	340	19	14
29624	48-30.281	-102.104	-3-03-	3.9	460	8.4	14	54.	50	0.7	14.	260	16	12
29627	48-30.259	-102.048	-3-03-	2.3	600	3.8	<2	65.	83	1.6	9.4	410	12	16
29644	48-30.085	-102.179	-3-03-	5.0	470	11.	<2	45.	86	2.0	22.	830	26	14
29648	48-30.073	-102.190	-3-03-	5.0	450	11.	<2	45.	120	1.4	22.	780	25	24
29654	48-30.126	-102.052	-3-03-	3.7	480	7.6	3	50.	64	1.8	20.	340	12	10
29655	48-30.142	-102.021	-3-03-	2.2	460	4.8	<2	74.	38	2.7	13.	170	<5	<10
29706	48-30.036	-102.085	-3-03-	2.5	550	4.6	<2	50.	75	1.5	17.	400	14	12
29708	48-30.041	-102.048	-3-03-	3.7	550	6.7	<2	51.	61	2.4	20.	490	15	<10
29710	48-30.076	-102.238	-3-03-	3.2	430	7.4	<2	49.	88	1.2	19.	520	19	19
29711	48-30.102	-102.231	-3-03-	6.4	540	12.	<2	47.	110	2.2	26.	1100	48	33
29715	48-30.080	-102.108	-3-03-	2.5	420	5.9	25	52.	68	1.2	11.	370	17	11
29717	48-30.120	-102.121	-3-03-	3.0	380	8.1	4	57.	65	1.6	12.	310	16	12
29718	48-30.077	-102.044	-3-03-	2.6	420	6.2	3	55.	52	2.3	22.	340	12	<10
29721	48-30.022	-102.008	-3-03-	3.3	480	6.8	4	49.	75	1.9	21.	460	19	12
29723	48-30.000	-102.035	-3-03-	2.8	480	5.9	20	54.	59	2.3	20.	380	15	<10
29734	48-30.010	-102.124	-3-03-	2.5	440	5.7	<2	58.	79	1.3	13.	400	15	11
29750	48-30.197	-102.060	-3-03-	0.88	460	1.9	3	56.	110	3.9	19.	1400	33	14
29751	48-30.047	-102.129	-3-03-	3.2	540	5.9	<2	56.	72	1.2	14.	390	10	<10
29754	48-30.046	-102.113	-3-03-	<0.20	870	0.12	<2	39.	180	7.2	25.	17000	64	82
29755	48-30.050	-102.196	-3-03-	3.2	890	3.6	11	47.	92	2.3	23.	1000	24	13
29758	48-30.182	-102.120	-3-03-	3.4	470	7.1	9	51.	81	1.2	19.	460	22	24
29759	48-30.192	-102.118	-3-03-	3.5	440	8.0	13	55.	76	1.1	15.	390	14	16
29761	48-30.190	-102.093	-3-03-	3.5	400	8.7	9	45.	69	1.9	25.	580	9	<10
29762	48-30.173	-102.095	-3-03-	0.39	460	0.85	2	53.	82	2.5	20.	950	33	13
29766	48-30.174	-102.049	-3-03-	3.5	430	8.1	4	44.	86	2.8	24.	920	14	12
29767	48-30.206	-102.027	-3-03-	3.1	600	5.1	9	63.	68	1.2	12.	370	7	11
29770	48-30.229	-102.008	-3-03-	3.6	550	6.5	<2	72.	93	0.8	9.6	280	10	23
29774	48-30.183	-102.013	-3-03-	0.22	490	0.45	<2	48.	100	2.7	24.	1200	43	12
29803	48-30.157	-102.125	-3-03-	3.4	340	10.	<2	42.	77	1.2	17.	370	22	15
29874	48-30.124	-102.018	-3-03-	3.6	360	9.9	<2	50.	59	1.9	22.	360	18	10
29875	48-30.090	-102.008	-3-03-	2.4	400	6.2	15	86.	51	2.6	12.	200	12	<10
29876	48-30.086	-102.062	-3-03-	3.5	290	12.	10	43.	68	2.6	19.	440	18	10

APPENDIX B

STREAM SEDIMENT

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

APPENDIX B

STREAM SEDIMENT

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

Table B-1

STATISTICAL SUMMARY FOR STREAM SEDIMENT OF THE DRYDEN 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-FL	78			0.83	3.57	1.96	1.85	1.55	0.520	0.265	0.64	0.27	0.64	0.27
U-NT	78			1.80	3.70	2.34	2.30	2.21	0.298	0.127	0.84	0.12	0.84	0.12
TH	78			2	21	6	6	7	3.0	0.4	1.84	0.39	1.84	0.35
U/TH	78			0.36	1.33	0.84	0.83	0.75	0.188	0.224	-0.20	0.24	-0.19	0.24
TH/U	78			0.63	10.50	2.96	2.78	3.21	1.425	0.481	1.00	0.41	1.00	0.37
AG	0	78	<2	<2	<2		<2	<2						
AL	78			1.90	4.85	3.51	3.48	3.63	0.483	0.138	1.25	0.14	1.25	0.15
AS	78			1.6	4.9	3.0	2.9	2.3	0.91	0.30	1.07	0.29	1.07	0.28
B	5	73	<10	<10	15	12	<10	<10	2.1	0.2	2.47	0.17		
BA	78			194	546	360	356	373	59.1	0.2	5.87	0.17	5.88	0.17
BE	78			1	1	1	1	1	0.0	0.0	0.0	0.0		
CA	78			11.42	26.40	17.65	17.16	17.13	2.819	0.160	2.86	0.16	2.86	0.15
CE	78			23	52	33	33	32	5.8	0.2	3.50	0.17	3.50	0.18
CO	75	3	<4	<4	7	4	<4	<4	0.7	0.2	1.49	0.15		
CR	78			15	35	25	25	27	3.3	0.1	3.22	0.13	3.23	0.12
CU	78			8	28	13	13	12	2.8	0.2	2.56	0.19	2.56	0.18
FE	78			0.92	2.27	1.66	1.66	1.67	0.206	0.124	0.50	0.13	0.51	0.12
K	78			0.49	1.39	0.81	0.80	0.82	0.161	0.198	-0.23	0.20	-0.22	0.20
LI	78			14	27	20	20	19	2.5	0.1	3.01	0.12	3.01	0.12
MG	78			0.31	0.88	0.55	0.54	0.49	0.091	0.166	-0.62	0.17	-0.61	0.17
MN	78			236	682	362	360	354	61.4	0.2	5.88	0.16	5.88	0.16
MO	8	70	<4	<4	9	4	<4	<4	1.7	0.4	1.54	0.28		
NA	78			0.17	0.53	0.31	0.30	0.28	0.066	0.213	-1.19	0.21	-1.19	0.23
NB	78			8	15	11	12	12	1.9	0.2	2.43	0.18	2.43	0.19
NI	78			9	60	20	16	15	11.3	0.5	2.93	0.44	2.92	0.41
P	78			327	973	594	595	624	108.2	0.2	6.37	0.19	6.38	0.18
SC	78			3	6	4	4	4	0.7	0.1	1.49	0.15	1.49	0.14
SE	42	36	<0.1	<0.1	0.6	0.2	0.1	<0.1	0.10	0.40	-1.46	0.37		
SR	78			142	516	242	217	186	81.6	0.3	5.45	0.29	5.43	0.32
TI	78			1088	2976	1939	1923	1792	302.7	0.2	7.56	0.16	7.56	0.16
V	78			26	84	46	44	44	9.3	0.2	3.81	0.19	3.80	0.18
Y	78			11	18	13	14	13	1.3	0.1	2.61	0.09	2.61	0.09
ZN	78			35	101	65	65	56	10.8	0.2	4.17	0.17	4.18	0.15
ZR	78			43	97	67	66	63	9.2	0.1	4.20	0.14	4.20	0.13

NOTE: Refer to Table 1, Page 27 and Table C-1, Page C-4 for concentration units and symbol defintions.

Table B-2

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

	L-U	LUTU	L-NB	L-AS	L-SR	LUNT	L-LI	L-V	L-NI	L-TH	LTUN	L-SE	L-P	L-ZN	L-CU
L-U	1.00 (78)														
LUTU	0.90*** 0.90*** (78)	1.00 (78)													
L-NB	-0.33*** -0.27** (78)	-0.33*** -0.30*** (78)	1.00 (78)												
L-AS	0.11 0.15 (78)	-0.17 -0.04 (78)	0.14 0.08 (78)	1.00 (78)											
L-SR	0.39*** 0.27** (78)	0.12 0.09 (78)	-0.04 0.02 (78)	0.68*** 0.68*** (78)	1.00 (78)										
LUNT	0.40*** 0.34*** (78)	-0.04 -0.04 (78)	-0.06 -0.03 (78)	0.59*** 0.59*** (78)	0.64*** 0.58*** (78)	1.00 (78)									
L-LI	0.15 0.15 (78)	-0.12 -0.11 (78)	-0.06 -0.15 (78)	0.54*** 0.55*** (78)	0.57*** 0.53*** (78)	0.58*** 0.60*** (78)	1.00 (78)								
L-V	0.27** 0.14 (78)	-0.09 -0.12 (78)	0.04 0.07 (78)	0.71*** 0.71*** (78)	0.73*** 0.65*** (78)	0.80*** 0.70*** (78)	0.31*** 0.35*** (78)	1.00 (78)							
L-NI	-0.21* 0.01 (78)	-0.40*** -0.17 (78)	0.16 -0.02 (78)	0.59*** 0.60*** (78)	0.37*** 0.37*** (78)	0.36*** 0.48*** (78)	0.52*** 0.53*** (78)	0.50*** 0.63*** (78)	1.00 (78)						
L-TH	0.02 0.07 (78)	0.03 0.00 (78)	0.23** 0.31*** (78)	-0.16 -0.03 (78)	-0.21* -0.10 (78)	-0.03 0.09 (78)	-0.11 -0.04 (78)	-0.08 0.06 (78)	-0.05 -0.04 (78)	1.00 (78)					
LTUN	-0.10 -0.04 (78)	0.04 0.02 (78)	0.24** 0.29*** (78)	-0.32*** -0.21* (78)	-0.39*** -0.26** (78)	-0.31*** -0.20* (78)	-0.27** -0.21* (78)	-0.31*** -0.15 (78)	-0.15 -0.19 (78)	0.96*** 0.94*** (78)	1.00 (78)				
L-SE	-0.21 -0.10 (42)	-0.16 -0.07 (42)	0.31** 0.27* (42)	0.14 0.24 (42)	-0.12 0.02 (42)	-0.16 0.02 (42)	-0.13 -0.33 (42)	-0.07 0.03 (42)	0.32** 0.36** (42)	0.17 0.29* (42)	0.20 0.28* (42)	1.00 (42)			
L-P	-0.08 -0.11 (78)	-0.28** -0.31*** (78)	-0.07 -0.15 (78)	0.08 0.10 (78)	0.05 0.16 (78)	0.40*** 0.42*** (78)	0.32*** 0.47*** (78)	0.35*** 0.33*** (78)	0.32*** 0.39*** (78)	0.06 0.03 (78)	-0.06 -0.08 (78)	-0.04 -0.04 (42)	1.00 (78)		
L-ZN	-0.16 -0.18 (78)	-0.33*** -0.37*** (78)	0.02 -0.09 (78)	0.06 0.05 (78)	0.02 0.07 (78)	0.33*** 0.32*** (78)	0.58*** 0.50*** (78)	0.42*** 0.36*** (78)	0.40*** 0.47*** (78)	0.06 0.02 (78)	-0.04 -0.07 (78)	-0.08 -0.05 (42)	0.88*** 0.83*** (78)	1.00 (78)	
L-CU	-0.20* -0.19* (78)	-0.34*** -0.36*** (78)	0.09 -0.02 (78)	0.22* 0.27** (78)	0.05 0.09 (78)	0.25** 0.30*** (78)	0.52*** 0.56*** (78)	0.38*** 0.45*** (78)	0.64*** 0.70*** (78)	-0.03 -0.02 (78)	-0.10 -0.12 (78)	0.19 0.05 (42)	0.66*** 0.69*** (78)	0.73*** 0.75*** (78)	1.00 (78)
L-CO	0.02 0.08 (75)	-0.06 -0.04 (75)	0.01 -0.10 (75)	0.18 0.20* (75)	0.01 0.02 (75)	0.18 0.25** (75)	0.45*** 0.44*** (75)	0.37*** 0.43*** (75)	0.30*** 0.38*** (75)	0.35*** 0.24** (75)	0.28** 0.15 (75)	0.02 0.01 (41)	0.35*** 0.34*** (75)	0.37*** 0.29** (75)	0.37*** 0.45*** (75)
L-BA	-0.29*** -0.30*** (78)	-0.42*** -0.48*** (78)	0.26** 0.16 (78)	0.02 0.03 (78)	-0.21* -0.09 (78)	0.20* 0.26** (78)	0.41*** 0.43*** (78)	0.26** 0.34*** (78)	0.15 0.23** (78)	0.10 0.08 (78)	0.04 0.01 (78)	0.01 -0.01 (42)	0.66*** 0.60*** (78)	0.72*** 0.61*** (78)	0.57*** 0.64*** (78)
L-K	-0.29** -0.25** (78)	-0.40*** -0.39*** (78)	0.16 0.09 (78)	-0.01 0.00 (78)	-0.30*** -0.26** (78)	0.17 0.17 (78)	0.48*** 0.47*** (78)	0.26** 0.31*** (78)	0.19* 0.28** (78)	0.12 0.16 (78)	0.06 0.19 (78)	0.10 0.12 (42)	0.65*** 0.55*** (78)	0.72*** 0.61*** (78)	0.54*** 0.60*** (78)
L-NA	-0.32*** -0.31*** (78)	-0.43*** -0.44*** (78)	0.28** 0.23** (78)	-0.13 -0.07 (78)	-0.34*** -0.28** (78)	0.16 0.12 (78)	0.20* 0.21** (78)	0.11 0.15 (78)	0.05 0.19 (78)	0.12 0.12 (78)	0.07 0.06 (78)	0.17 0.27* (42)	0.48*** 0.43*** (78)	0.56*** 0.48*** (78)	0.43*** 0.51*** (78)
L-CA	0.16 0.11 (78)	0.21* 0.21* (78)	0.05 0.18 (78)	0.19 0.21* (78)	0.44*** 0.41*** (78)	-0.06 -0.05 (78)	-0.33*** -0.25** (78)	-0.12 -0.09 (78)	-0.13 -0.20* (78)	-0.19 -0.13 (78)	-0.16 -0.11 (78)	-0.12 -0.09 (42)	-0.68*** -0.55*** (78)	-0.75*** -0.64*** (78)	-0.59*** -0.58*** (78)
L-TI	-0.29** -0.30*** (78)	-0.41*** -0.47*** (78)	0.43*** 0.39*** (78)	0.01 0.04 (78)	-0.25** -0.16 (78)	0.20* 0.23** (78)	0.37*** 0.32*** (78)	0.29** 0.37*** (78)	0.18 0.23** (73)	0.20* 0.25** (78)	0.13 0.17 (78)	0.17 0.19 (42)	0.58*** 0.45*** (78)	0.66*** 0.52*** (78)	0.53*** 0.53*** (78)
L-ZR	-0.28** -0.28** (78)	-0.39*** -0.45*** (78)	0.39*** 0.35*** (78)	-0.03 0.03 (78)	-0.24** -0.08 (78)	0.17 0.23** (78)	0.29*** 0.35*** (73)	0.26** 0.39*** (78)	0.13 0.27** (78)	0.24** 0.27** (78)	0.18 0.18 (78)	0.13 0.17 (42)	0.54*** 0.47*** (73)	0.62*** 0.55*** (78)	0.51*** 0.55*** (78)
L-Y	-0.28** -0.25** (78)	-0.39*** -0.42*** (78)	0.32*** 0.23** (78)	0.05 0.06 (78)	-0.19* -0.05 (78)	0.17 0.22* (78)	0.42*** 0.45*** (78)	0.31*** 0.40*** (78)	0.19* 0.30*** (78)	0.19 0.18 (78)	0.13 0.10 (78)	0.09 0.07 (42)	0.61*** 0.59*** (78)	0.68*** 0.63*** (78)	0.55*** 0.61*** (78)
L-MN	-0.31*** -0.31*** (78)	-0.31*** -0.38*** (78)	0.44*** 0.38*** (78)	-0.09 -0.04 (78)	-0.35*** -0.22* (78)	-0.04 -0.04 (78)	0.14 0.09 (78)	0.05 0.08 (78)	0.01 0.04 (78)	0.25** 0.21* (78)	0.25** 0.23** (78)	0.09 0.10 (42)	0.45*** 0.36*** (78)	0.51*** 0.39*** (78)	0.39*** 0.37*** (78)
L-CR	-0.15 -0.17 (78)	-0.30*** -0.36*** (78)	0.41*** 0.36*** (78)	0.21* 0.19* (78)	0.04 0.10 (78)	0.27** 0.32*** (78)	0.50*** 0.52*** (78)	0.48*** 0.57*** (78)	0.32*** 0.36*** (78)	0.23** 0.30*** (78)	0.14 0.21* (78)	0.05 0.04 (42)	0.57*** 0.48*** (78)	0.67*** 0.54*** (78)	0.55*** 0.56*** (78)
L-SC	-0.18 -0.17 (78)	-0.32*** -0.34*** (78)	0.23** 0.19* (78)	0.16 0.16 (78)	-0.05 0.05 (78)	0.26** 0.32*** (78)	0.54*** 0.50*** (78)	0.41*** 0.48*** (78)	0.28** 0.29*** (78)	0.15 0.21* (78)	0.07 0.12 (78)	0.00 -0.04 (42)	0.67*** 0.60*** (78)	0.67*** 0.56*** (78)	0.52*** 0.52*** (78)
L-AL	-0.20* -0.20* (78)	-0.35*** -0.38*** (78)	0.24** 0.11 (78)	0.16 0.13 (78)	-0.09 -0.04 (78)	0.27** 0.30*** (78)	0.54*** 0.59*** (78)	0.43*** 0.46*** (78)	0.34*** 0.40*** (78)	0.08 0.14 (78)	0.00 0.05 (78)	0.08 0.07 (42)	0.75*** 0.67*** (78)	0.81*** 0.71*** (78)	0.68*** 0.71*** (78)
L-FE	-0.22** -0.23** (78)	-0.39*** -0.42*** (78)	0.35*** 0.22** (78)	0.26** 0.25** (78)	-0.01 0.06 (78)	0.30*** 0.34*** (78)	0.55*** 0.50*** (78)	0.49*** 0.57*** (78)	0.43*** 0.49*** (78)	0.09 0.14 (78)	0.00 0.04 (78)	0.23 0.26 (42)	0.66*** 0.57*** (78)	0.76*** 0.64*** (78)	0.66*** 0.68*** (78)
L-MG	-0.22** -0.25** (78)	-0.34*** -0.40*** (78)	0.21* 0.09 (78)	0.04 0.04 (78)	-0.18 -0.05 (78)	0.19* 0.20* (78)	0.55*** 0.51*** (78)	0.31*** 0.35*** (78)	0.24** 0.34*** (78)	0.07 0.07 (78)	0.01 0.00 (78)	0.08 0.07 (42)	0.75*** 0.70*** (78)	0.78*** 0.68*** (78)	0.63*** 0.67*** (78)
L-CE	-0.20* -0.17 (78)	-0.26** -0.29*** (78)	0.30*** 0.26** (78)	-0.13 -0.12 (78)	-0.33*** -0.26** (78)	0.08 0.11 (78)	0.25** 0.23** (78)	0.16 0.23** (78)	0.07 0.09 (78)	0.54*** 0.52*** (78)	0.49*** 0.48*** (78)	0.03 0.04 (42)	0.46*** 0.37*** (78)	0.53*** 0.43*** (78)	0.29*** 0.36*** (78)
L-BE	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)	*****a *****a (42)	*****a *****a (78)	*****a *****a (78)	*****a *****a (78)

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-CO	L-BA	L-K	L-NA	L-CA	L-TI	L-ZR	L-Y	L-MN	L-CR	L-SC	L-AL	L-FE	L-MG	L-CE	L-BE
L-CO	1.00 (75)															
L-BA	0.32*** 0.37*** (75)	1.00 (78)														
L-K	0.39*** 0.40*** (75)	0.87*** 0.84*** (78)	1.00 (78)													
L-NA	0.11 0.16 (75)	0.82*** 0.76*** (78)	0.86*** 0.84*** (78)	1.00 (78)												
L-CA	-0.40*** -0.32*** (75)	-0.77*** -0.68*** (78)	-0.84*** -0.80*** (78)	-0.71*** -0.71*** (78)	1.00 (78)											
L-TI	0.31*** 0.32*** (75)	0.85*** 0.78*** (78)	0.83*** 0.80*** (78)	0.82*** 0.82*** (78)	-0.75*** -0.69*** (78)	1.00 (78)										
L-ZR	0.24** 0.31*** (75)	0.80*** 0.72*** (78)	0.78*** 0.74*** (78)	0.83*** 0.75*** (78)	-0.73*** -0.66*** (78)	0.93*** 0.94*** (78)	1.00 (78)									
L-Y	0.43*** 0.44*** (75)	0.80*** 0.79*** (78)	0.83*** 0.79*** (78)	0.74*** 0.71*** (78)	-0.76*** -0.70*** (78)	0.87*** 0.86*** (78)	0.90*** 0.89*** (78)	1.00 (78)								
L-MN	0.33*** 0.26** (75)	0.70*** 0.59*** (78)	0.67*** 0.56*** (78)	0.57*** 0.53*** (78)	-0.60*** -0.50*** (78)	0.80*** 0.75*** (78)	0.76*** 0.70*** (78)	0.77*** 0.73*** (78)	1.00 (78)							
L-CR	0.49*** 0.48*** (75)	0.68*** 0.65*** (78)	0.71*** 0.66*** (78)	0.54*** 0.52*** (78)	-0.65*** -0.53*** (78)	0.85*** 0.85*** (78)	0.78*** 0.82*** (78)	0.79*** 0.79*** (78)	0.65*** 0.60*** (78)	1.00 (78)						
L-SC	0.47*** 0.46*** (75)	0.64*** 0.64*** (78)	0.71*** 0.67*** (78)	0.50*** 0.51*** (78)	-0.69*** -0.57*** (78)	0.76*** 0.76*** (78)	0.73*** 0.77*** (78)	0.78*** 0.77*** (78)	0.59*** 0.58*** (78)	0.84*** 0.83*** (78)	1.00 (78)					
L-AL	0.48*** 0.48*** (75)	0.81*** 0.83*** (78)	0.89*** 0.89*** (78)	0.53*** 0.75*** (78)	-0.82*** -0.76*** (78)	0.86*** 0.85*** (78)	0.79*** 0.83*** (78)	0.87*** 0.87*** (78)	0.70*** 0.65*** (78)	0.87*** 0.83*** (78)	0.85*** 0.85*** (78)	1.00 (78)				
L-FE	0.51*** 0.54*** (75)	0.77*** 0.75*** (78)	0.81*** 0.78*** (78)	0.53*** 0.57*** (78)	-0.74*** -0.65*** (78)	0.86*** 0.86*** (78)	0.78*** 0.84*** (78)	0.84*** 0.87*** (78)	0.70*** 0.66*** (78)	0.91*** 0.88*** (78)	0.84*** 0.84*** (78)	0.96*** 0.94*** (78)	1.00 (78)			
L-MG	0.52*** 0.47*** (75)	0.85*** 0.85*** (78)	0.88*** 0.82*** (78)	0.53*** 0.56*** (78)	-0.82*** -0.72*** (78)	0.80*** 0.73*** (78)	0.73*** 0.70*** (78)	0.85*** 0.85*** (78)	0.72*** 0.64*** (78)	0.77*** 0.69*** (78)	0.78*** 0.72*** (78)	0.93*** 0.90*** (78)	0.89*** 0.83*** (78)	1.00 (78)		
L-CE	0.60*** 0.61*** (75)	0.62*** 0.58*** (78)	0.68*** 0.66*** (78)	0.55*** 0.51*** (78)	-0.66*** -0.58*** (78)	0.73*** 0.71*** (78)	0.68*** 0.67*** (78)	0.69*** 0.66*** (78)	0.64*** 0.58*** (78)	0.73*** 0.72*** (78)	0.69*** 0.67*** (78)	0.66*** 0.66*** (78)	0.65*** 0.64*** (78)	0.66*** 0.60*** (78)	1.00 (78)	
L-BE	****** ****** (75)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	****** ****** (78)	1.00 (78)

