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NATIONAL URANIUM RESOURCE EVALUATION PROGRAM

HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE BASIC DATA FOR HOT SPRINGS NTMS QUADRANGLE, SOUTH DAKOTA

Uranium Resource Evaluation Project

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Date of Issue: December 31, 1979 Report Number: K/UR-132

Subject Category: UC-51, Nuclear Raw Materials

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HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE BASIC DATA FOR HOT SPRINGS NTMS QUADRANGLE, SOUTH DAKOTA

Uranium Resource Evaluation Project

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Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee

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

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ABSTRACT

Results of a reconnaissance geochemical survey of the Hot Springs Quadrangle, South Dakota are reported. Field and laboratory data are presented for 340 groundwater and 394 stream sediment samples. Statistical and areal distributions of uranium and possible uranium-related variables are displayed. A generalized geologic map of the survey area is provided, and pertinent geologic factors which may be of significance in evaluating the potential for uranium mineralization are briefly discussed.

The groundwater data indicate potential for uranium mineralization in the north central part of the quadrangle. Groundwaters with high uranium concentrations form a ring around the Black Hills. The ring crosses many geological formations, implying that the location of any existing deposits in this area are structurally controlled and that the sources of the uranium are rock units in the Black Hills. Ash-bearing Tertiary units that have since been removed by erosion are thought to have been a source of uranium in this area. The Pierre Shale, a black, marine shale, also produces groundwaters with relatively high uranium concentrations. These groundwaters may only appear to be anomalously high in uranium due to the lithology of black shales.

The sediment data indicate that the highest potential for uranium mineralization occurs in and around the Black Hills. Uranium and thorium in stream sediments are concentrated in heavy and resistate minerals. Sediments with high uranium concentrations appear to be derived from igneous rocks in the Black Hills. Sediments with high-to-moderate uranium values are also derived from the Niobrara Marl and Carlile Shale, but the apparently high values may be due to lithology rather than anomalous uranium concentrations.

HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE BASIC DATA FOR HOT SPRINGS NTMS QUADRANGLE, SOUTH DAKOTA

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 1983, and the first comprehensive assessment report of the entire United States is scheduled for completion in 1985. 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 (see Figure 1). 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. Described herein is a portion of the work done by UCC-ND in the Hot Springs NTMS Quadrangle, South Dakota.