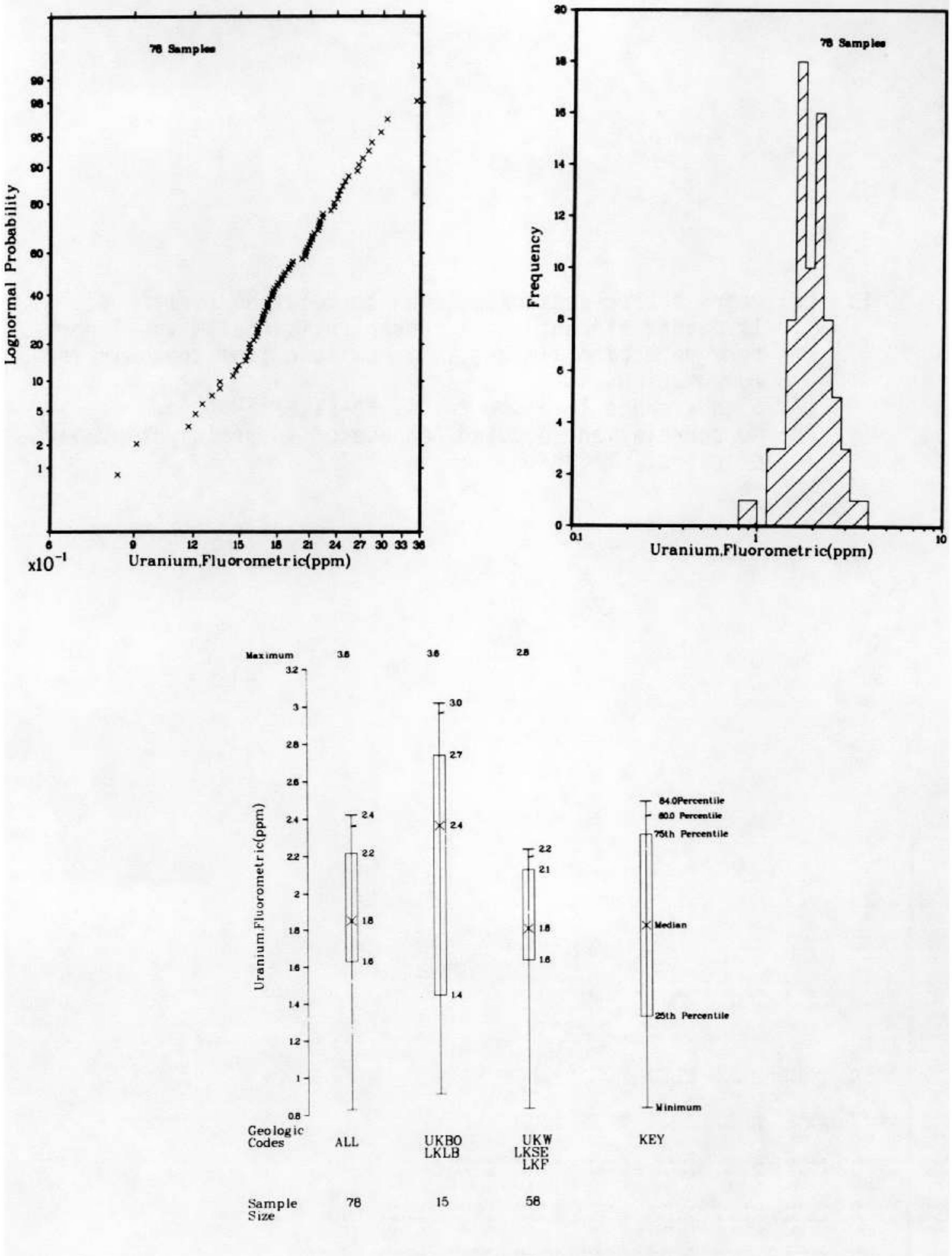


Figure B-1a

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

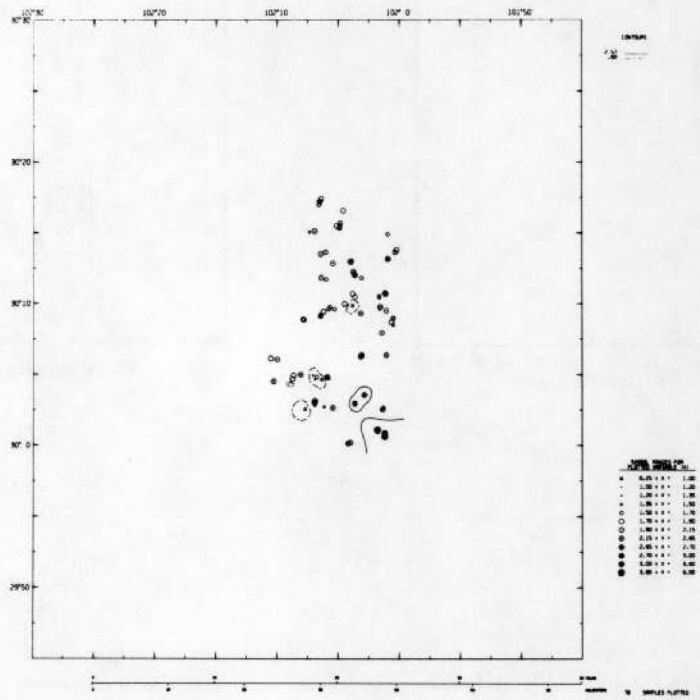


Figure B-1b

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

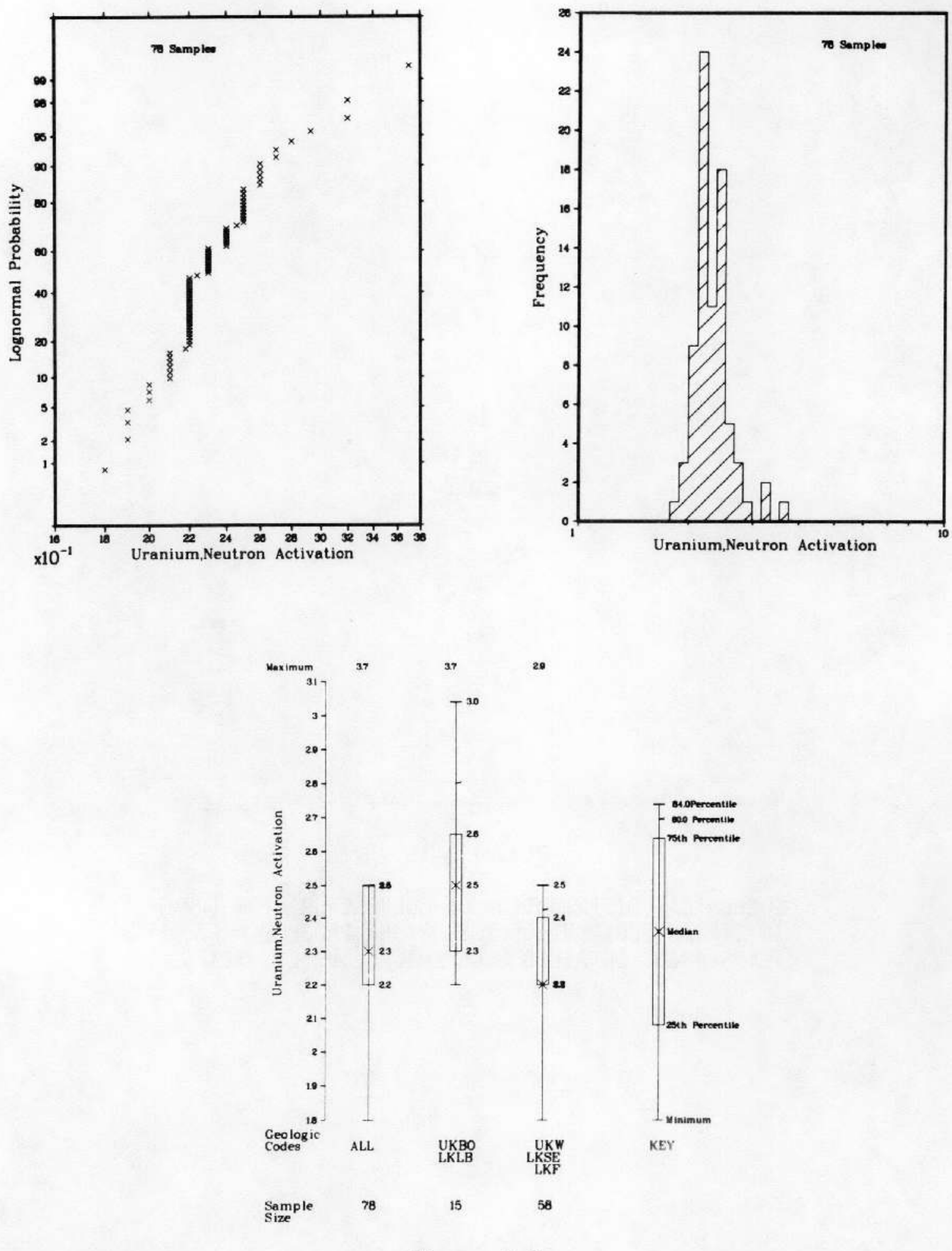


Figure B-2a

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

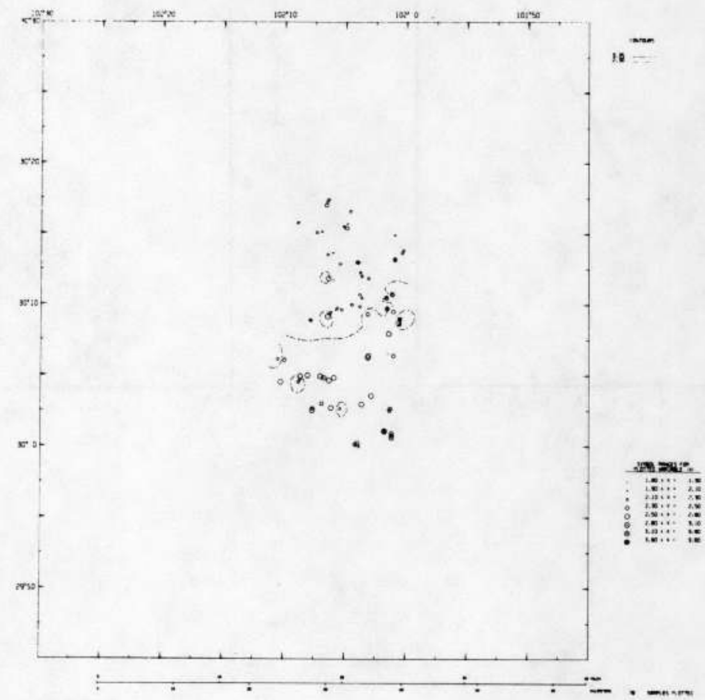


Figure B-2b

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

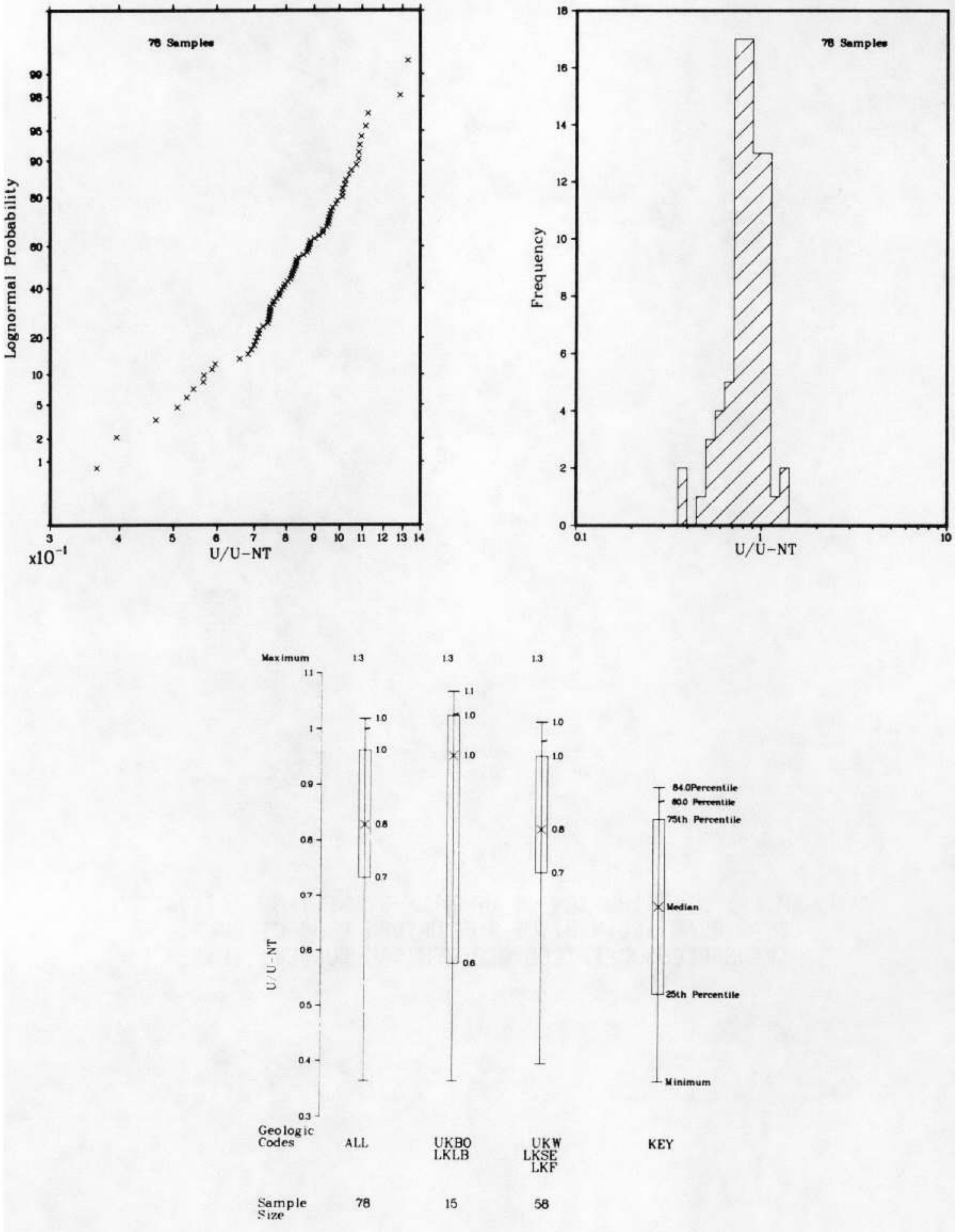


Figure B-3a

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

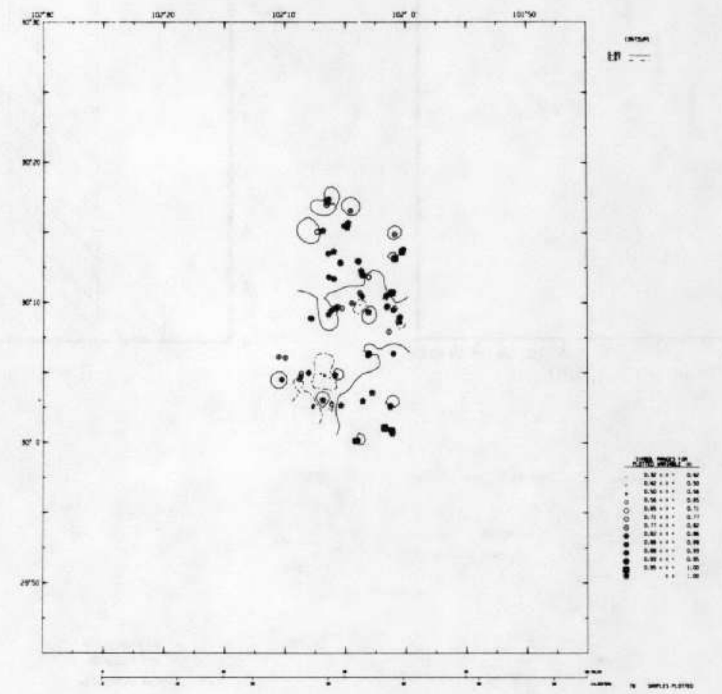


Figure B-3b

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

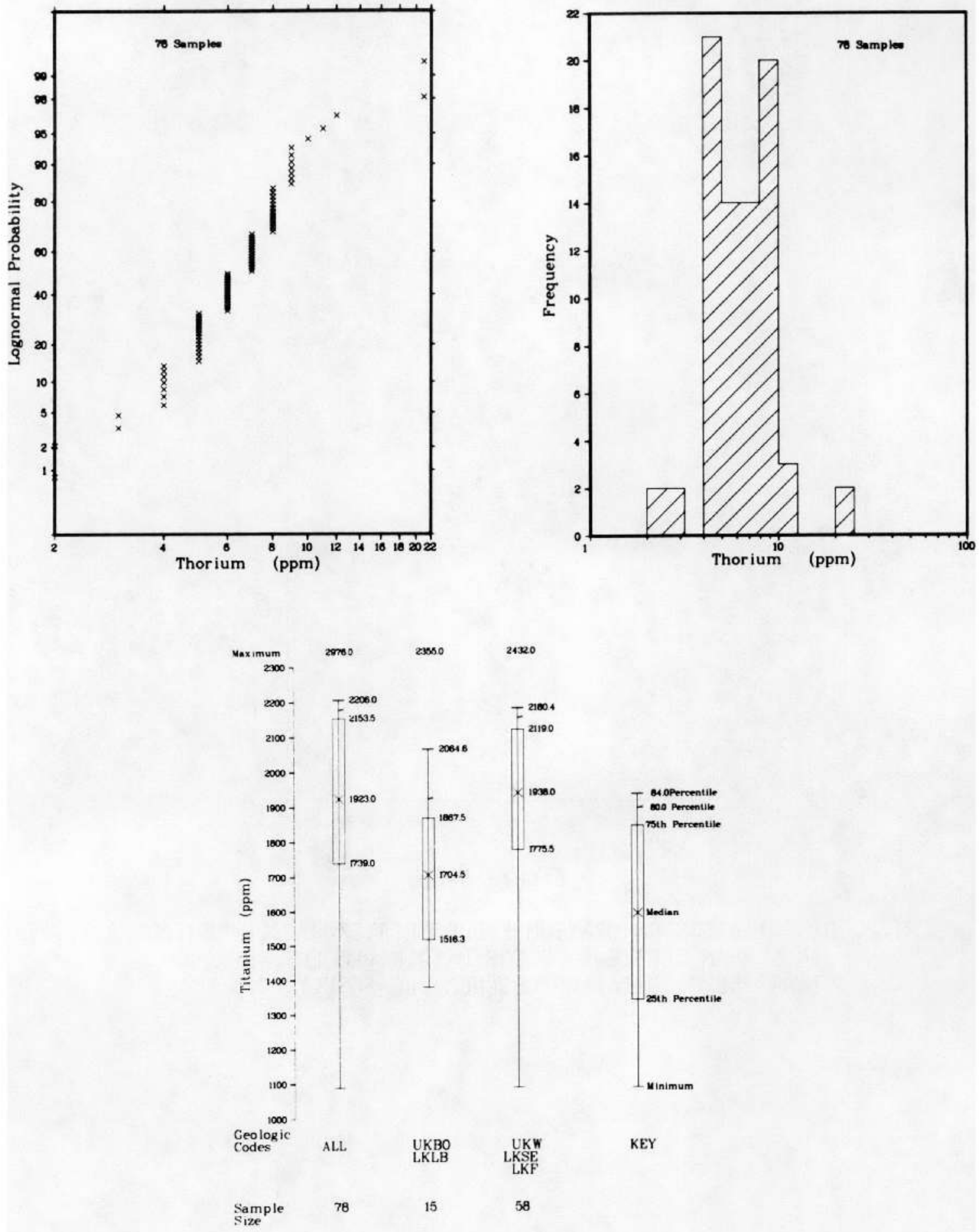


Figure B-4a

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

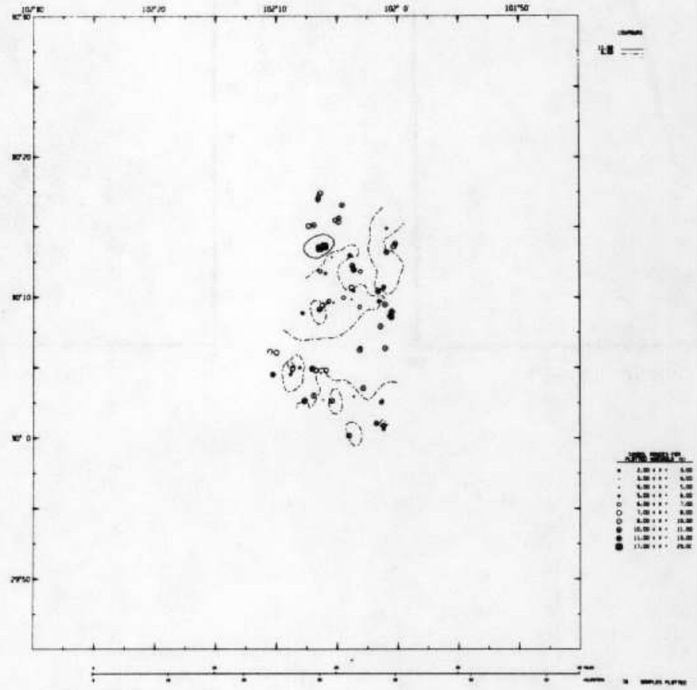


Figure B-4b

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

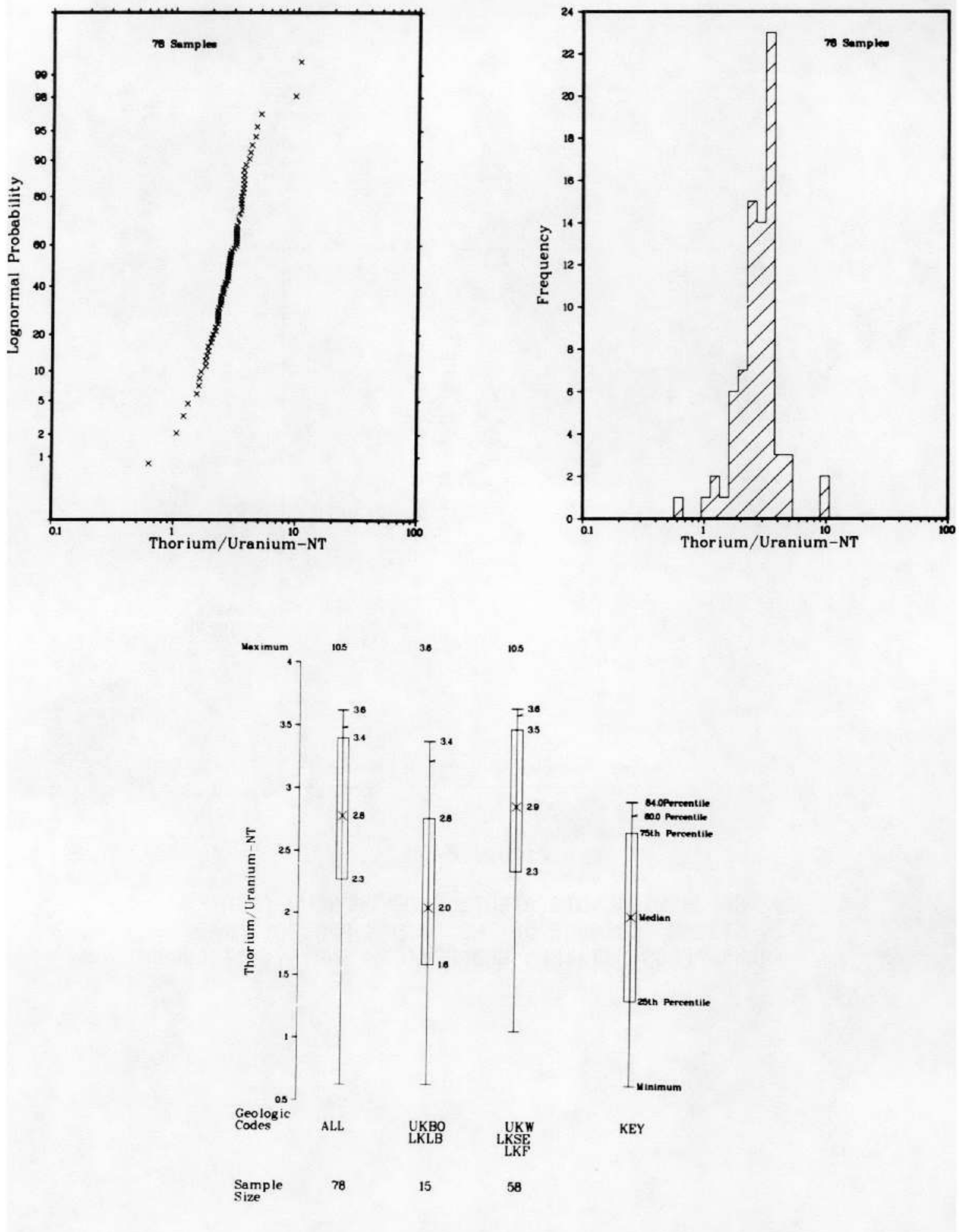


Figure B-5a

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

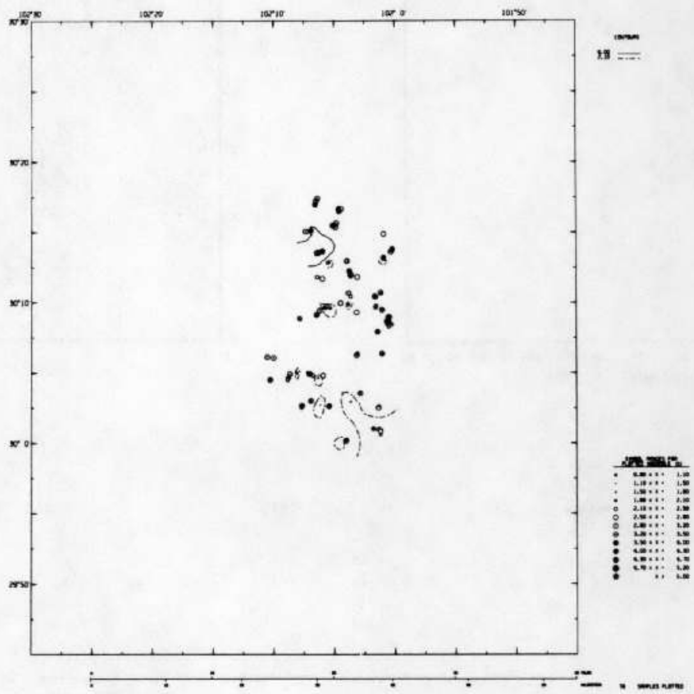


Figure B-5b

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

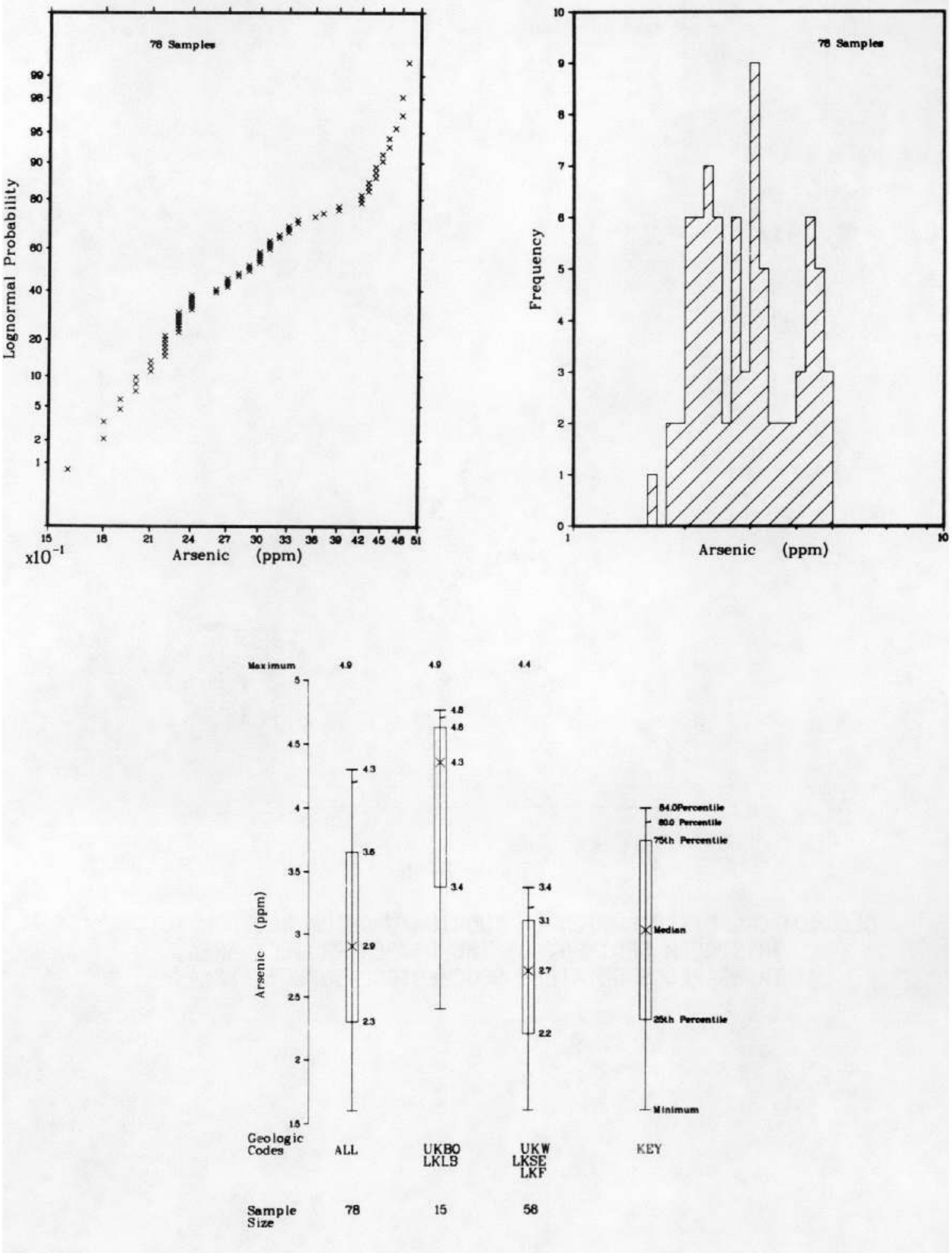


Figure B-6a

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

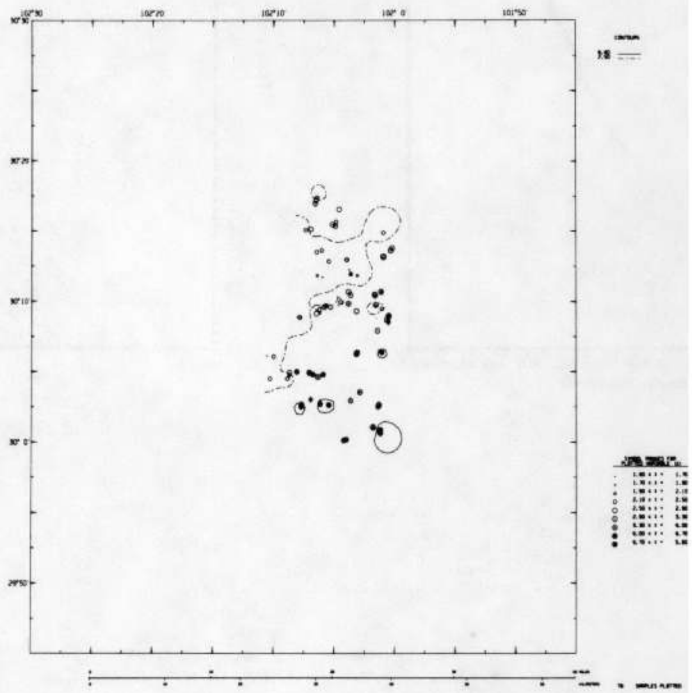


Figure B-6b

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

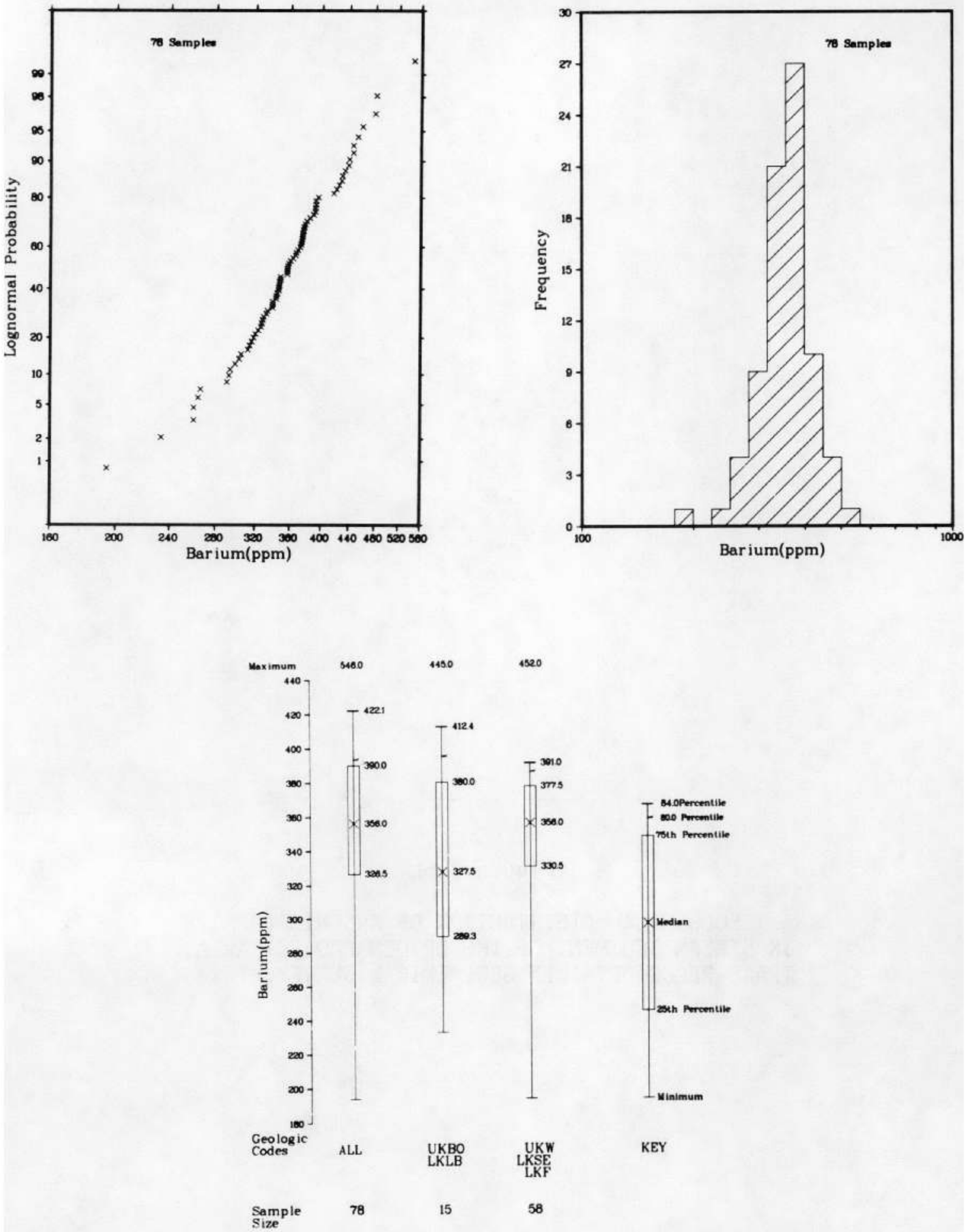


Figure B-7a

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

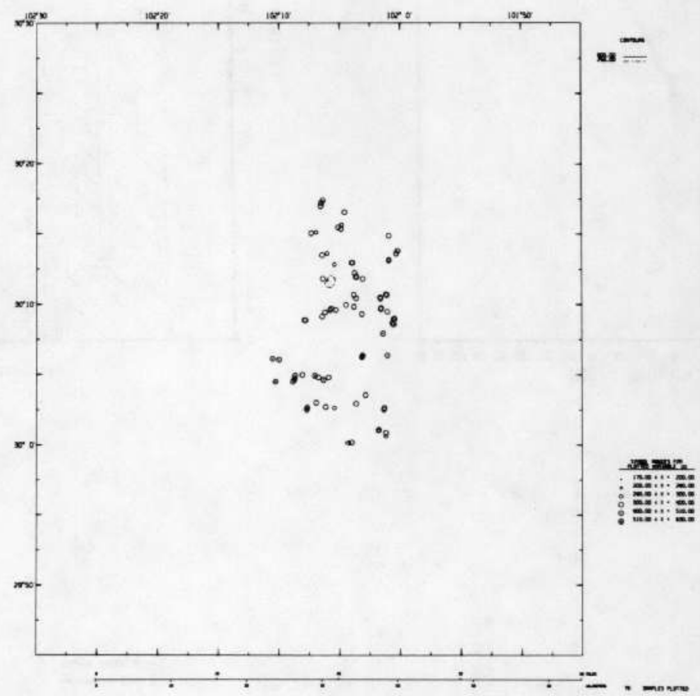


Figure B-7b

GEOCHEMICAL DISTRIBUTION OF BARIUM (PPM)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

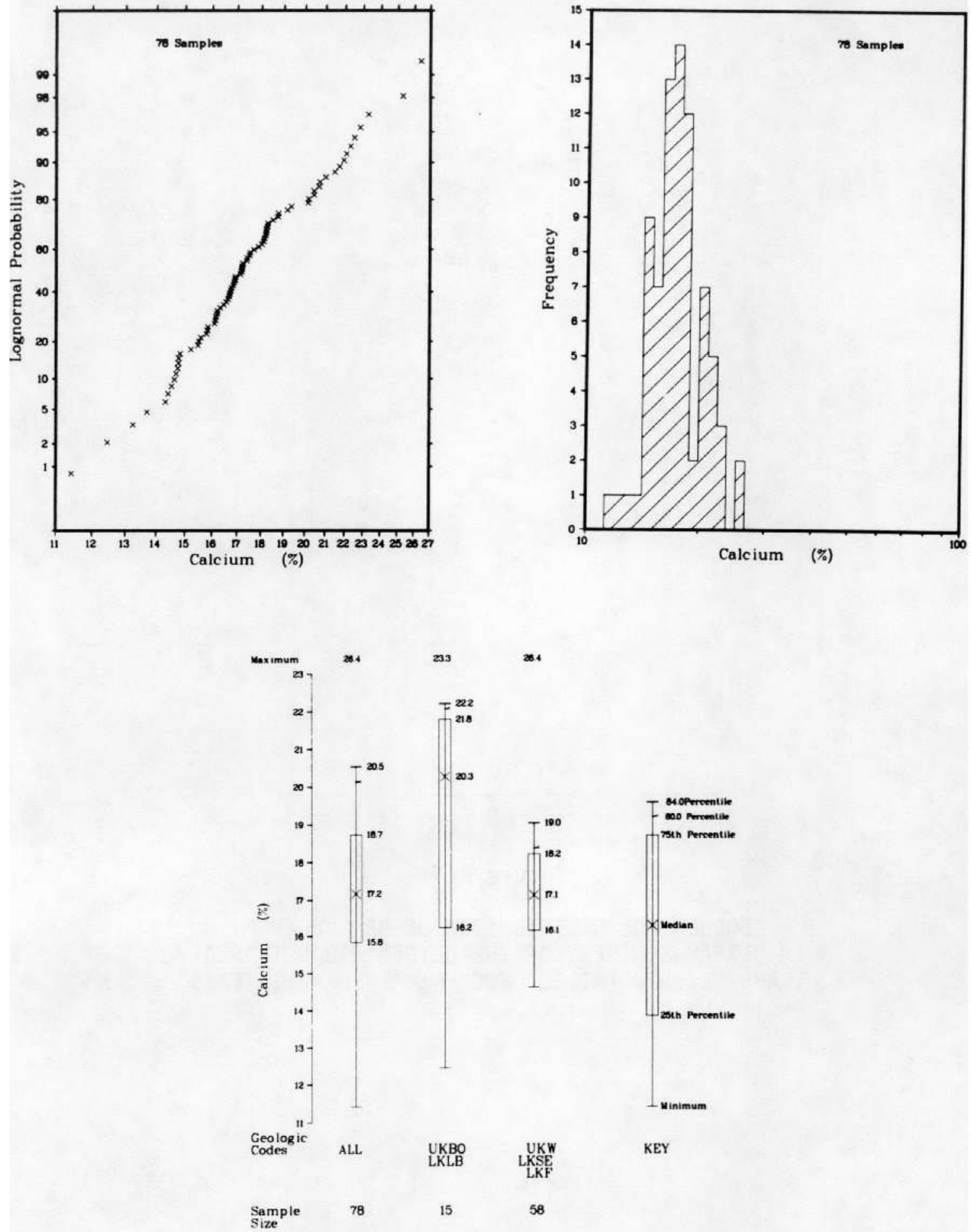


Figure B-8a

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

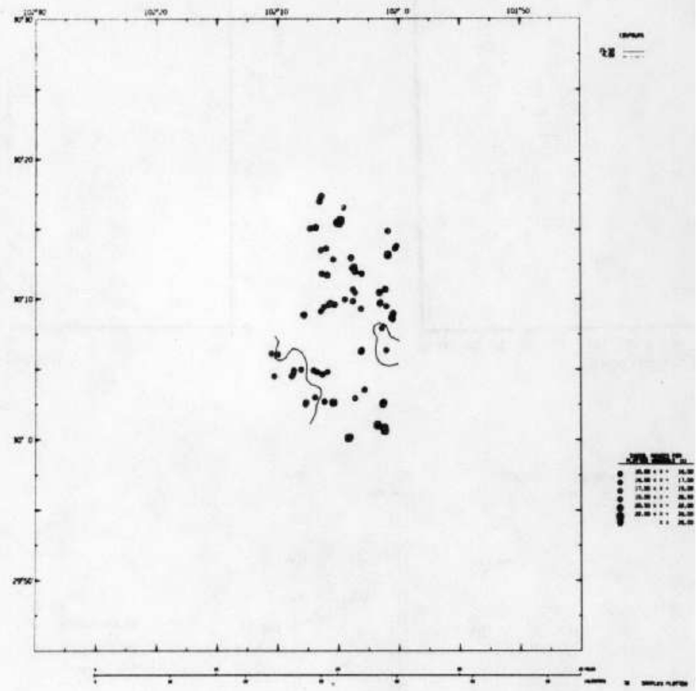


Figure B-8b

GEOCHEMICAL DISTRIBUTION OF CALCIUM (%)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