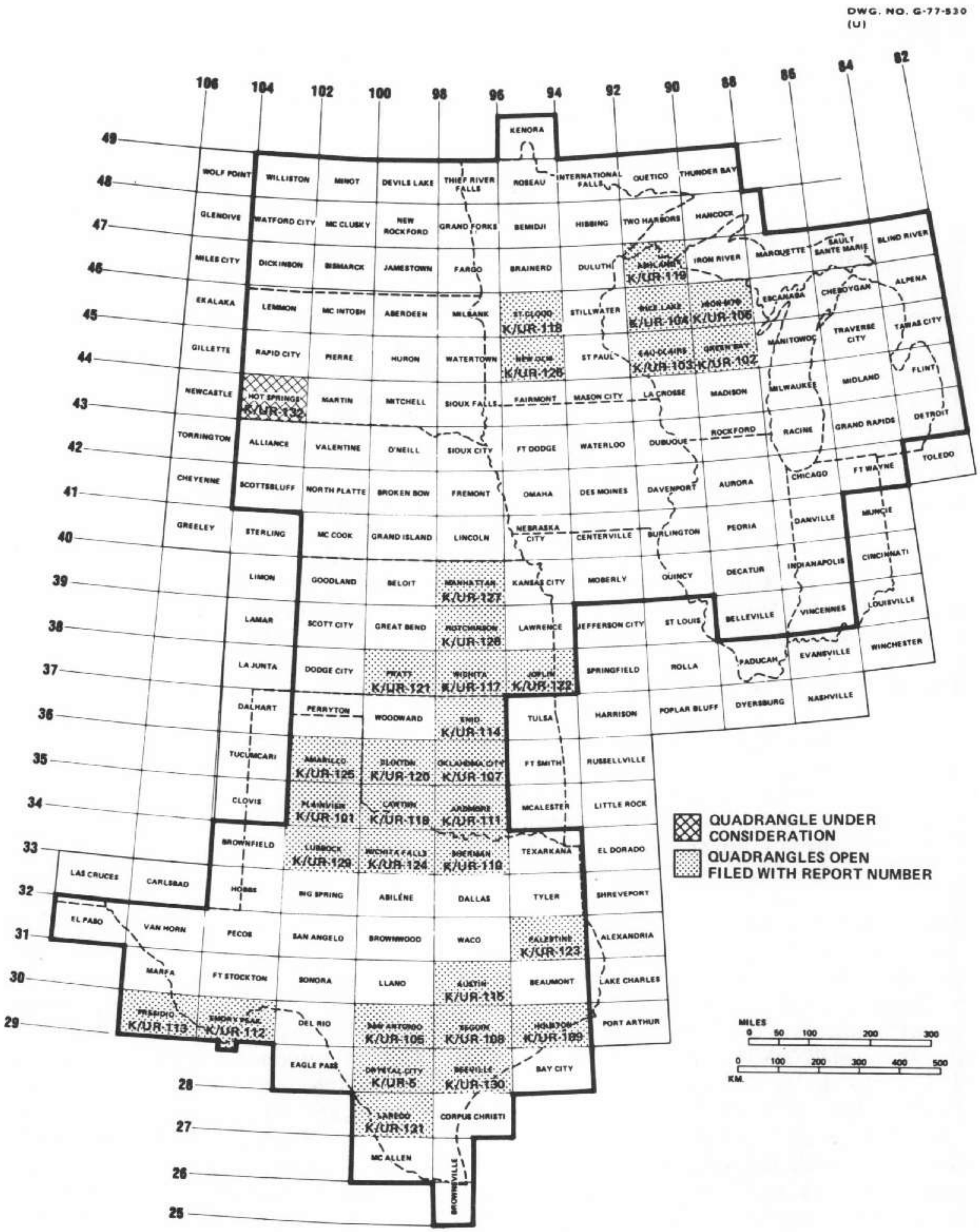

Figure 1

INDEX MAP SHOWING THE ORGDP AREA OF RESPONSIBILITY
FOR THE HSSR SURVEY, THE HOT SPRINGS QUADRANGLE
AND QUADRANGLES FOR WHICH BASIC DATA REPORTS
HAVE BEEN OPEN FILED

GEOLOGY

LOCATION AND GEOLOGIC SETTING

The Hot Springs Quadrangle covers a surface area of approximately 18,493 km^2 (7,140 mi^2) in southwestern South Dakota between lat. 43° and 44° N. and long. 102° and 104° W. The survey area is outlined on the generalized geologic map of South Dakota, shown in Figure 2, and includes all, or parts, of Fall River, Custer, Pennington, Jackson, Washabaugh, Bennett, and Shannon Counties in South Dakota. A generalized geologic map of the Hot Springs Quadrangle, along with a stratigraphic column listing the geologic codes used in this report, is presented in Figure 3 and Plate 7.

The Hot Springs Quadrangle is an area of regional uplift with rolling hills and prairies in the east and mountains in the west. The Black Hills Physiographic Province occurs in the west and is characterized by uplifted igneous, metamorphic, and sedimentary rocks ranging from Precambrian through Cenozoic in age. Maximum regional relief is up to 1,370 m (4,500 ft) in the western half of the study area. The eastern half of the study area is in the Pierre Hills and Tertiary Tablelands division of the Missouri Plateau Physiographic Province and is characterized by steeply rolling prairies with local badlands. Late Cretaceous and Cenozoic units occur at the surface throughout the eastern half of the quadrangle.