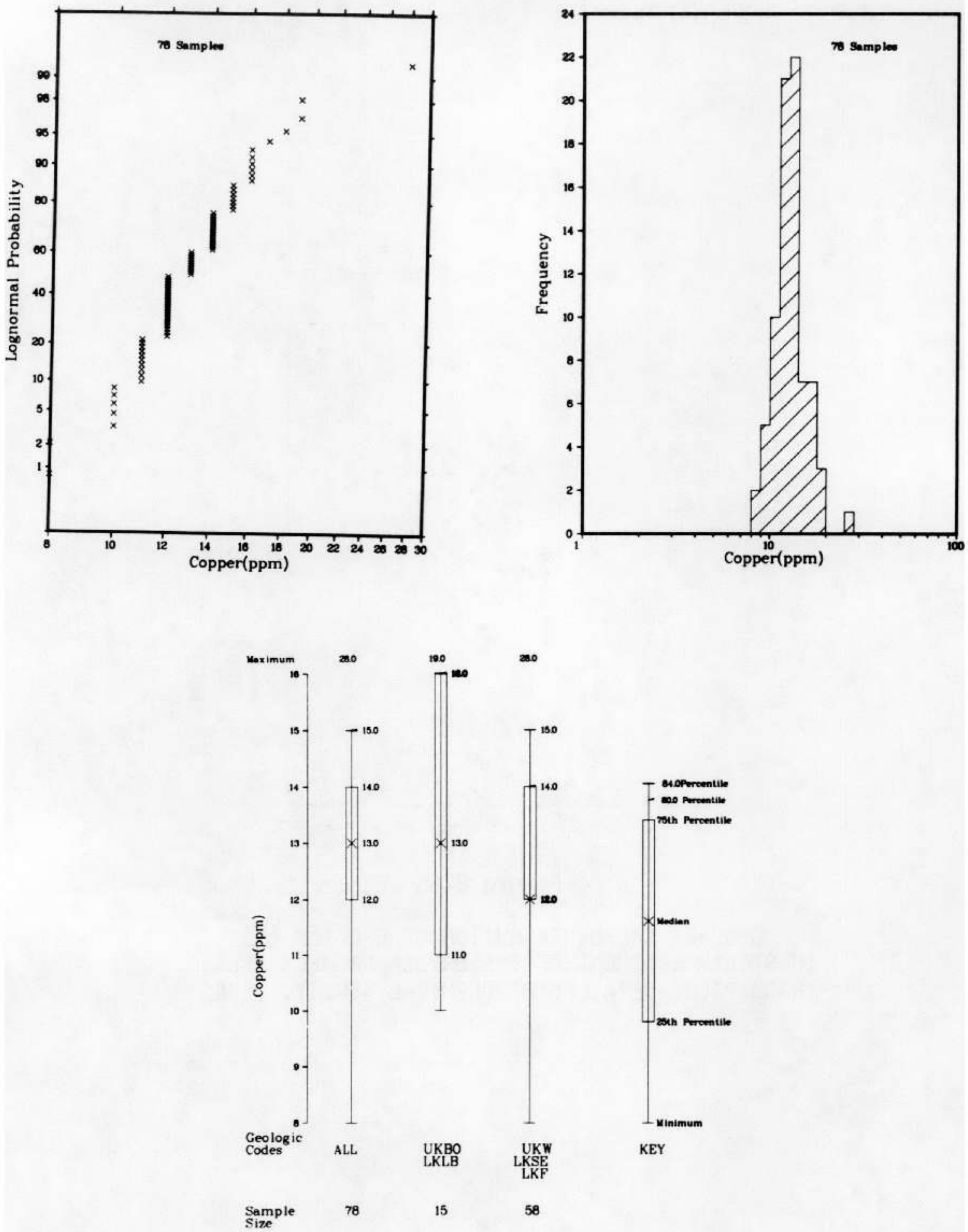


Figure B-9a

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

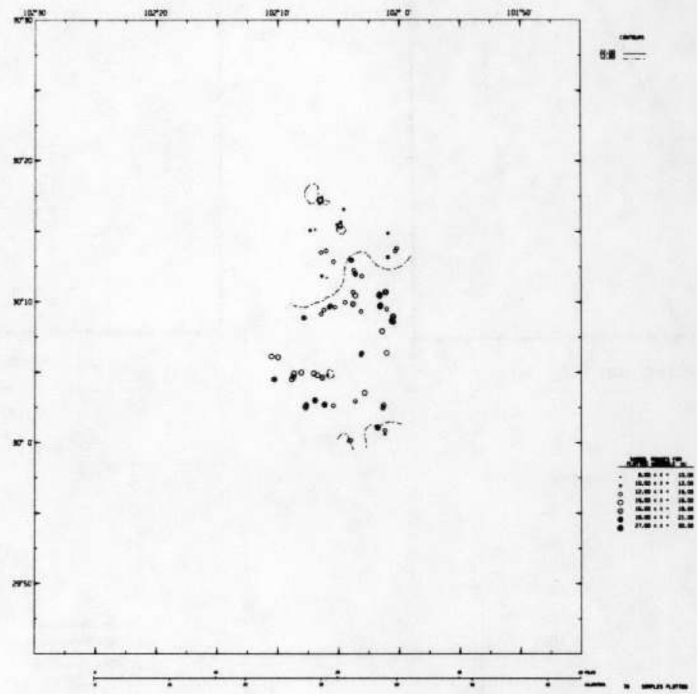


Figure B-9b

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

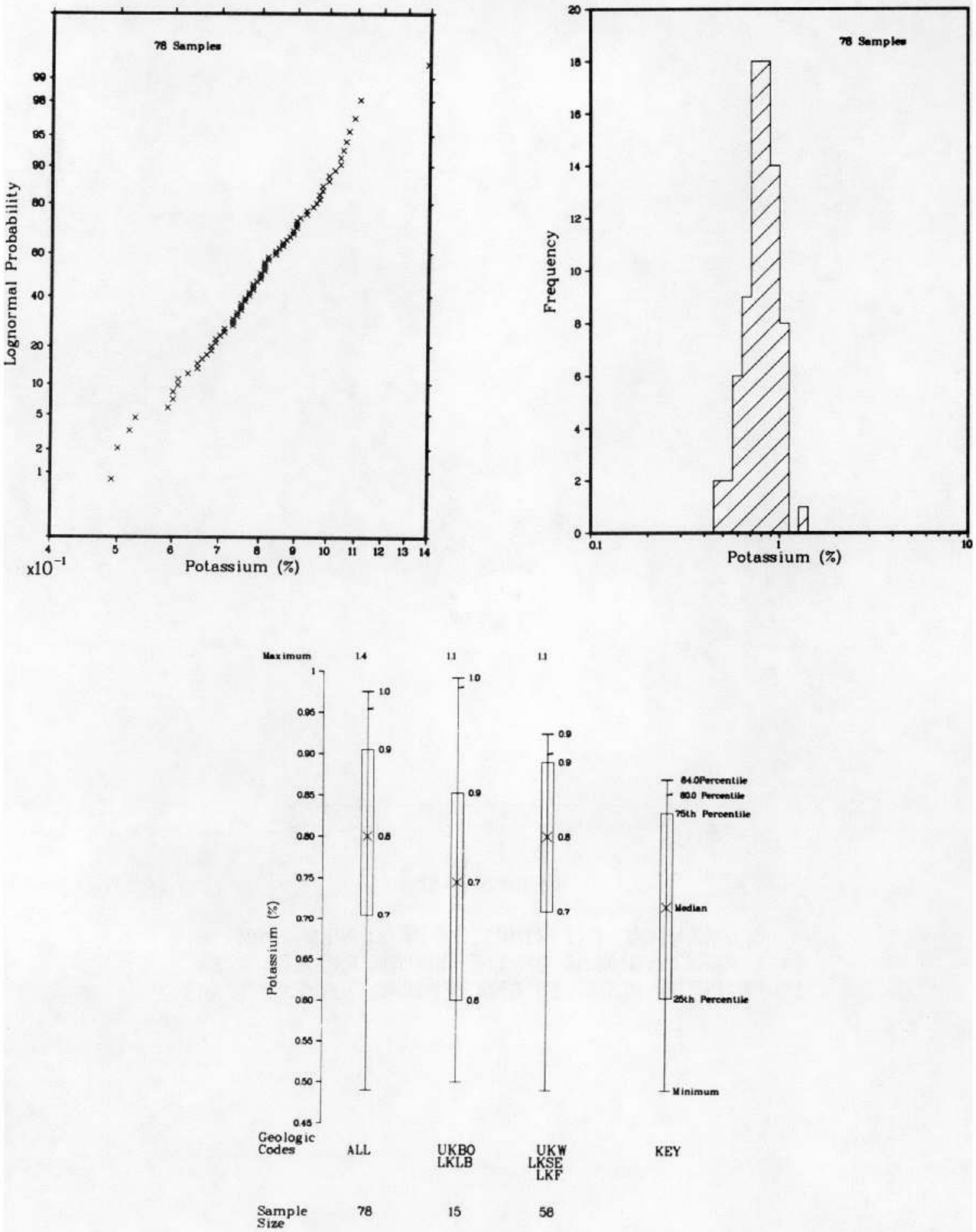


Figure B-10a

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

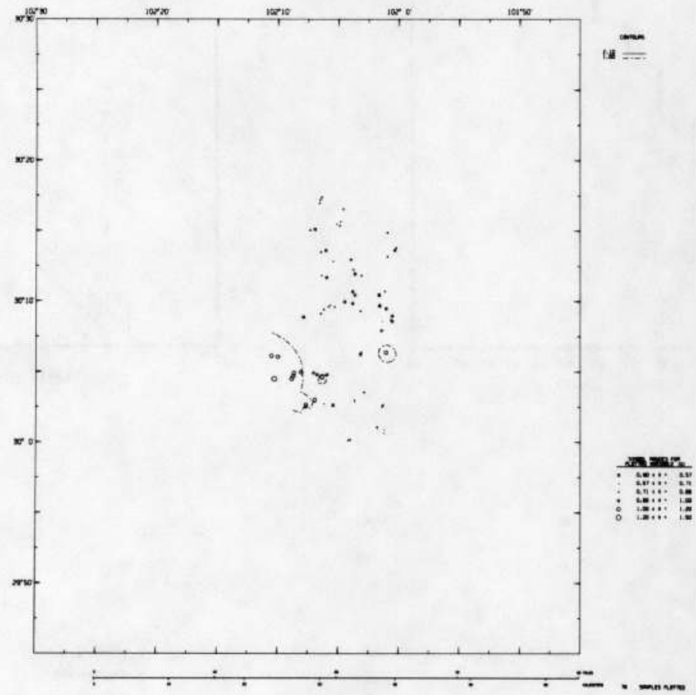


Figure B-10b

GEOCHEMICAL DISTRIBUTION OF POTASSIUM (%)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

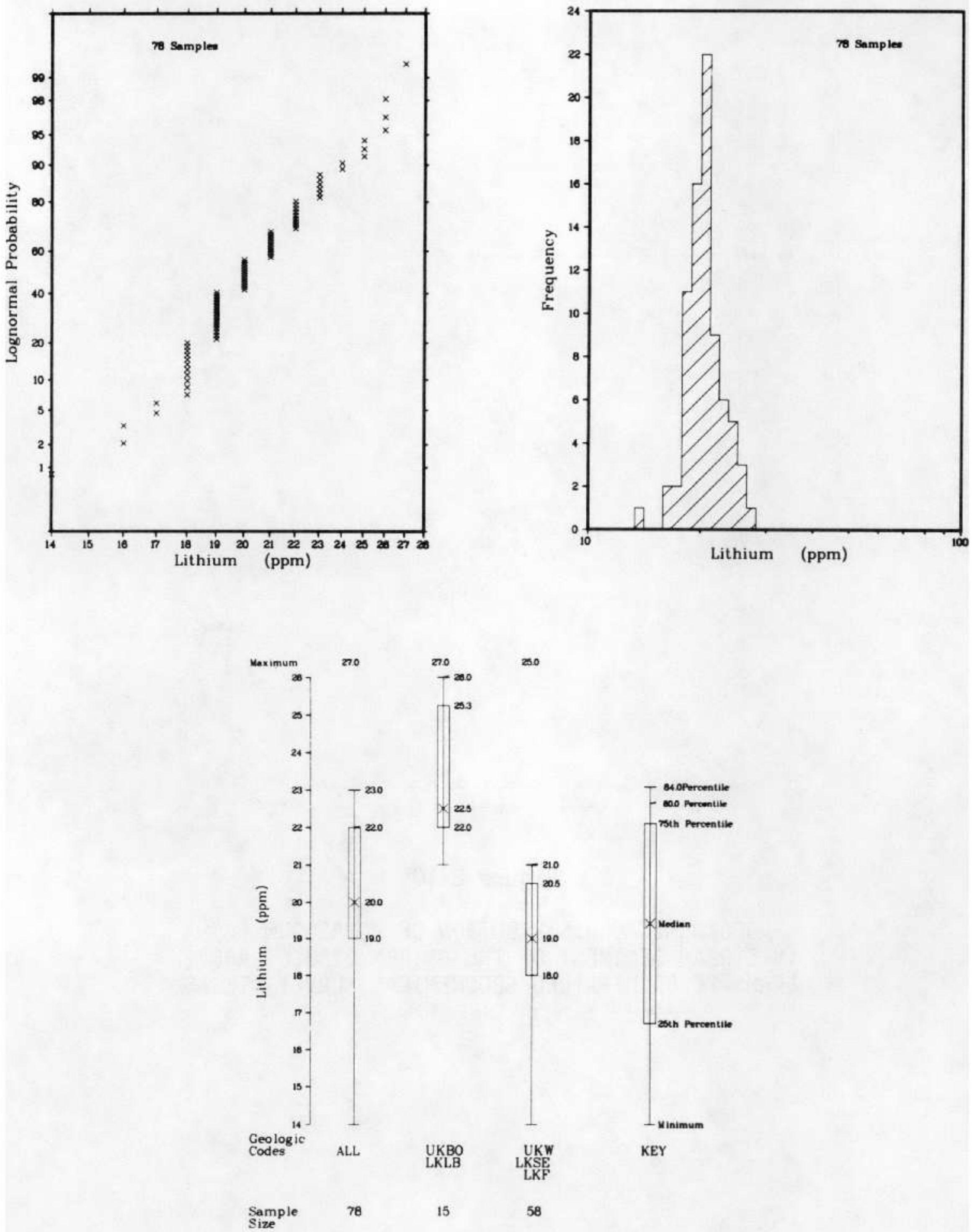


Figure B-11a

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

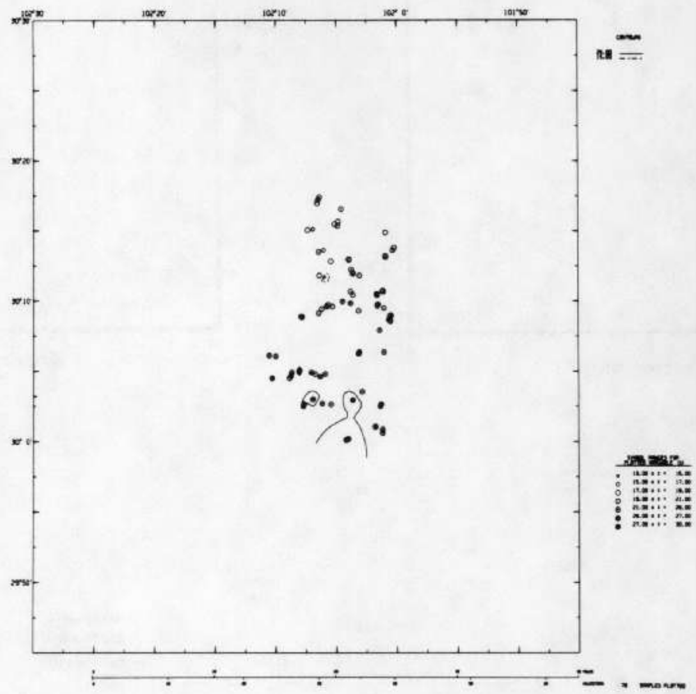


Figure B-11b

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

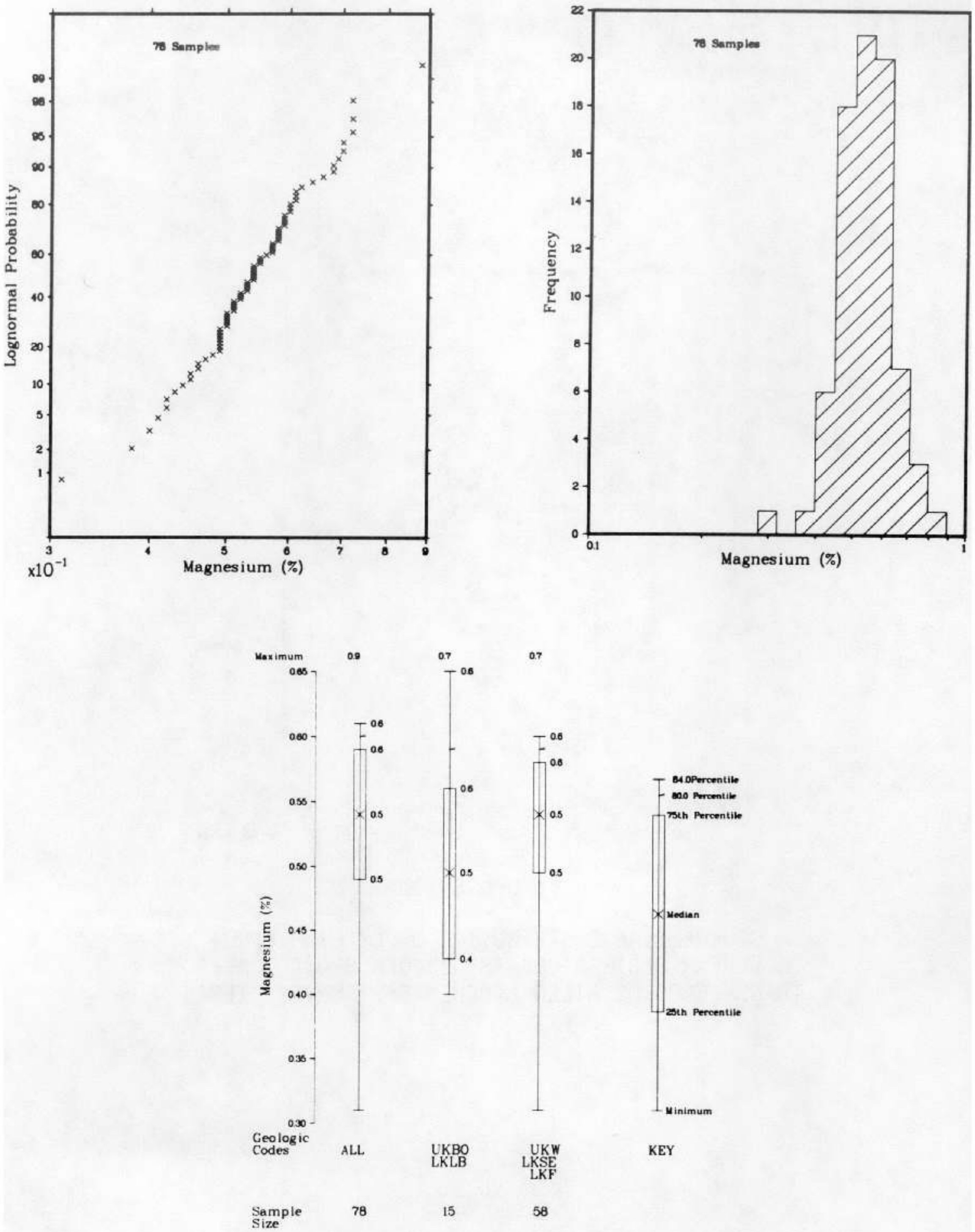


Figure B-12a

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

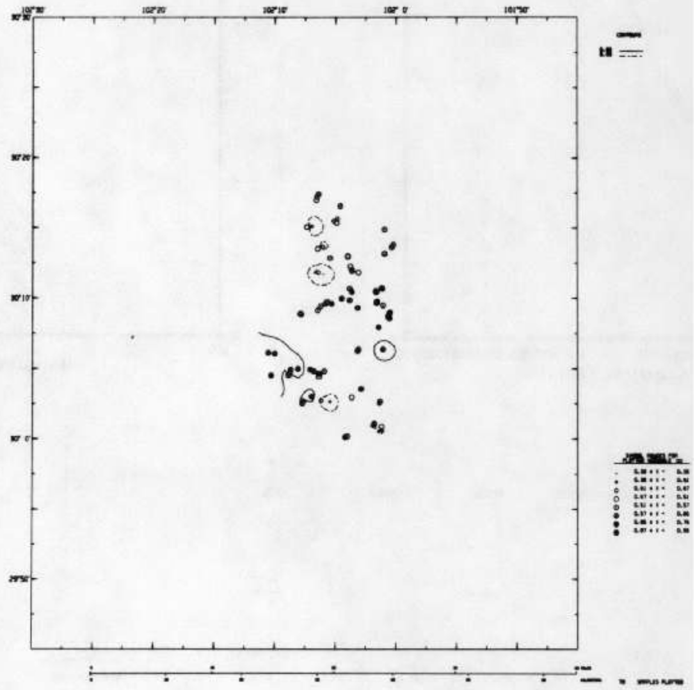


Figure B-12b

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

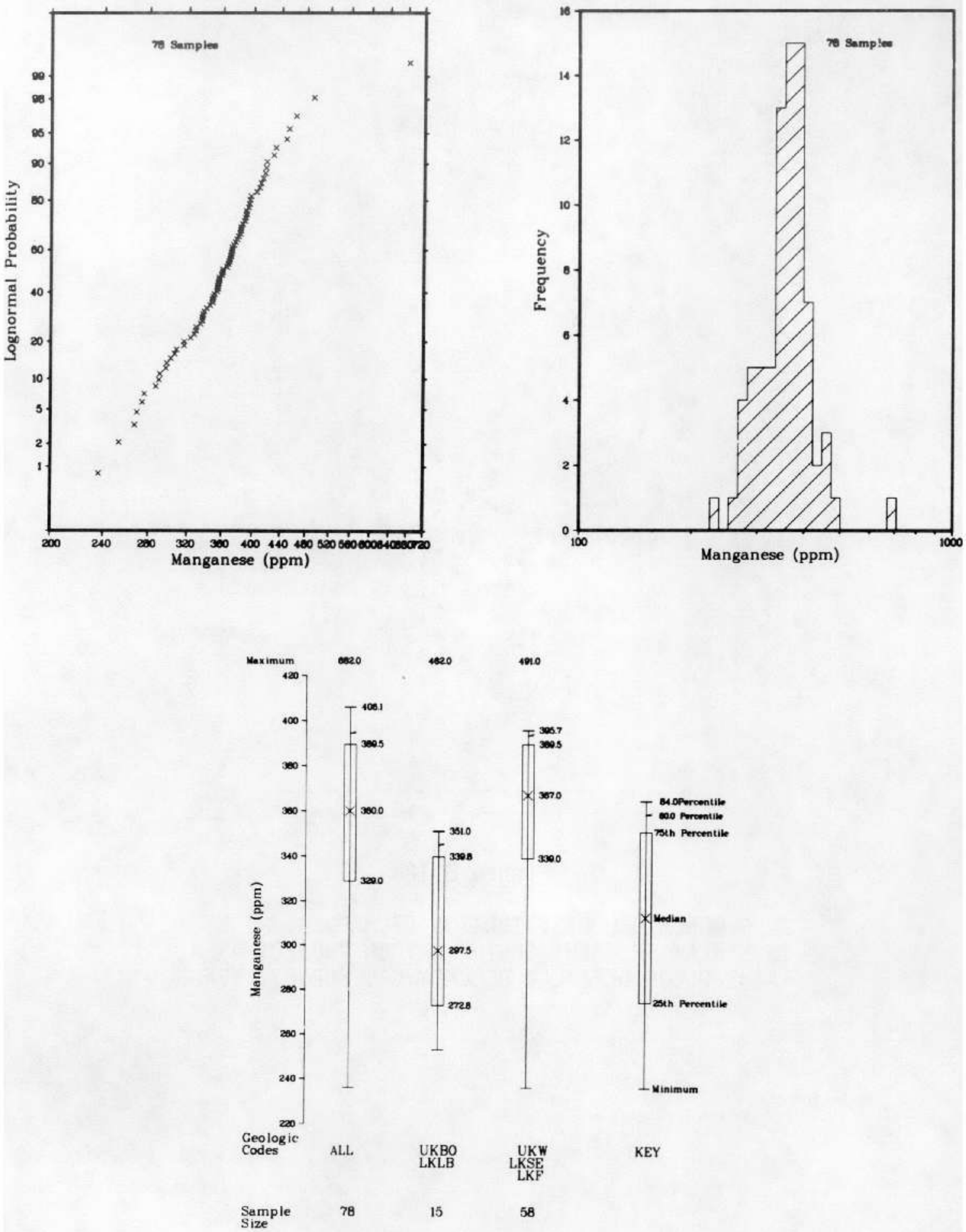


Figure B-13a

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

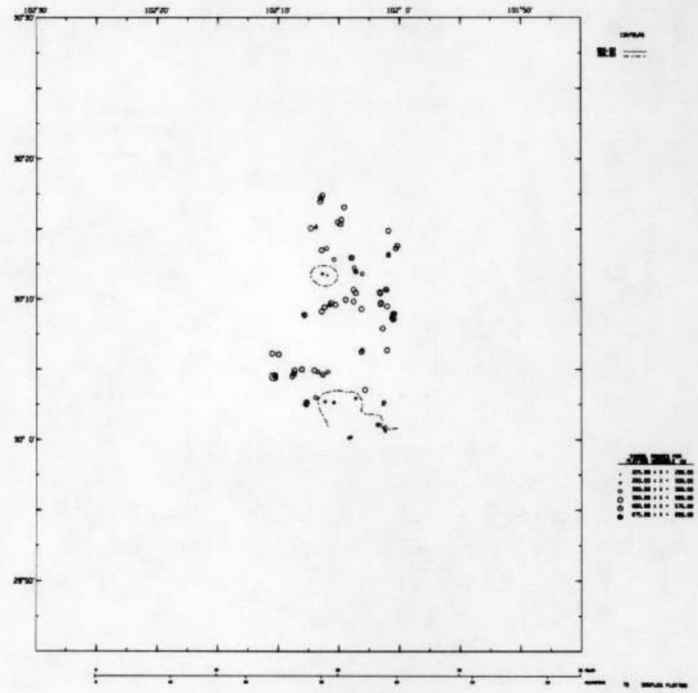


Figure B-13b

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

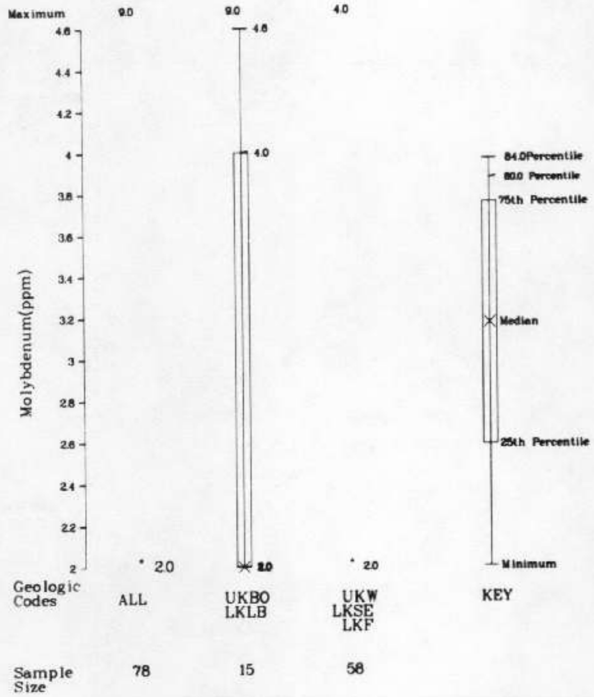


Figure B-14a

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

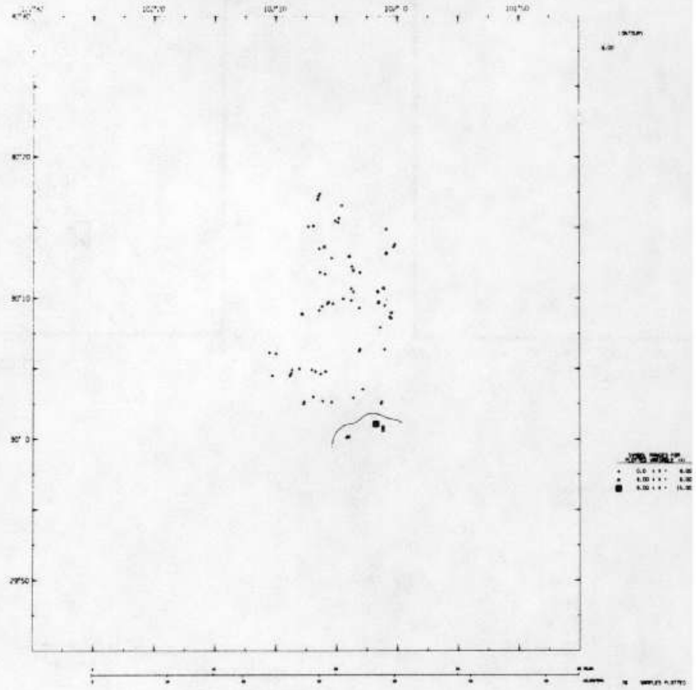


Figure B-14b

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

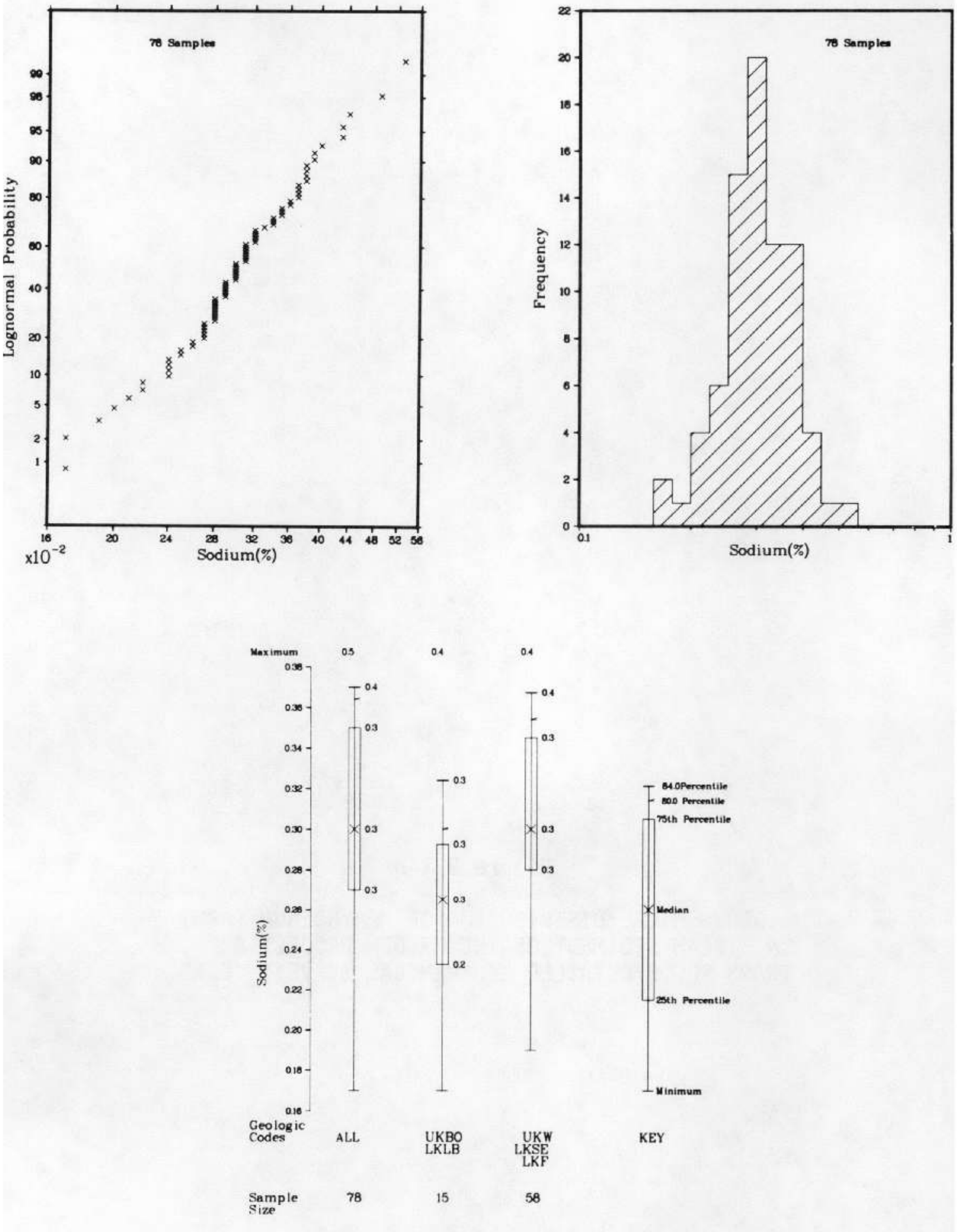


Figure B-15a

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

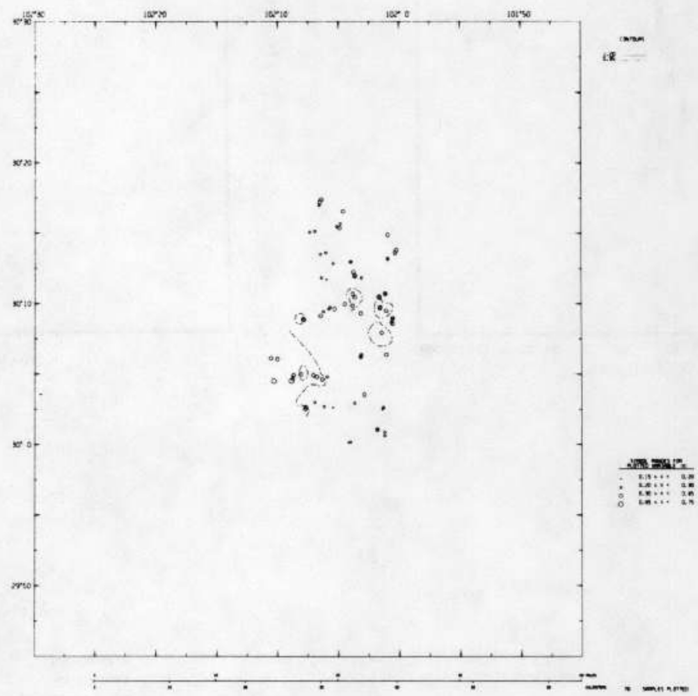


Figure B-15b

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

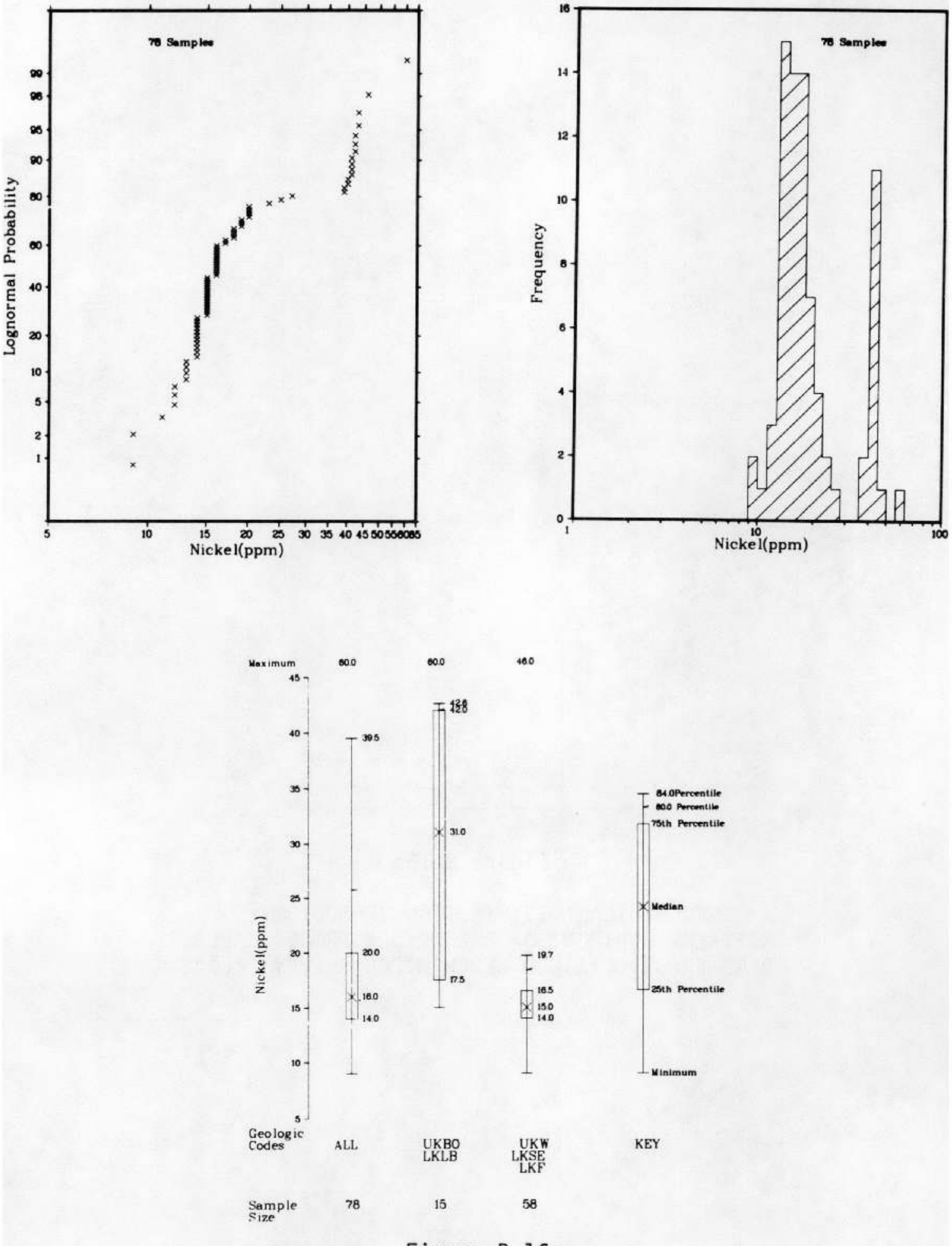


Figure B-16a

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

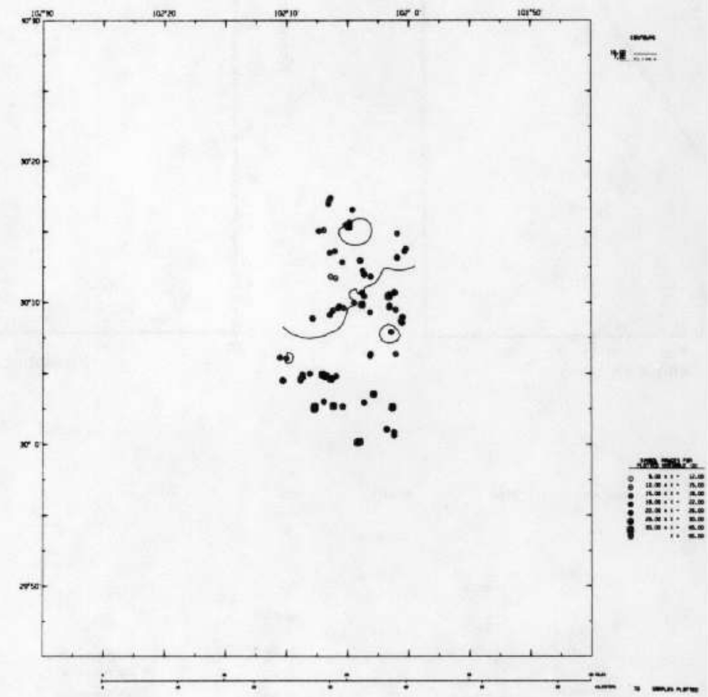


Figure B-16b

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

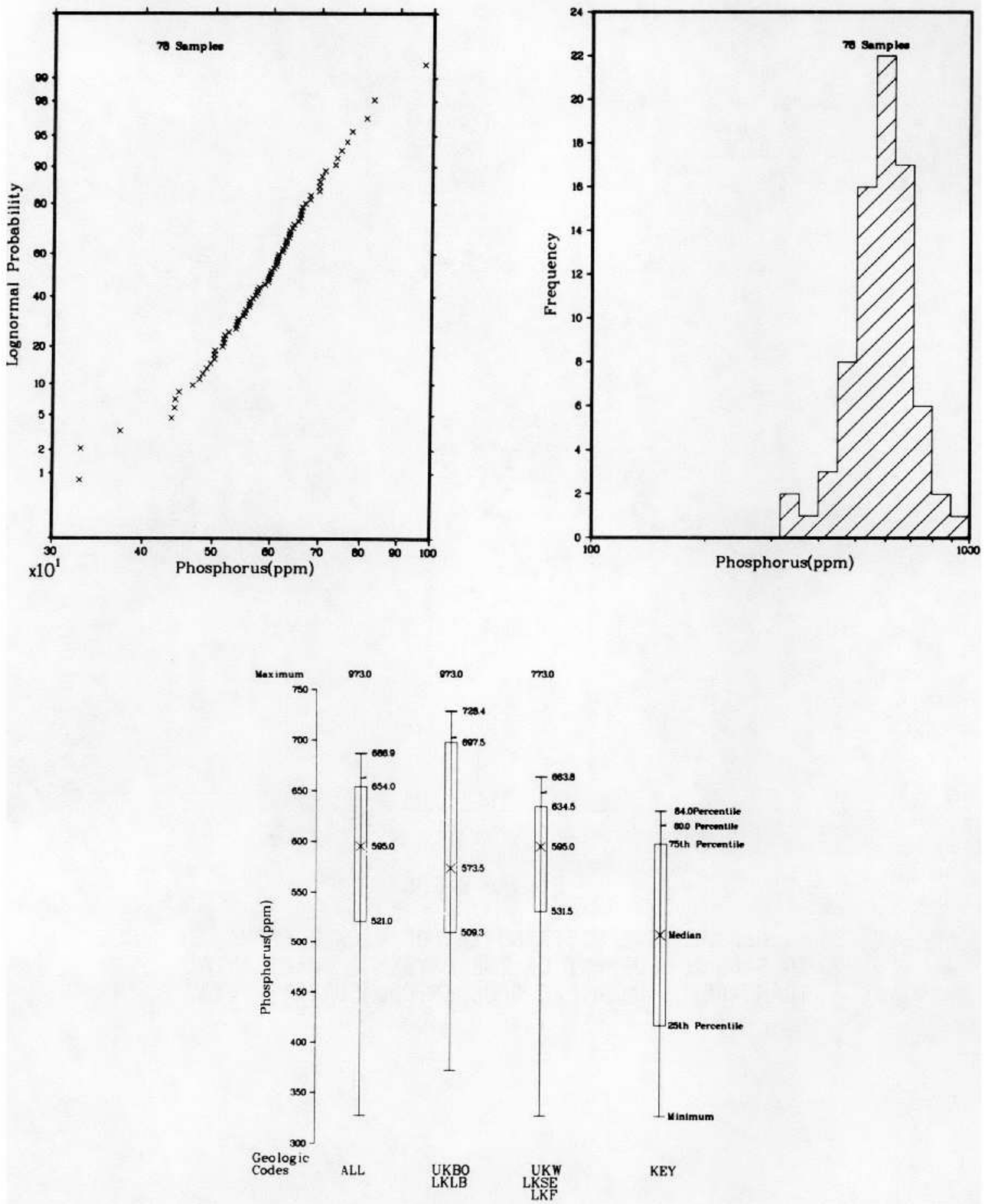


Figure B-17a

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

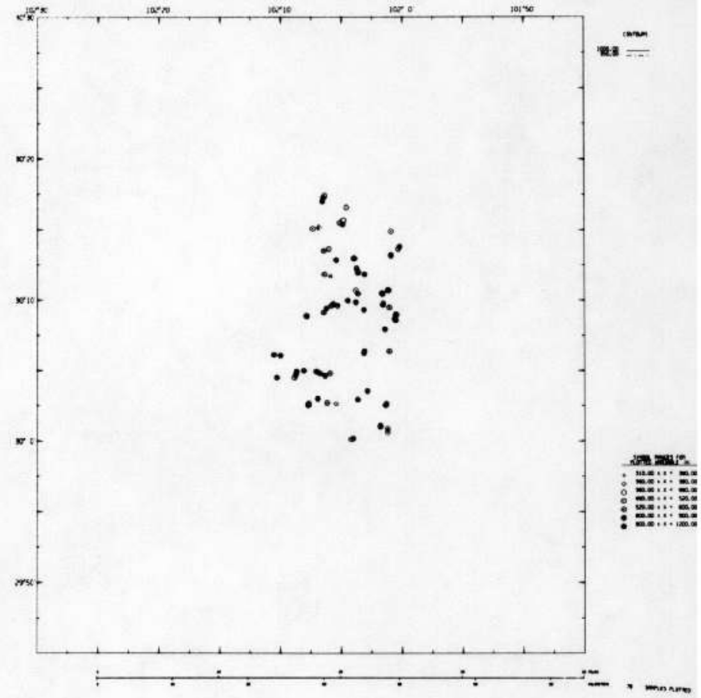


Figure B-17b

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

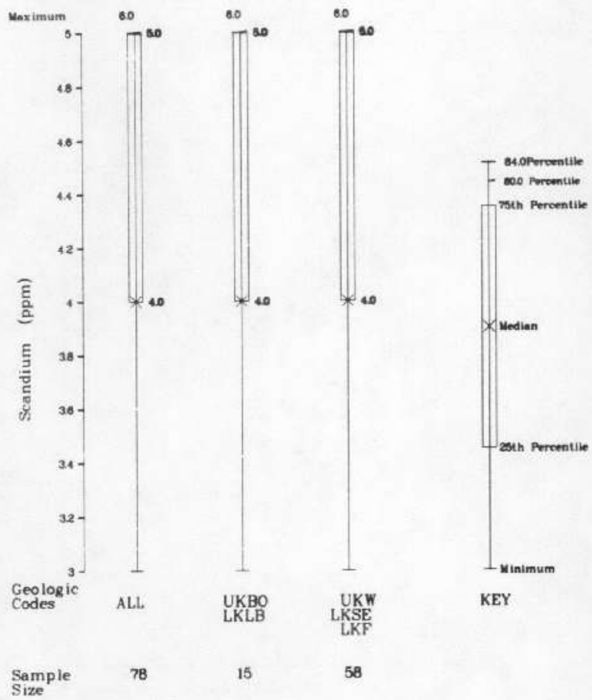


Figure B-18a

PERCENTILE PLOTS FOR SCANDIUM (PPM)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