LITHOLOGY AND ENVIRONMENTS OF DEPOSITION

The Precambrian core of the Black Hills is very complex and has been the subject of a large number of studies. Precambrian rocks are composed largely of metamorphosed sedimentary rocks with lesser amounts of metabasalt, metagabbro, granite, and pegmatites. The highest metamorphic grade is a sillimanite zone in the southern part of the Precambrian exposures with metamorphic grade generally decreasing to the north (Redden and Norton, 1975). Oldest known Precambrian rocks are biotite schists in the core of the Bear Mountain dome which are intruded by small bodies of granite and pegmatite dated at 2.5 billion years by Ratte and Zortman (1970). The youngest Precambrian rock in the Black Hills core is the Harney Peak Granite dated at 1.74 billion years (Riley, 1970). Total thickness of the Precambrian units in the Black Hills is approximately 18,290 m (60,000 ft). The area has been subjected to at least three and possibly as many as six separate periods of deformation and probably two metamorphic events (Redden and Norton, 1975).

The Cambrian Deadwood Formation, oldest Paleozoic unit in the study area, is primarily a dusky buff or brown sandstone, with greenish-gray shale and carbonates. A pebble conglomerate locally underlies the basal quartize. The Deadwood Formation represents a nearshore deposit of a gradually retreating Late Cambrian to Early Ordovician sea, and is 122 m

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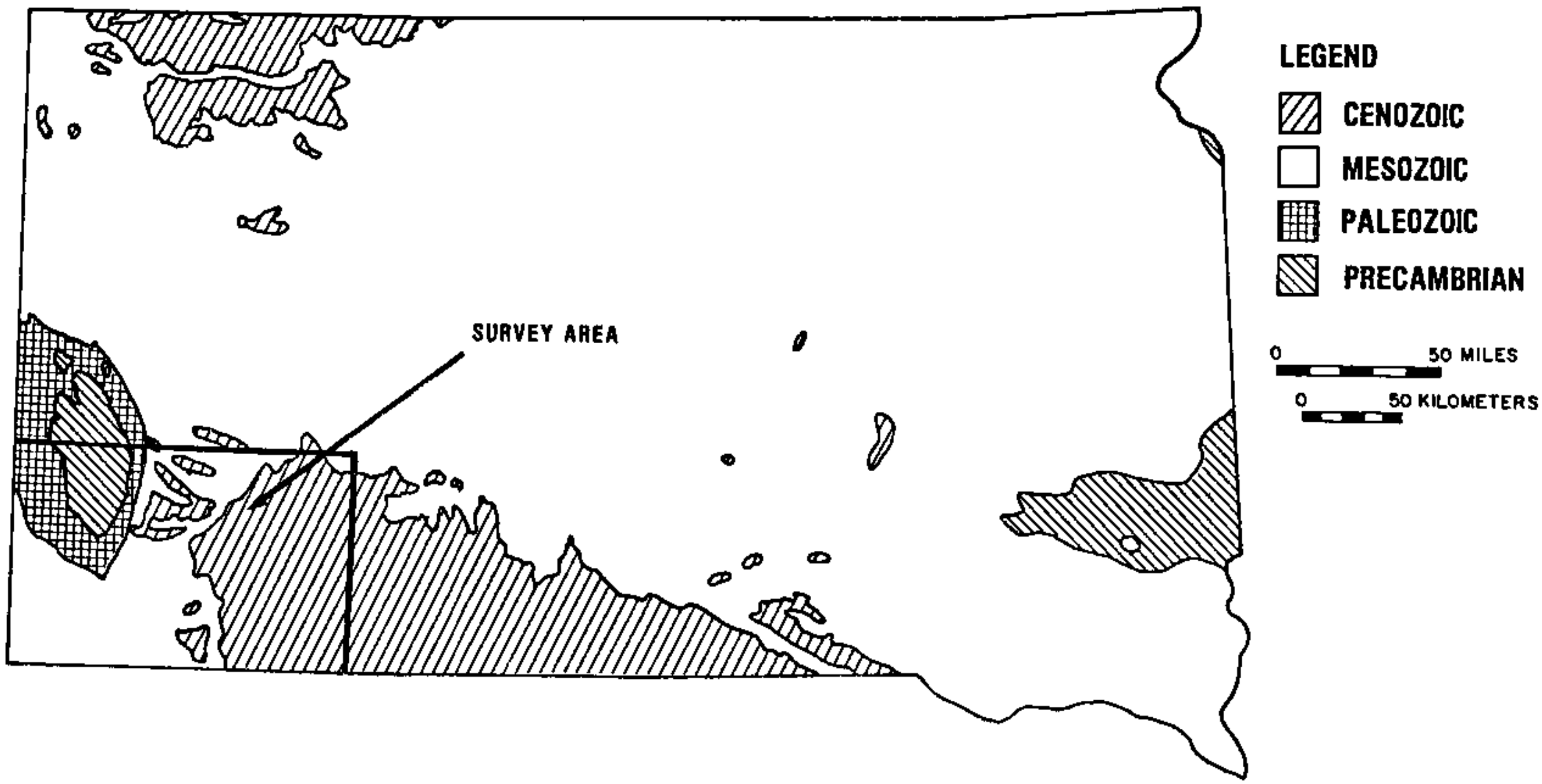