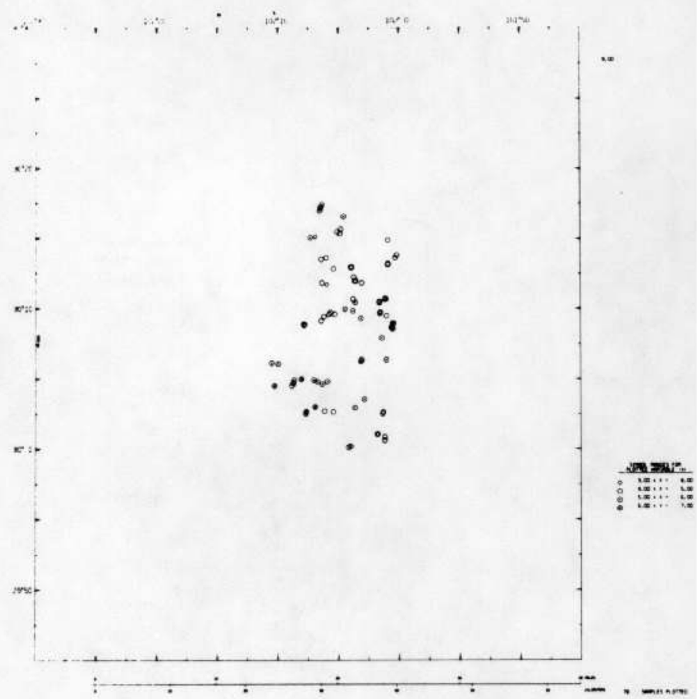


Figure B-18b

GEOCHEMICAL DISTRIBUTION OF SCANDIUM (PPM)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

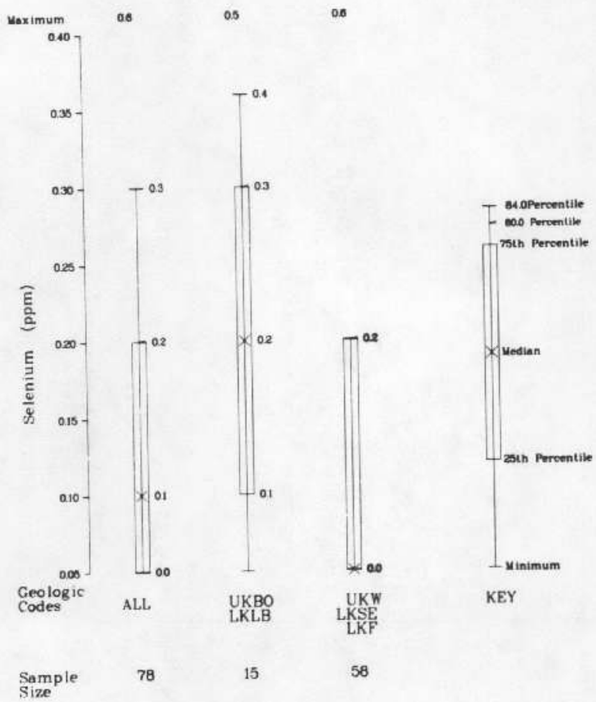


Figure B-19a

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

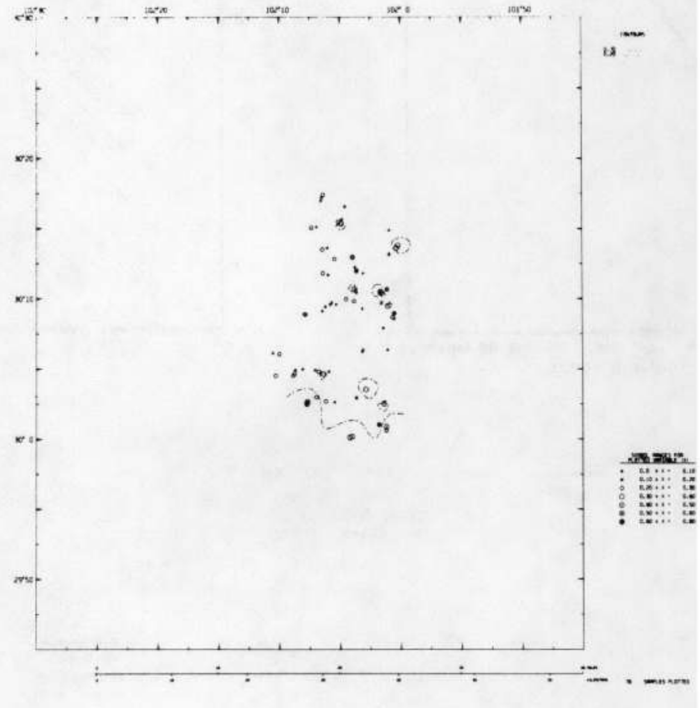


Figure B-19b

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

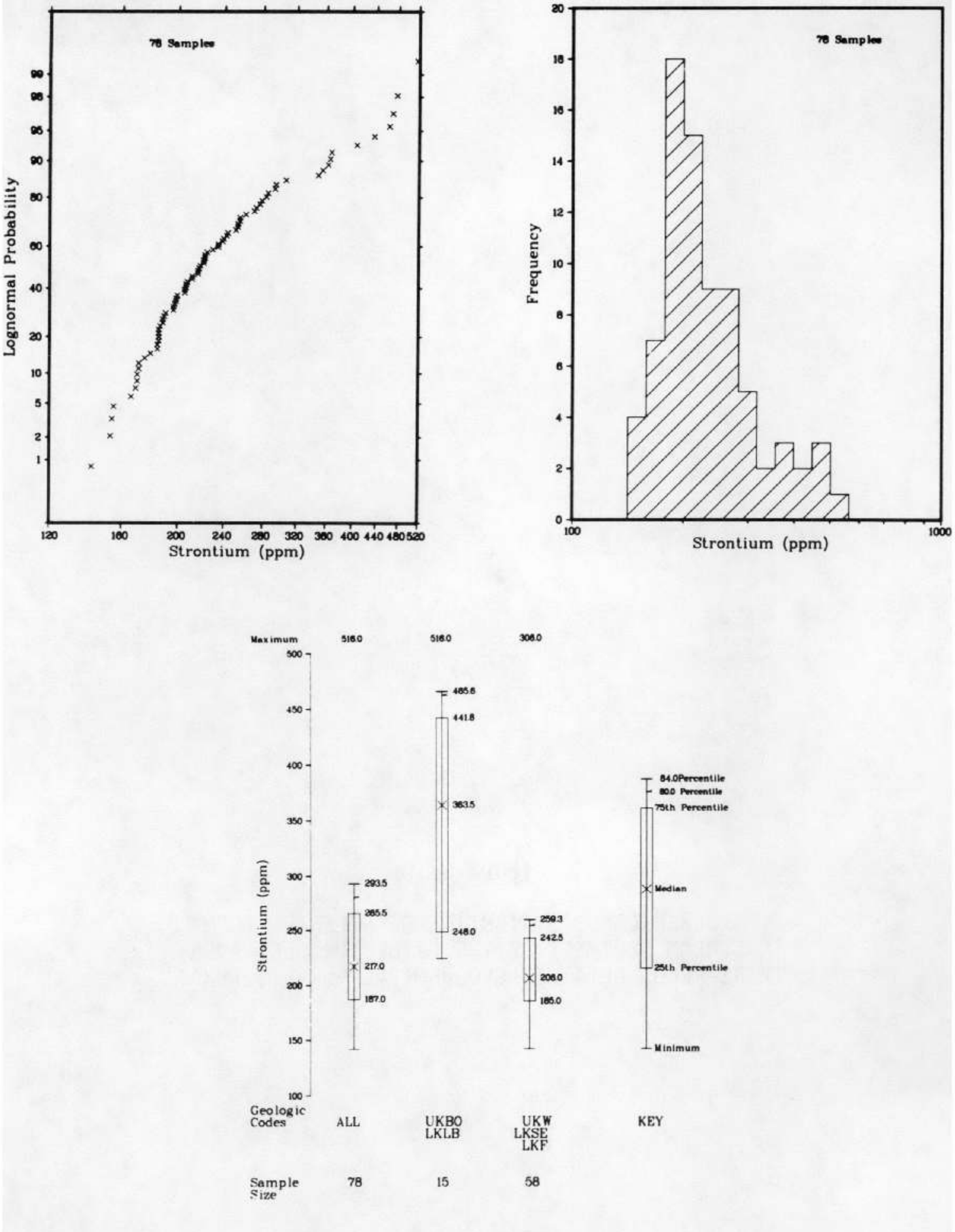


Figure B-20a

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

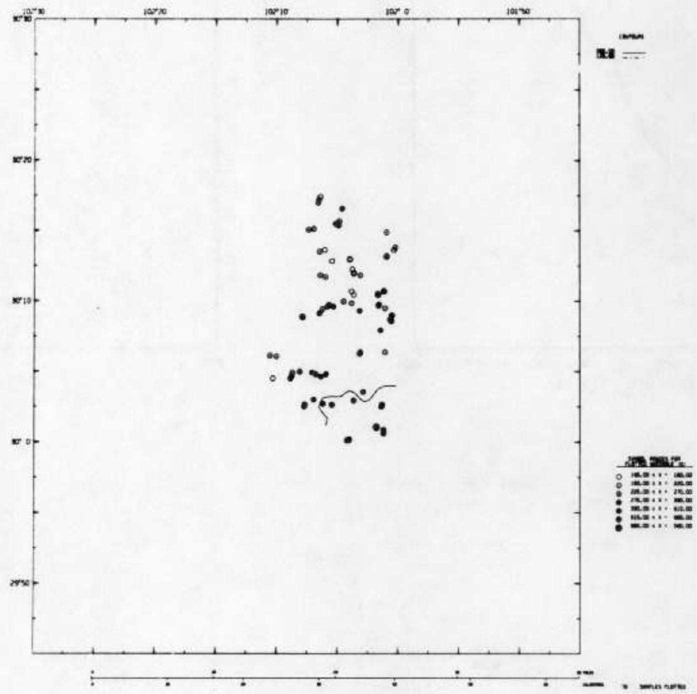


Figure B-20b

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

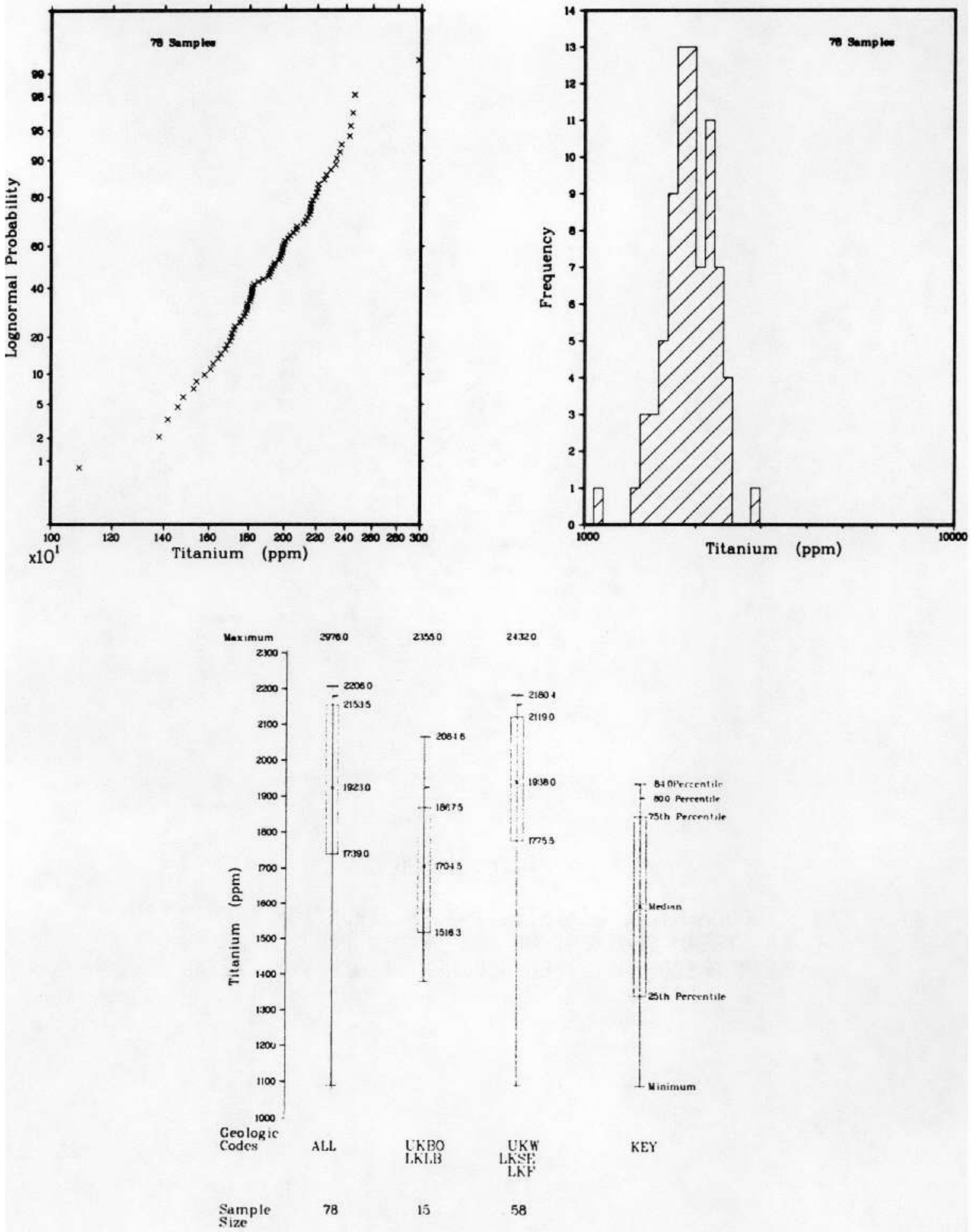


Figure B-21a

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

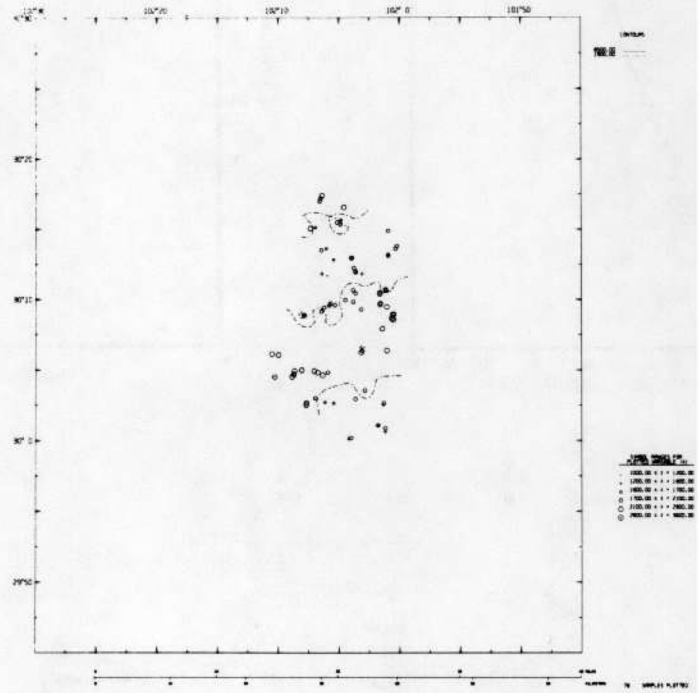


Figure B-21b

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

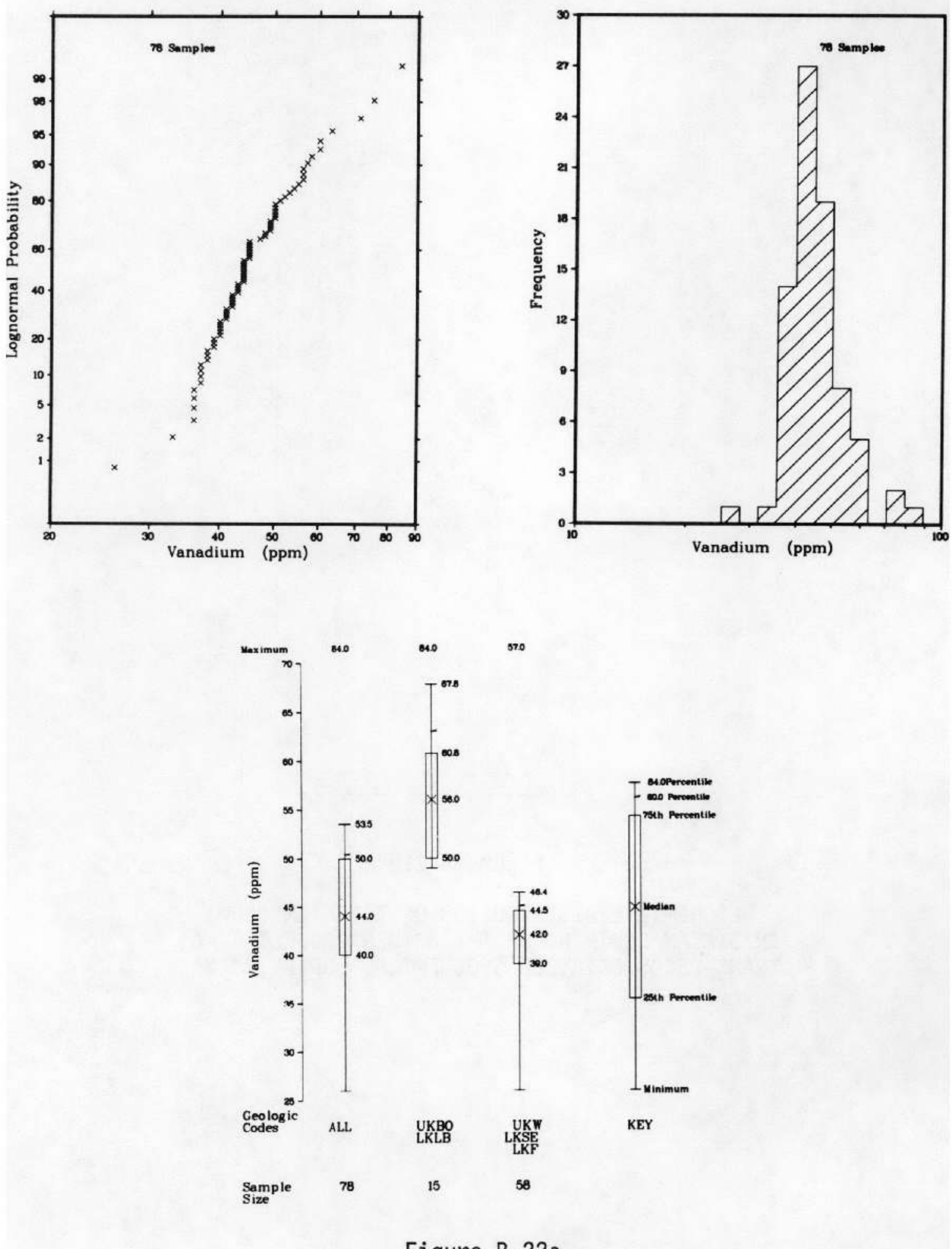


Figure B-22a

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

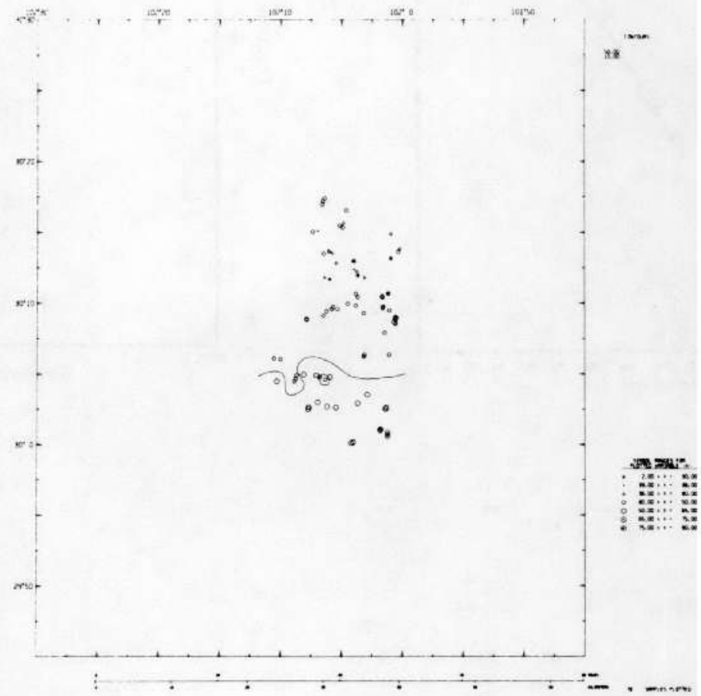


Figure B-22b

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

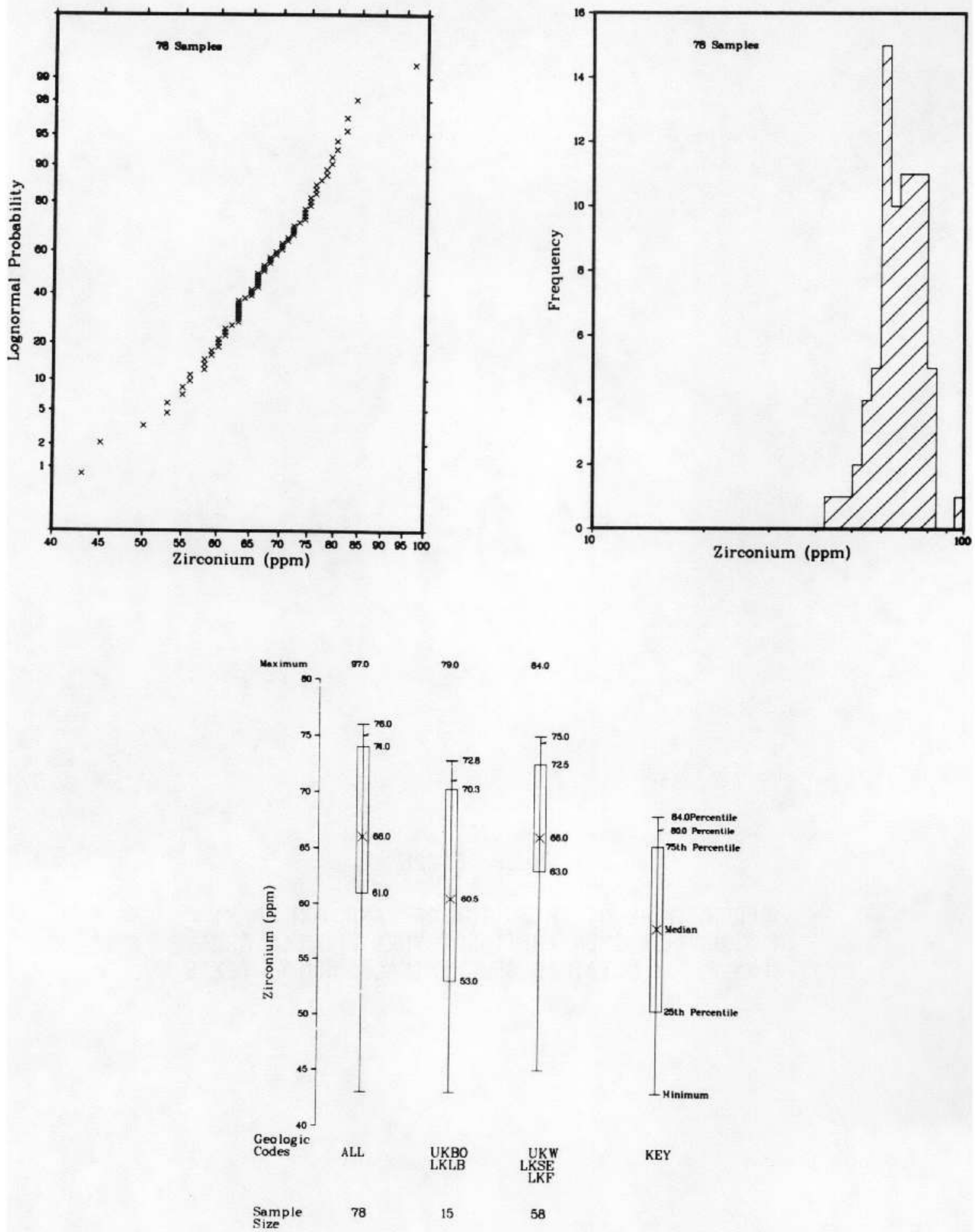


Figure B-23a

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

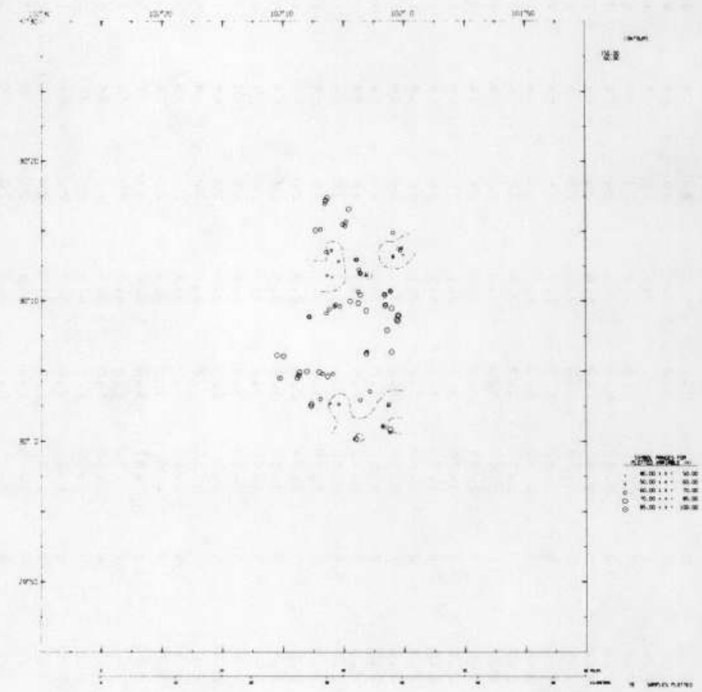


Figure B-23b

GEOCHEMICAL DISTRIBUTION OF ZIRCONIUM (PPM)
IN STREAM SEDIMENT OF THE DRYDEN PROJECT AREA,
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY, TEXAS

Table B-3

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE DRYDEN 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)	U/TU	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	SR (PPM)	V (PPM)
29305	48-30.044 -102.091 -3-15-	2.4	2.2	8	1.1	3.5	4.5	22	<4	60	350	50
29593	48-30.042 -102.129 -3-15-	1.4	2.5	5	0.54	2.0	4.8	21	4	41	240	60
29594	48-30.044 -102.128 -3-15-	1.2	2.3	8	0.51	3.5	4.3	25	<4	41	230	56
29621	48-30.252 -102.116 -3-15-	2.1	1.9	8	1.1	4.2	2.7	16	<4	9	220	33
29623	48-30.261 -102.081 -3-15-	2.1	1.9	6	1.1	3.2	2.4	18	<4	14	220	37
29626	48-30.287 -102.109 -3-15-	2.2	2.2	6	0.99	2.7	2.6	19	<4	14	210	42
29628	48-30.147 -102.131 -3-15-	1.8	2.2	5	0.80	2.3	2.2	21	<4	14	240	44
29629	48-30.175 -102.028 -3-15-	1.7	2.2	5	0.77	2.3	2.8	20	<4	46	240	40
29630	48-30.162 -102.026 -3-15-	1.8	2.2	5	0.81	2.3	2.7	20	<4	25	220	41
29645	48-30.102 -102.176 -3-15-	1.8	2.2	7	0.82	3.2	1.6	22	<4	19	200	45
29646	48-30.101 -102.167 -3-15-	1.9	2.4	7	0.79	2.9	2.4	23	<4	15	190	44
29647	48-30.075 -102.172 -3-15-	2.2	2.5	10	0.88	4.0	2.3	24	<4	27	180	56
29649	48-30.083 -102.135 -3-15-	2.3	2.7	5	0.86	1.9	4.4	25	<4	18	310	57
29650	48-30.082 -102.145 -3-15-	1.9	2.5	7	0.76	2.8	3.0	23	<4	17	210	49
29651	48-30.078 -102.146 -3-15-	1.7	2.1	4	0.82	1.9	1.9	21	<4	14	190	45
29652	48-30.075 -102.148 -3-15-	1.3	2.2	5	0.57	2.3	2.3	20	<4	18	200	45
29656	48-30.132 -102.024 -3-15-	2.0	2.7	9	0.75	3.3	2.9	22	<4	13	220	48
29657	48-30.143 -102.009 -3-15-	1.3	2.2	11	0.60	5.0	2.3	20	<4	19	190	44
29658	48-30.144 -102.011 -3-15-	1.9	2.5	7	0.74	2.8	3.0	21	<4	20	290	50
29659	48-30.149 -102.008 -3-15-	1.7	2.2	8	0.76	3.6	3.1	20	<4	17	290	47
29660	48-30.149 -102.009 -3-15-	1.7	2.3	8	0.73	3.5	4.2	24	<4	15	280	55
29683	48-30.251 -102.123 -3-15-	1.4	2.2	7	0.66	3.2	2.2	18	<4	13	210	44
29684	48-30.258 -102.086 -3-15-	1.8	2.1	7	0.87	3.3	3.2	18	<4	12	230	43
29685	48-30.256 -102.082 -3-15-	2.5	2.3	7	1.1	3.0	3.1	19	<4	40	190	43
29686	48-30.283 -102.110 -3-15-	1.6	2.3	8	0.71	3.5	2.9	18	<4	14	190	42
29687	48-30.290 -102.107 -3-15-	1.7	2.2	7	0.78	3.2	2.3	19	<4	13	160	43
29688	48-30.276 -102.077 -3-15-	1.7	2.2	9	0.78	4.1	2.8	19	<4	13	220	45
29689	48-30.148 -102.132 -3-15-	1.6	2.2	5	0.74	2.3	2.2	20	<4	12	220	40
29690	48-30.174 -102.027 -3-15-	1.4	2.4	9	0.57	3.8	3.4	22	<4	40	260	45
29691	48-30.161 -102.027 -3-15-	1.6	2.3	5	0.68	2.2	1.9	20	<4	20	180	44
29692	48-30.158 -102.018 -3-15-	2.1	2.4	8	0.88	3.3	2.4	20	<4	16	210	45
29693	48-30.155 -102.053 -3-15-	2.4	2.4	6	1.0	2.5	2.6	20	<4	16	280	44
29704	48-30.045 -102.103 -3-15-	1.5	2.5	3	0.59	1.2	4.8	22	<4	42	370	56
29705	48-30.164 -102.064 -3-15-	0.83	2.1	4	0.40	1.9	3.7	21	<4	41	190	44
29709	48-30.059 -102.046 -3-15-	2.7	2.6	9	1.0	3.5	3.9	21	<4	39	290	50
29713	48-30.082 -102.118 -3-15-	1.2	2.6	12	0.47	4.6	4.4	21	<4	41	260	54
29714	48-30.080 -102.113 -3-15-	1.5	2.9	7	0.53	2.4	4.3	19	<4	42	220	49
29716	48-30.077 -102.106 -3-15-	0.91	2.5	4	0.36	1.6	3.6	23	<4	43	220	49
29719	48-30.044 -102.022 -3-15-	1.7	2.4	5	0.69	2.1	4.7	23	<4	39	370	50
29722	48-30.042 -102.023 -3-15-	2.4	2.3	6	1.0	2.6	3.3	22	<4	15	350	50
29724	48-30.010 -102.020 -3-15-	3.6	3.2	2	1.1	0.63	4.6	22	5	20	470	75
29725	48-30.018 -102.030 -3-15-	3.5	3.7	6	0.95	1.6	4.6	25	9	23	520	84
29726	48-30.017 -102.030 -3-15-	2.4	2.5	6	0.96	2.4	3.4	22	4	15	410	52
29735	48-30.049 -102.061 -3-15-	2.7	2.6	4	1.0	1.5	3.3	26	<4	16	360	53
29736	48-30.080 -102.099 -3-15-	2.8	2.6	7	1.1	2.7	4.2	23	<4	16	280	51
29737	48-30.050 -102.116 -3-15-	3.0	2.3	8	1.3	3.5	2.4	26	<4	20	250	60
29738	48-30.197 -102.052 -3-15-	1.5	2.2	6	0.70	2.7	2.0	19	<4	14	200	36
29739	48-30.225 -102.108 -3-15-	1.9	2.2	21	0.88	9.5	2.3	19	<4	15	190	42
29740	48-30.227 -102.101 -3-15-	2.1	2.0	21	1.0	11.	2.1	16	4	14	170	36
29743	48-30.214 -102.091 -3-15-	2.0	2.2	4	0.93	1.8	2.2	18	<4	14	150	36
29744	48-30.216 -102.066 -3-15-	2.0	2.2	6	0.93	2.7	2.2	18	<4	16	180	37
29745	48-30.216 -102.067 -3-15-	1.9	2.3	5	0.83	2.2	2.4	19	<4	15	170	40
29747	48-30.204 -102.063 -3-15-	2.2	2.2	8	1.0	3.6	1.9	19	<4	16	170	37
29748	48-30.200 -102.061 -3-15-	2.8	2.1	6	1.3	2.9	2.0	18	<4	15	140	36
29749	48-30.199 -102.061 -3-15-	1.5	2.0	9	0.74	4.5	2.1	19	<4	14	150	38

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE DRYDEN 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)	U/TU	TH/U	AS (PPM)	LI (PPM)	MO (PPM)	NI (PPM)	SR (PPM)	V (PPM)
29752	48-30.003	-102.067	-3-15-	2.1	2.8	9	0.75	3.2	4.4	26	5	43	440	63
29753	48-30.002	-102.070	-3-15-	2.4	2.4	4	0.98	1.7	4.3	27	4	42	480	58
29756	48-30.197	-102.107	-3-15-	2.1	2.5	6	0.83	2.4	2.0	17	<4	11	200	37
29757	48-30.195	-102.100	-3-15-	1.6	1.8	5	0.90	2.8	1.8	14	<4	9	180	26
29763	48-30.166	-102.075	-3-15-	1.7	2.2	6	0.78	2.8	2.3	22	<4	15	210	41
29764	48-30.178	-102.064	-3-15-	1.8	2.2	7	0.80	3.2	3.0	19	<4	15	170	41
29765	48-30.174	-102.061	-3-15-	1.8	2.1	5	0.83	2.4	3.1	20	<4	18	170	42
29768	48-30.219	-102.016	-3-15-	2.2	2.3	3	0.96	1.3	3.0	19	<4	15	240	39
29769	48-30.220	-102.016	-3-15-	1.6	2.2	8	0.71	3.6	2.7	17	<4	14	210	38
29771	48-30.227	-102.006	-3-15-	2.1	2.2	7	0.96	3.2	3.1	19	<4	16	170	41
29772	48-30.230	-102.004	-3-15-	1.8	2.2	8	0.84	3.6	3.0	18	<4	15	200	39
29773	48-30.248	-102.016	-3-15-	1.6	2.0	5	0.82	2.5	2.1	18	<4	12	190	38
29775	48-30.178	-102.019	-3-15-	2.6	2.5	5	1.1	2.0	3.2	20	<4	16	270	44
29777	48-30.179	-102.020	-3-15-	2.2	2.3	6	0.97	2.6	2.4	18	<4	15	270	39
29799	48-30.152	-102.108	-3-15-	2.5	2.5	9	1.0	3.6	2.7	19	<4	15	260	43
29801	48-30.157	-102.104	-3-15-	1.8	2.2	7	0.83	3.2	2.2	19	<4	15	200	40
29802	48-30.160	-102.097	-3-15-	1.7	1.9	2	0.88	1.1	3.9	19	<4	16	220	45
29806	48-30.162	-102.095	-3-15-	1.6	2.1	6	0.75	2.9	2.3	18	<4	14	250	40
29808	48-30.160	-102.089	-3-15-	1.6	2.2	4	0.71	1.8	2.9	20	<4	16	230	42
29810	48-30.106	-102.052	-3-15-	2.5	2.6	6	0.95	2.3	4.2	21	<4	16	250	44
29872	48-30.104	-102.053	-3-15-	1.8	2.5	7	0.70	2.8	3.3	21	<4	16	210	48
29873	48-30.106	-102.018	-3-15-	2.2	2.4	8	0.92	3.3	4.5	23	<4	19	190	49
29886	48-30.014	-102.020	-3-15-	3.0	3.2	8	0.95	2.5	4.9	21	4	18	460	71

APPENDIX C

FIELD FORM AND COMPUTER CODE LIST

APPENDIX C

FIELD FORM AND COMPUTER CODE LIST

LIST OF TABLES

Table C-1

COMPUTER CODE LIST OF GEOCHEMICAL VARIABLES

Variable[a]	Code	Variable[a]	Code
Uranium Measured by Fluorometry[b]	U-FL	Scandium	SC
		Silicon	SI
Uranium Measured by Mass Spectrometry[b]	U-MS	Strontium	SR
Uranium Measured by Neutron Activation	U-NT	Thorium	TH
		Titanium	TI
Arsenic	AS	Vanadium	V
Selenium	SE	Yttrium	Y
Silver	AG	Zinc	ZN
Aluminum	AL	Zirconium	ZR
Boron	B	Sulfate (ppm)	SO_4
Barium	BA	Chloride (ppm)	CL
Beryllium	BE	Conductivity from Lab (μmhos/cm)	CT-L
Calcium	CA	Conductivity from Field (μmhos/cm)	CT-F
Cerium	CE	Dissolved Oxygen (ppm)	DO
Cobalt	CO	Air Temperature (°C)	ATEM
Chromium	CR	Water Temperature (°C)	WTEM
Copper	CU	pH	PH
Iron	FE	pH Measured by Lo Ion Paper	PH-P
Hafnium	HF	Total Alkalinity (ppm)	T-AK
Potassium	K	M-Alkalinity (ppm)	M-AK
Lanthanum	LA	P-Alkalinity (ppm)	P-AK
Lithium	LI	Carbonate (ppm)[c]	CB
Mangesium	MG	Bicarbonate (ppm)[c]	BC
Manganese	MN	Undissociated Carbonic Acid (ppm)[c]	CAB
Molybdenum	MO	U-NT/U-FL	TU/U
Sodium	NA	U-FL/U-NT	U/TU
Niobium	NB	TH/U-NT	TH/U
Nickel	NI	1,000·U/SP	U/SP
		1,000·U/B	U/B
Phosphorus	P	1,000·U/SO	U/SO
Lead	PB	Sodium/Chloride	NA/C
Platinum	PT	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		59	
C	Calm	C	Clear
P	Lt Wind	L	Pt Cldy
V	Windy	W	Overcst
R	V. Windy	V	Rainy
S	Gale	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		70	
D	Dry	N	Normal
P	Pools	H	High
L	Low	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 VLt	PK Pink
L Light	RD Red
M Medium	GN Green
D Dark	BU Blue
	BN Brown
CL Clear	GY Gray
WH White	BK Black
YL Yellow	ØT Other
ØR Orange	

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		26	
R	Alto Verde	U	Locust
A	Ash	P	Maple
B	Beech	M	Mesquite
I	Birch	K	Oak, Other
D	Box Elder	V	Olive
F	Cherry	Y	Poplar
N	Cottonwood	S	Sycamore
E	Elm	T	Salt Cedar
H	Hackberry	G	Walnut
C	Hickory	X	Willow
W	Huisache	Ø	Other
L	Live Oak		

Name of Tree, Conifer

27		27	
A	N. Wh. Cedar	L	Larch
C	Cedar, Other	P	Pine
F	Fir	S	Spruce
H	Hemlock	Ø	Other
J	Juniper		

Name of Bush

28		28	
A	Alder	W	Witch Hazel
B	Blueberry	Y	Yew
P	Pussy Willow	Ø	Other

Name of Moss (29)

P	Peat
S	Sphagnum (live)
Ø	Other

Algae (30)

G	Blue-Green
B	Brown
Ø	Other

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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 Precedure 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					

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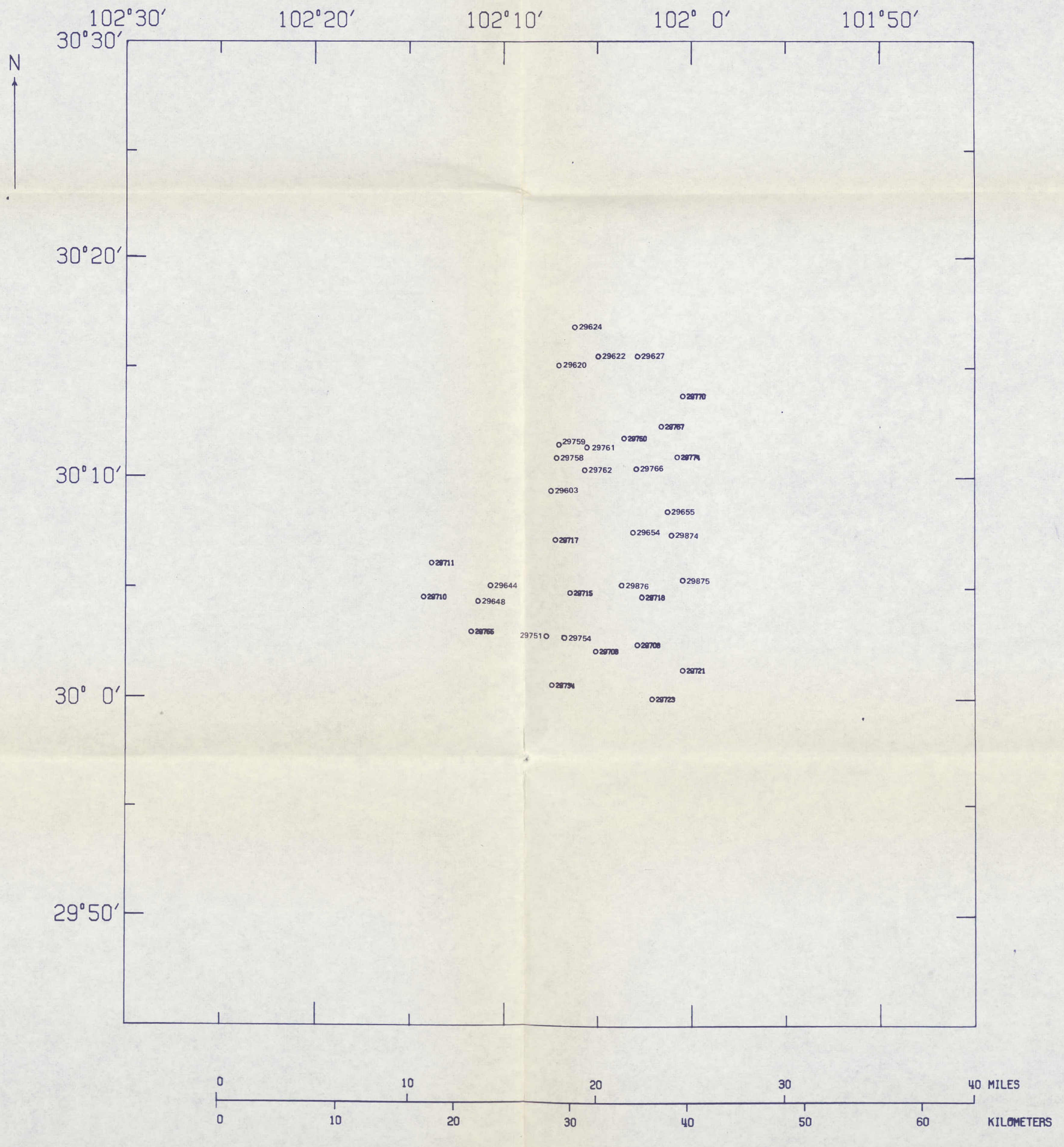
APPENDIX D

MICROFICHE OF FIELD AND LABORATORY DATA

APPENDIX D

MICROFICHE OF FIELD AND LABORATORY DATA

CONTENTS

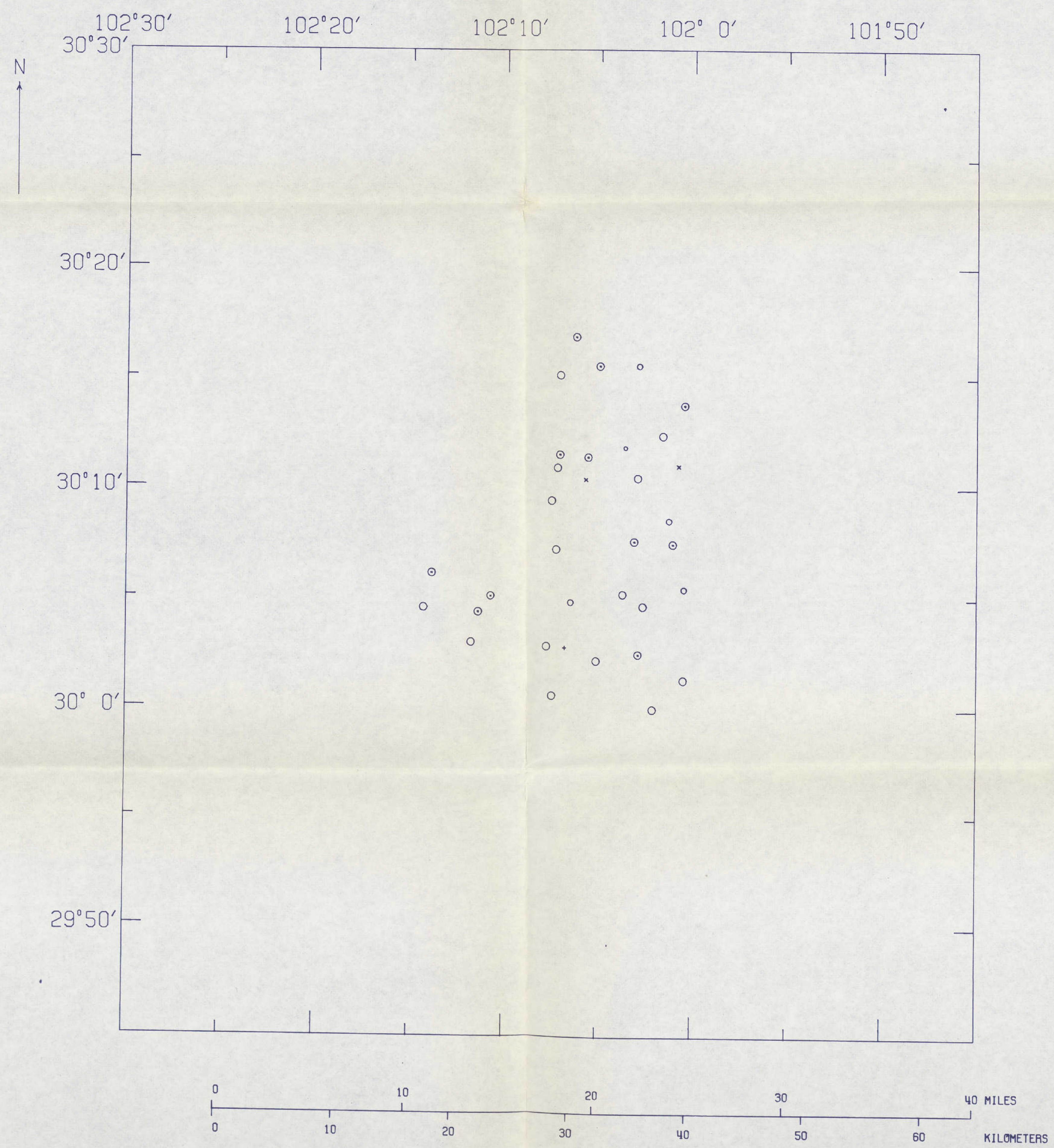


LEGEND

∘ WELL WATER

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

SCALE 1: 250000
34 SAMPLES PLOTTED



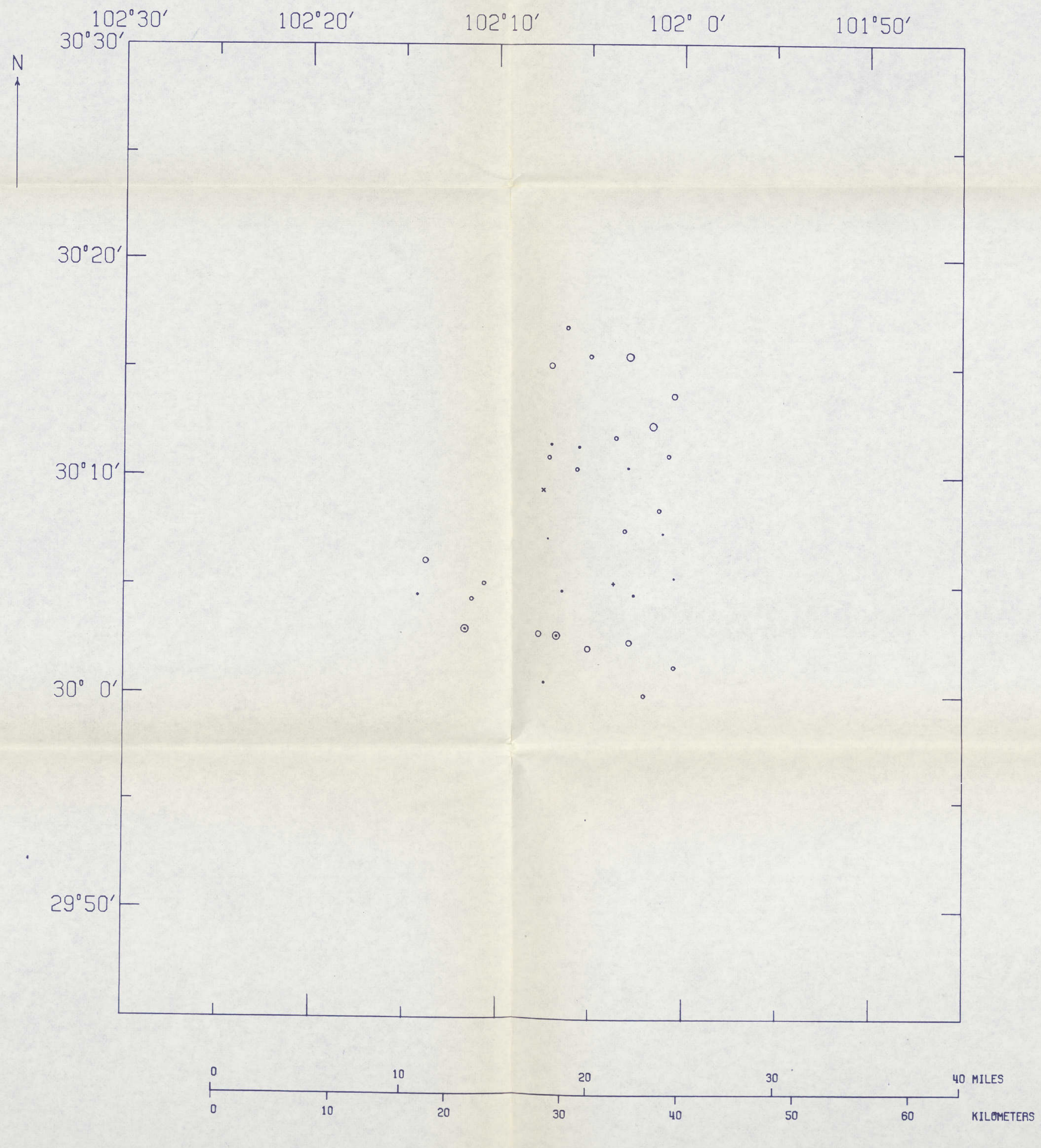
SYMBOL RANGES FOR
PLOTTED VARIABLE (X)