Figure 2

GENERALIZED GEOLOGIC MAP OF SOUTH DAKOTA

STRATIGRAPHIC COLUMN FOR THE HOT SPRINGS QUADRANGLE

ERA	SYSTEM	SERIES	GEOLOGIC MAP CODE	GEOLOGIC GROUP	GEOLOGIC MEMBER	MAXIMUM THICKNESS METERS	FEET
CENOZOIC	QUATERNARY		QAL	ALLUVIUM			
	TERTIARY	MIOCENE	TMPA	ARIKAREE GROUP		177	575
		OLIGOCENE	TOW	WHITE RIVER GROUP	BRULE FORMATION CHADRON FORMATION	195	630
MESOZOIC	CRETACEOUS		KGMF		FOX HILLS FORMATION	23	75
			KGMP		PIERRE SHALE	407	1,336
			KNC		NIOBRARA FORMATION AND CARLILE FORMATION, UNDIVIDED	235	750
			KGCG		GREENHORN FORMATION	92	300
			KGDS	GRANEROS GROUP	BELLE FOURCHE SHALE, MOWRY SHALE, NEWCASTLE SANDSTONE, AND SKULL CREEK SHALE	287	925
			KFL	INYAN KARA GROUP	FALL RIVER FORMATION LAKOTA FORMATION	216	700
	JURASSIC		JMS		MORRISON FORMATION SUNDANCE FORMATION	244	800
	TRIASSIC		TRSP		SPEARFISH FORMATION	210	700
PALEOZOIC	PERMIAN		PEMO		MINNEKAHTA LIMESTONE AND OPECHE SHALE	50	165
	PENNSYLVANIAN		PMIN		MINNELUSA FORMATION	427	1,400
	MISSISSIPPIAN		MIPE		PAHASAPA AND ENGLEWOOD LIMESTONES	158	520
	CAMBRIAN		CDEA		DEADWOOD FORMATION	122	400
PRECAMBRIAN			PCRE		HARNEY PEAK GRANITE, GRANITES UNDIFFERENTIATED AND PEGMATITE		
			PCMS		METAMORPHIC ROCK		

SOURCE OF GEOLOGY:

1. STACH, ROBERT, PRIVATE COMMUNICATION, SOUTH DAKOTA GEOLOGICAL SURVEY (1979).

LEGEND FOR FIGURE 3

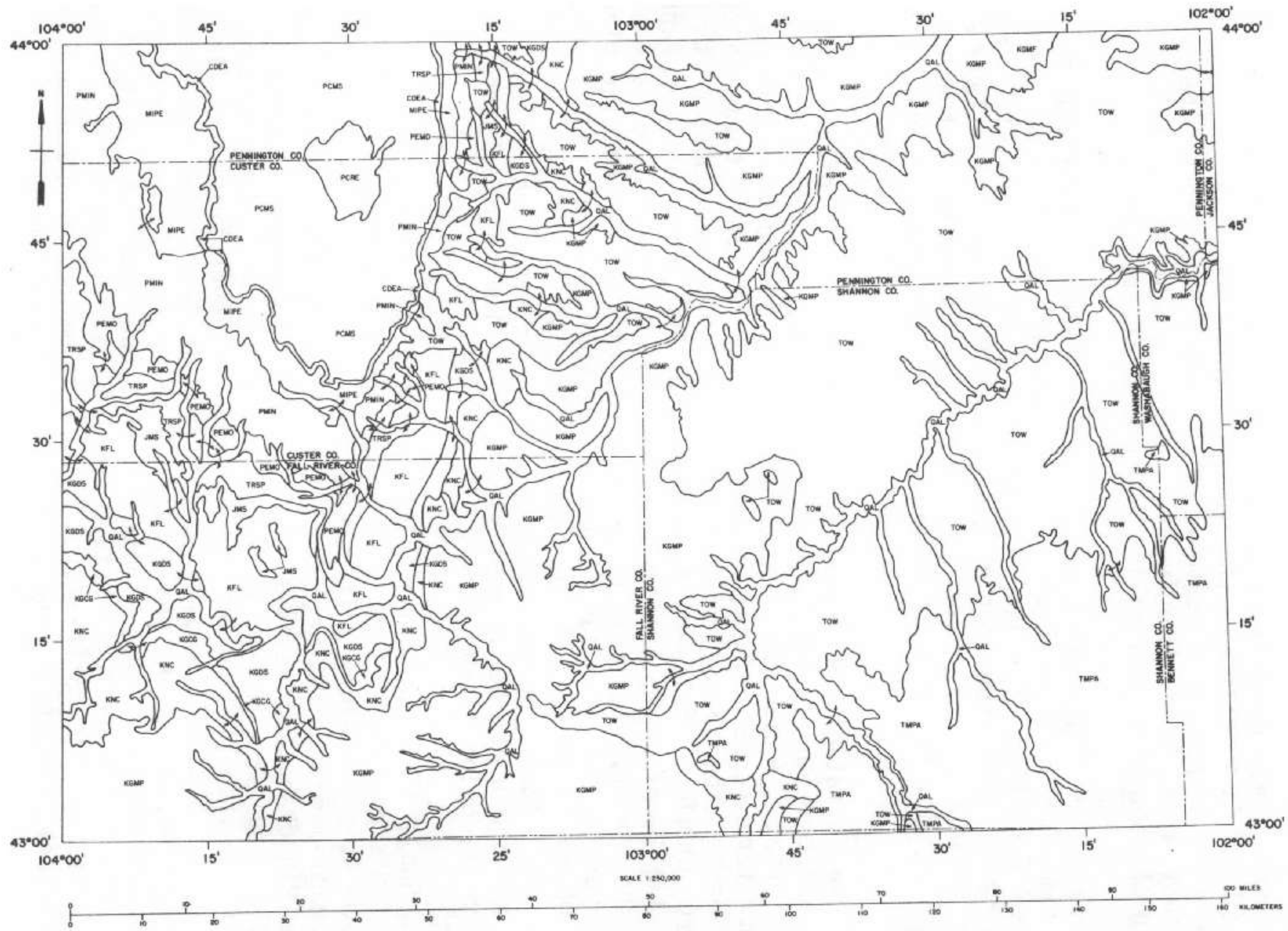

Figure 3

GENERALIZED GEOLOGIC MAP OF THE HOT SPRINGS QUADRANGLE

(400 ft) thick at the type section in the northern Black Hills. It thins rapidly southward and appears to be absent in the southeastern half of the study area (Gries, 1975).

The Englewood Limestone (Mississippian) is a red to lavender dolomite 0 to 21 m (0 to 75 ft) thick, which lies unconformably on the Deadwood Formation. The Englewood Limestone may be present in the northern part of the study area, however only as a thin remnant and should not be present in the southern half of the study area (Keene, 1973).

Where present the Englewood Limestone is conformably overlain by the Pahasapa Limestone (Mississippian). The Pahasapa is a local name for the Madison Formation. It consists of a gray to buff, massive, dense limestone having a thickness of up to 137 m (450 ft) with thin layers of chert and laterite. The upper surface is marked by karst topography (Gries, 1975). The Pahasapa is absent in the southeastern corner of the quadrangle.