Symbol	Range
·	0.0 ≤ X < 0.20
×	0.20 ≤ X < 0.80
∘	0.80 ≤ X < 1.50
○	1.50 ≤ X < 2.50
○	2.50 ≤ X < 3.50
⊙	3.50 ≤ X < 5.00
⊙	5.00 ≤ X < 7.00

PLATE 2
DRYDEN PRØJECT AREA
TRANS-PECØS DETAILED GEØCHEMICAL SURVEY
SYMBØL PLØT GRØUNDWATER

URANIUM (PPB)

SCALE 1: 250000
34 SAMPLES PLØTTED



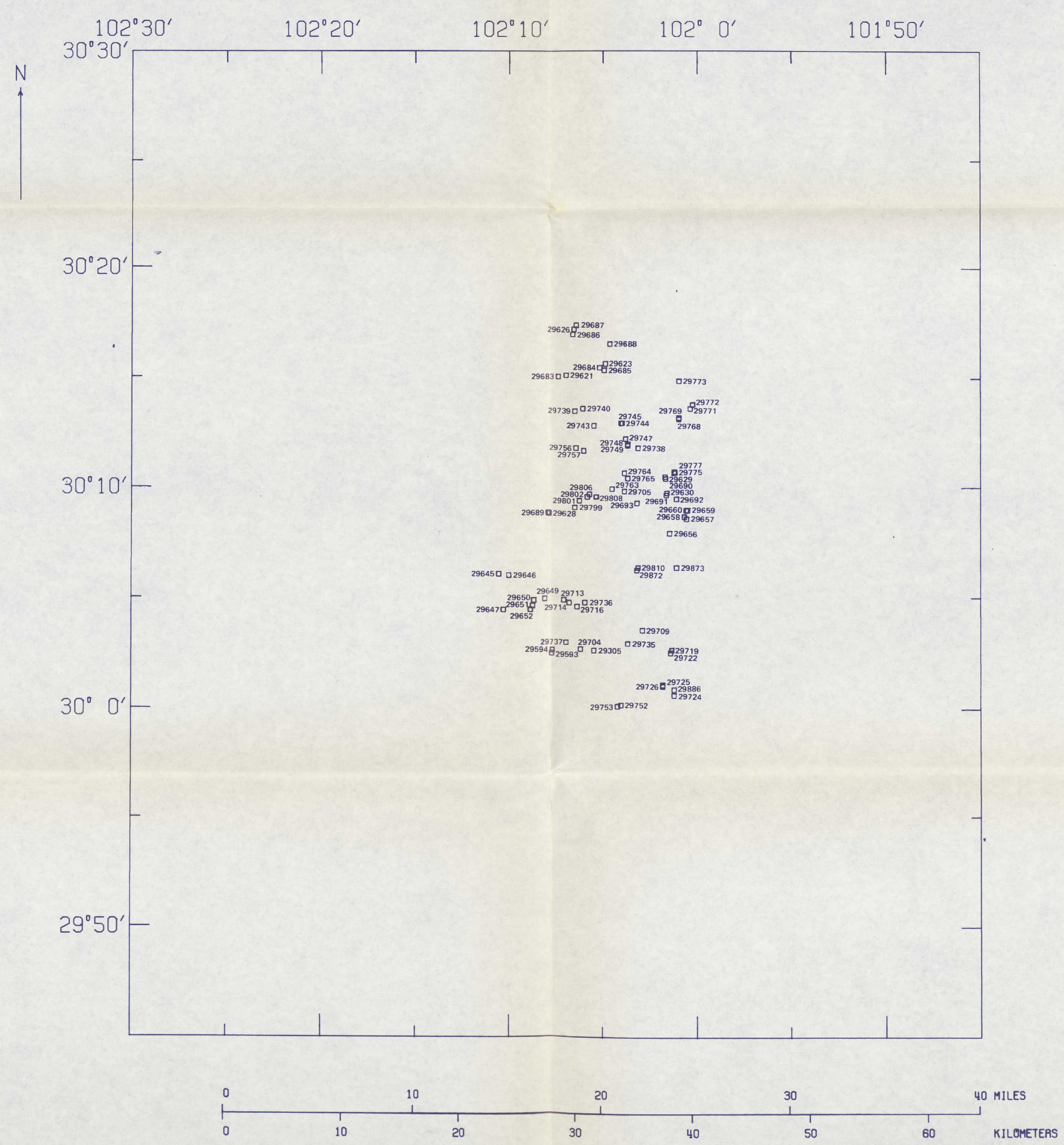
SYMBOL RANGES FOR PLOTTED VARIABLE (X)

0.0 ≤ X < 300.00
300.00 ≤ X < 350.00
350.00 ≤ X < 400.00
400.00 ≤ X < 450.00
450.00 ≤ X < 500.00
500.00 ≤ X < 600.00
600.00 ≤ X < 700.00
700.00 ≤ X < 900.00

PLATE 3
DRYDEN PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
SYMBOL PLOT GROUNDWATER

SPECIFIC CONDUCTANCE (UMHOS/CM)

SCALE 1: 250000
34 SAMPLES PLOTTED

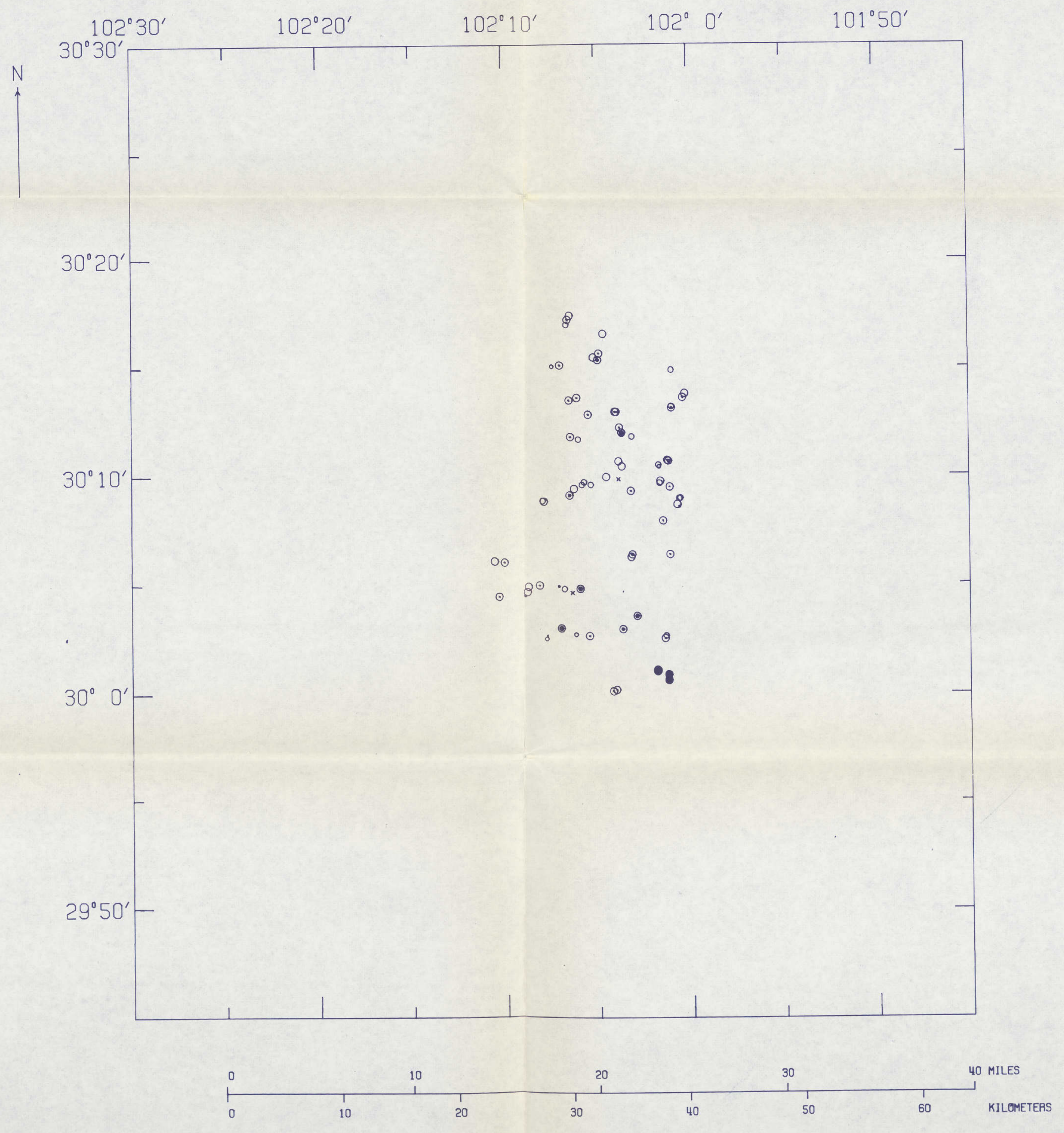


LEGEND

▫ STREAM SEDIMENT

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

SCALE 1: 250000
78 SAMPLES PLOTTED



SYMBOL RANGES FOR PLOTTED VARIABLE (X)

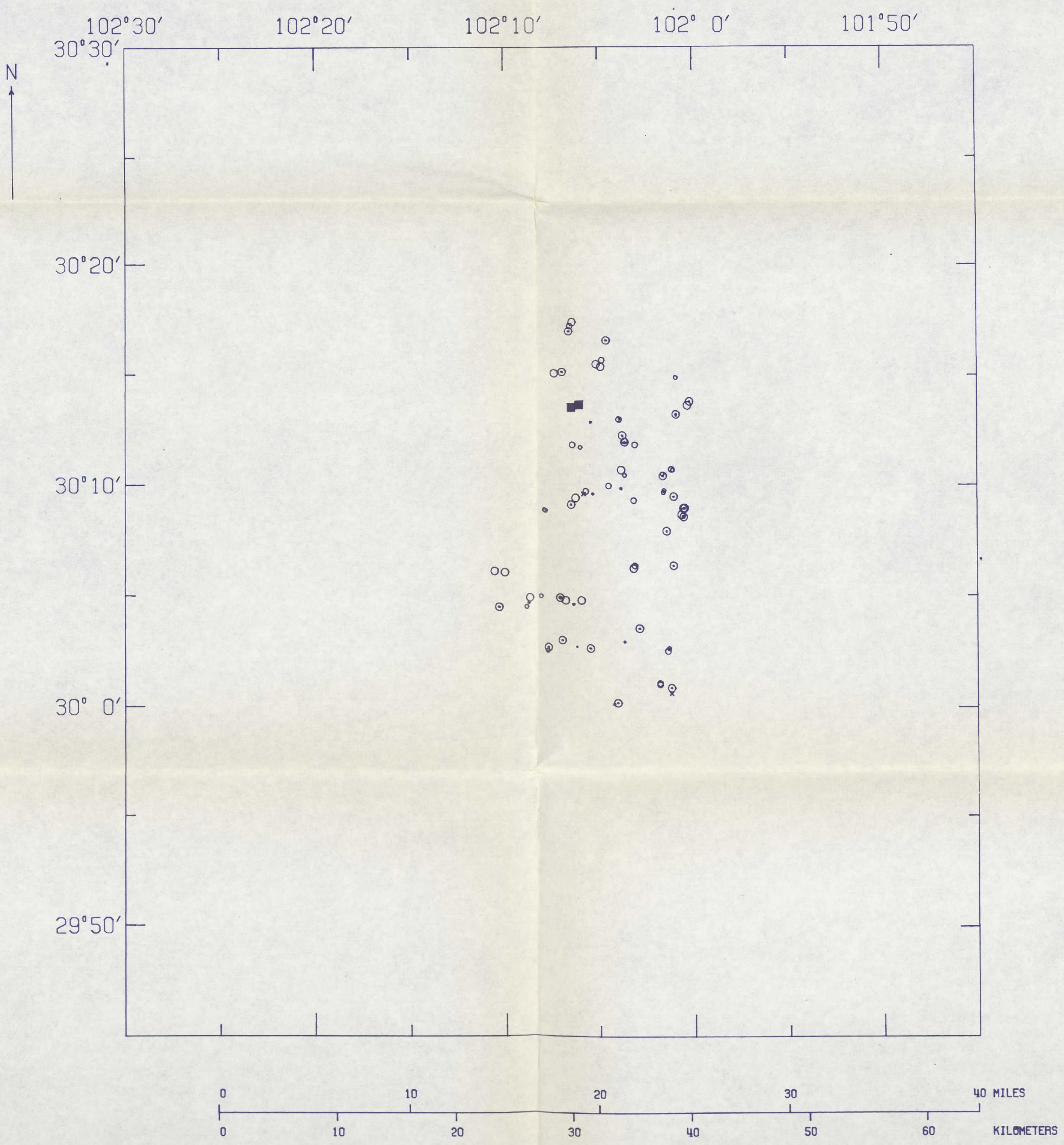
0.25 ≤ X < 1.00
1.00 ≤ X < 1.20
1.20 ≤ X < 1.35
1.35 ≤ X < 1.50
1.50 ≤ X < 1.70
1.70 ≤ X < 1.90
1.90 ≤ X < 2.15
2.15 ≤ X < 2.45
2.45 ≤ X < 2.70
2.70 ≤ X < 3.00
3.00 ≤ X < 3.40
3.40 ≤ X < 4.00

PLATE 5
DRYDEN PROJECT AREA
TRANS-PECOS DETAILED GEOCHEMICAL SURVEY
SYMBOL PLOT STREAM SEDIMENT

URANIUM (PPM)

SCALE 1: 250000

78 SAMPLES PLOTTED

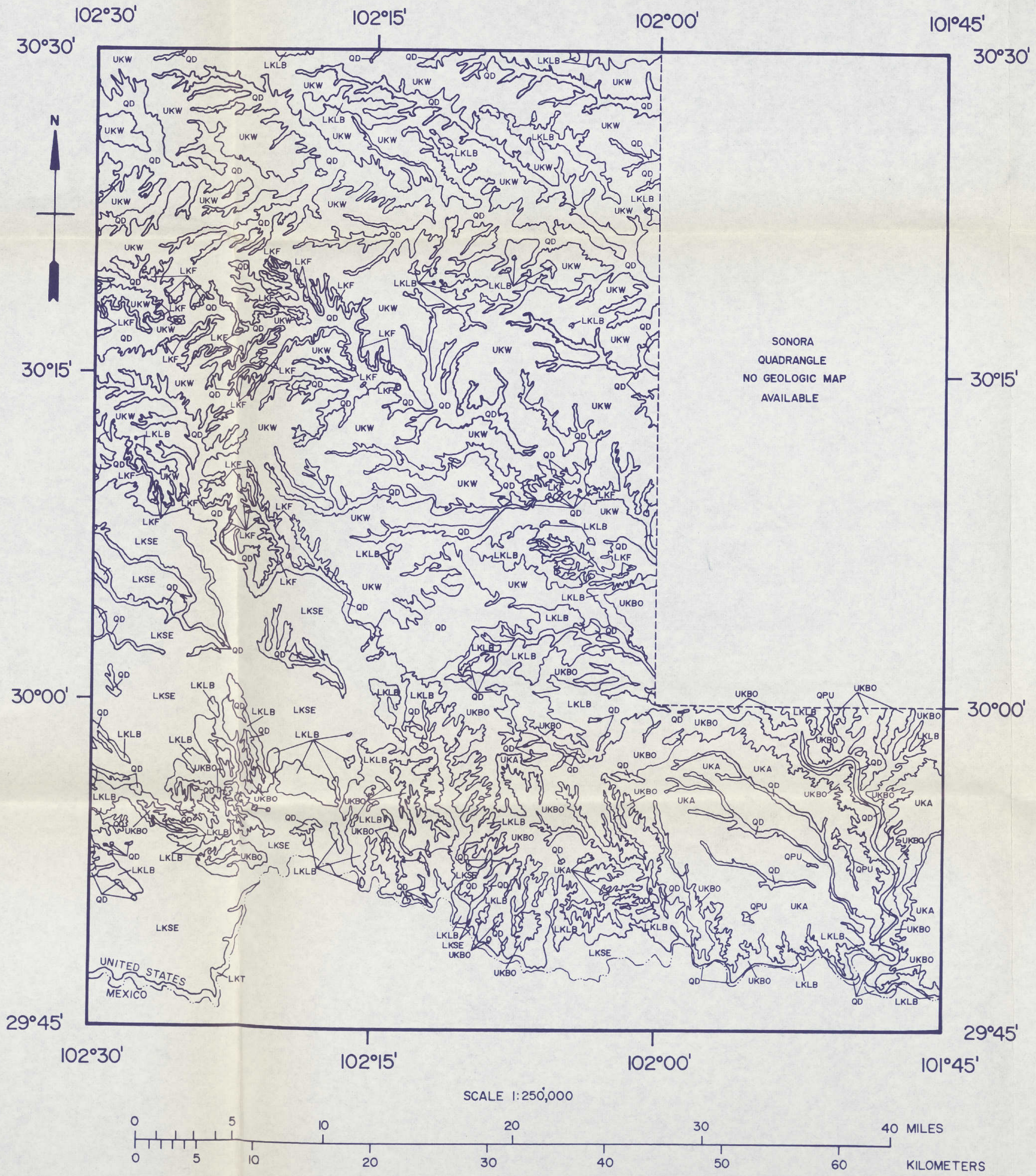


SYMBOL RANGES FOR
PLOTTED VARIABLE (X)

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
17.00 ≤ X < 23.00

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

SCALE 1: 250000
78 SAMPLES PLOTTED



DRYDEN PROJECT AREA, TRANS-PECOS DETAILED GEOCHEMICAL SURVEY

ERA	SYSTEM	SERIES	MAP CODE	GEOLOGIC UNIT
CENOZOIC	QUATERNARY	RECENT	QD	ALLUVIUM AND OTHER QUATERNARY DEPOSITS
	QUATERNARY OR TERTIARY	PLEISTOCENE OR PLIOCENE	QPU	UVALDE GRAVEL
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS		BOQUILLAS FORMATION
			UKA	AUSTIN CHALK (SAN VICENTE)
			UKBO	ERNST MEMBER
				BOQUILLAS FLAGS
			UKW	WASHITA GROUP
			LKLB	BUDA LIMESTONE
				DEL RIO CLAY
		LOWER CRETACEOUS	LKSE	SANTA ELENA LIMESTONE
				SUE PEAKS FORMATION
			LKF	FREDRICKSBURG GROUP
				KIAMICHI FORMATION
				EDWARDS LIMESTONE
				COMANCHE PEAK LIMESTONE
				WALNUT CLAY
				MAXON FORMATION
			LKT	GLEN ROSE FORMATION

SOURCE OF GEOLOGY:

1. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, EMORY PEAK-PRESIDIO SHEET (PRELIMINARY SHEET, 1977).
2. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, FORT STOCKTON SHEET (PRELIMINARY SHEET, 1978).
3. BARNES, V. E., GEOLOGIC ATLAS OF TEXAS, DEL RIO SHEET (1977).

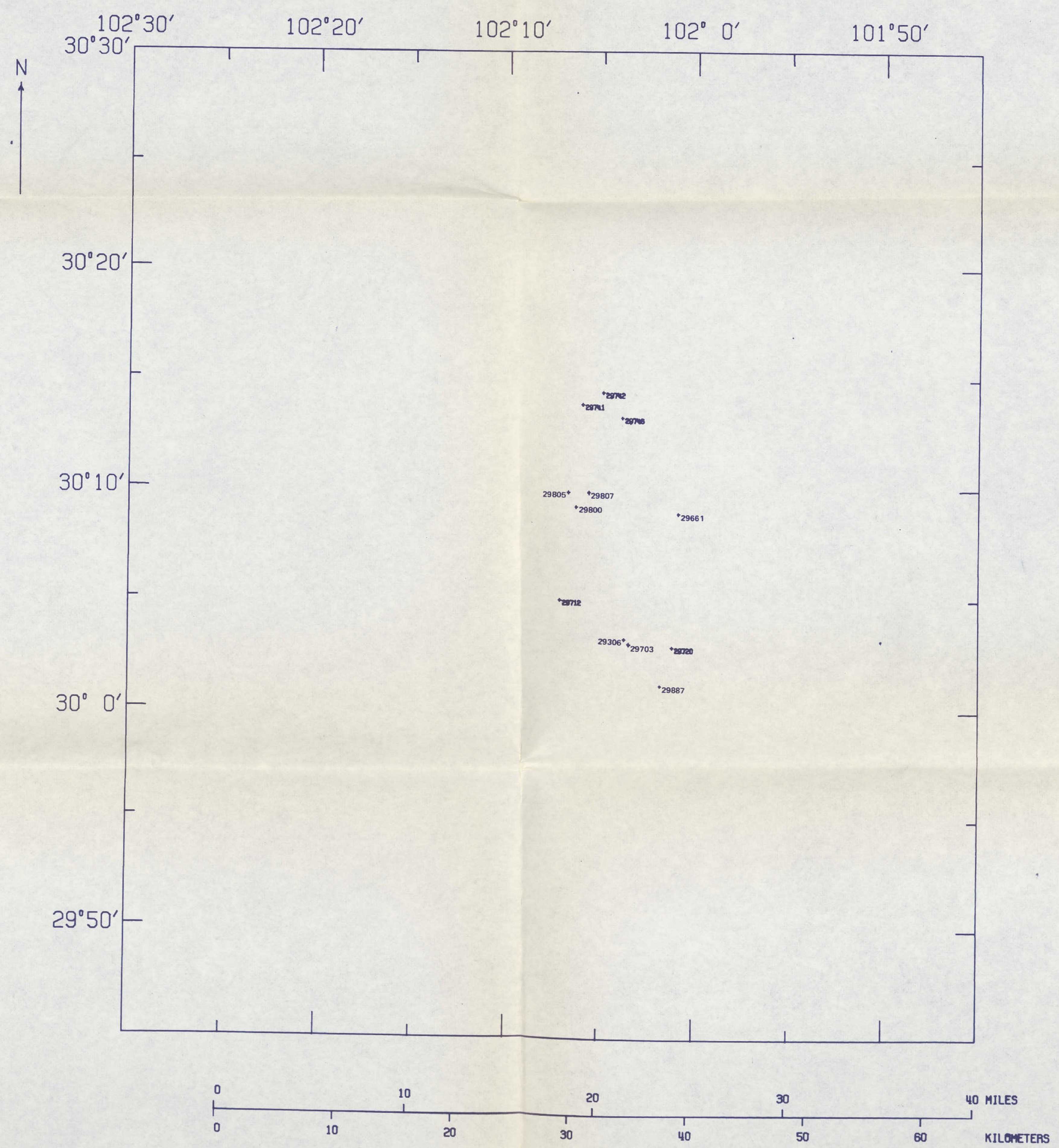
LEGEND

GEOLOGIC CONTACT ————————

INTERNATIONAL BOUNDARY LINE — - — - —

PLATE 7

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



LEGEND

+ SOIL, ROCK, AND OTHER

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

SCALE 1: 250000
12 SAMPLES PLOTTED