The Minnelusa Formation (Pennsylvanian-Permian) consists of alternating beds of sandstone and dolomite with lesser amounts of red and black shales and chert. A maximum thickness of 427 m (1,400 ft) is found in the southwestern corner of the quadrangle, but the unit thins to the north and east. The formation is divided into lower and upper parts by a red shale which is believed to be an erosional break between Pennsylvanian and Permian deposition. The lower unit consists of a basal red shale and the upper unit is composed of dolomites, radioactive black shales, anhydrite, and thin sandstones. The upper unit of the Minnelusa Formation which is Permian in age can in turn be subdivided into two sequences, the lower being composed of dolomites, anhydrites, and sandstone and the upper being mostly sandstone with thin dolomites and locally a cherty dolomite cap (Gries, 1975).

The Opeche Shale (Permian), a red silty shale and fine red sandstone with thin, discontinuous beds of gypsum and anhydrite, lies unconformably over the Minnelusa. It ranges from 25 to 38 m (85 to 125 ft) thick, averaging around 30 m (100 ft) thick in the study area (Keene, 1973). The Minnekahata Limestone (Permian), unconformably overlies the Opeche Shale, and is a 10- to 12-m (35 to 40 ft) thick, gray to purple thin-bedded limestone. Four members occur: a lower brick red shaley unit with up to 60% silt and clay, a pure limestone zone with little insoluble residue, an upper shaley zone with up to 10% insoluble clay and silt which weathers into slabs, and an upper unit of nearly pure limestone. The Minnekahata Limestone is overlain conformably by the Spearfish Formation (Permo-Triassic), which is mainly composed of red beds of siltstone, sandstone, and shale, with some gypsum beds.

The Sundance Formation, an Upper Jurassic marine sequence, lies unconformably over the Spearfish Formation in the study area. The Sundance Formation consists of alternating sandstones and shales, thickening from east to west. The thickness ranges from 76 to 137 m (250 to 450 ft) (Keene, 1973). Conformably overlying the Sundance Formation is the

Morrison Formation, a nonmarine deltaic sequence consisting of an interbedded sequence of varicolored shale, sandstone, and minor amounts of limestone. Dinosaur bones and small fossil invertebrates are abundant. The Morrison Formation ranges in thickness from 8 to 107 m (26 to 350 ft) (Merewether, 1975).

The Early Cretaceous Inyan Kara Group lies unconformably over the Morrison Formation. It includes the Lakota and younger Fall River Formations. The Lakota consists of as much as 170 m (550 ft) of cross-bedded, channel-fill sandstone, shale, and locally occurring limestone. Thin lenses of conglomerate and fossil wood commonly occur in the sandstone (Gries, 1952). The Fall River Formation, is separated from the Lakota by a transgressional disconformity and consists of 37 to 46 m (120 to 150 ft) of well-bedded, fine-grained sandstone with less abundant interbedded siltstone and clay. The Inyan Kara Group represents a change from continental to marginal marine depositional environments (Merewether, 1975).

The Graneros Group (Early through Late Cretaceous) consists of four conformable formations. The Skull Creek Shale is about 77 m (250 ft) of dark-gray, noncalcareous marine shale (Keene, 1973). Overlying the Skull Creek Shale is the Newcastle Sandstone (Early Cretaceous), which is a thin, soft, white channel sandstone interbedded with shales and bentonite probably deposited in a fluvial or deltaic environment. It attains a maximum thickness of 30 m (100 ft) in the study area. Overlying the Newcastle is the Mowry Shale (Early Cretaceous) which consists of 40 m (125 ft) of gray shale. The Mowry grades into the Belle Fourche Shale (Late Cretaceous) which consists of up to 140 m (450 ft) of soft gray concretion-bearing shale with small amounts of bentonite, deposited in an inland sea (Merewether, 1975).

Overlying the Belle Fourche Shale is the Greenhorn Formation (Late Cretaceous), a marine unit of approximately 92 m (300 ft) of fossiliferous calcareous shale and limestone (Keene, 1973). The Greenhorn is conformably overlain by the Carlile Formation (Late Cretaceous). The Carlile Formation is also of marine origin and can be as much as 160 m (520 ft) thick. It consists of a light gray shale with interbedded sandstone layers and abundant concretions. Overlying the Carlile is the Niobrara Formation (Late Cretaceous), 60 to 75 m (200 to 230 ft) of gray to yellow, white speckled chalk or marl with thin bentonite beds. The Niobrara was deposited in a broad inland seaway (Merewether, 1975).

The Pierre Shale which was deposited in the last Cretaceous sea to cover South Dakota, is conformable and interfingers with the Niobrara Formation in western South Dakota. The Pierre is as much as 407 m (1,336 ft) thick and consists of concretion-bearing gray shale with bentonites, thin sandstone units, and calcareous shale units (Keene, 1973).

In the extreme northeastern corner of the quadrangle, the Fox Hills Formation is represented by erosional remnants. Up to 23 m (75 ft) of thinly bedded silts, sands, and clays may be conformably present on the Pierre Shale and represent a regression of the Cretaceous sea (Personal Communications, R. F. Bretz, 1979).

The Oligocene White River Group is separated from the underlying Fox Hills Formation and Pierre Shale by the Eocene Interior Paleosol. The White River Group represents the beginning of a depositional cycle following a period of soil formation in a warm, moist climate, which lasted from the Paleocene until the start of Oligocene deposition. The Chadron Formation, the lower of the two formations in the White River Group, contains up to 55 m (180 ft) of light green claystone with local channel sandstones up to 9 m (30 ft) thick. Overlying the Chadron Formation is the Brule Formation, which consists of up to 140 m (450 ft) of pink siltstone and volcanic ash, presumably from Colorado, Wyoming, and Montana.

The Arikaree Group (Miocene), conformably overlies the Brule Formation. It consists of up to 110 m (350 ft) of pink, silty claystone with calcareous concretions, and a 6- to 7-m (20 to 25 ft) layer of impure white volcanic ash. Overlying this is 30 m (100 ft) of tan sandy siltstone with abundant volcanic ash, and a gray, ash-bearing sandstone with many lenses of fresh-water limestone, 37 m (125 ft) thick. Quaternary terrace gravels, alluvium, colluvium, and eolian deposits, exist locally throughout the study area.

STRUCTURE

The dominant structural feature in the Hot Springs Quadrangle is the Black Hills, an arcuate, north to northwest trending, dome-shaped anticline (Gott, et al, 1974). Uplift probably began in Late Cretaceous times and, continued until the Early Eocene (Bartram, 1940). Sedimentary rocks overlying the southern end of the uplift have been extensively folded and faulted. Three south plunging anticlines and the Sheep Canyon Monocline dominate the southern Black Hills east of Edgemont. Northwest of Edgemont are the Long Mountain Structural Zone and the Dewey Fault and Structural Zone. These zones are dominated by steeply dipping to vertical northeast-trending normal faults (Gott, et al, 1974).

Slightly east of long. 103° W., the north end of the Chadron Arch extends for 20 mi into Shannon County northwestward from Nebraska. Little is known of this structural feature in South Dakota (Denson, 1964).

In the eastern half of the Hot Springs Quadrangle, relatively flat-lying sediments dip southeasterly at about 30 ft/mi. Sediments of the White River Group contain sandstone dikes probably caused by differential compaction (Curtiss, 1955).

In sediments in the southern Black Hills, many structural features such as breccia pipes, collapse structures, and synclinal folds are a result of dissolution of anhydrite, gypsum, limestone, and dolomite with subsequent development of solution features (Gott, et al, 1974).

HYDROLOGY

Principal aquifers in the study area are the Pahasapa Limestone, Sundance Formation, Inyan Kara Group, and Quaternary alluvial deposits.

The Pahasapa Limestone has excellent potential as an aquifer, but because of its depth away from the Black Hills and the cost of well construction, its use is restricted primarily to municipal water supplies.

Although the Sundance Formation underlies much of the study area, it is only used as an aquifer near the outcrop area. The Canyon Springs Member is the principal zone of production and yields sulfate-type waters. The Inyan Kara Group is the most productive aquifer in the study area, yielding artesian flow in many areas. Sand zones, varying considerably in thickness and permeability, occur at depths from 30 m (90 ft) to 367 m (1,206 ft) in the study area.

Quaternary alluvial deposits along larger streams are locally an important source of groundwater. Generally, the wells are quite shallow, ranging from 2.5 to 18 m (8 to 59 ft).

Locally, shallow wells produce from the Pierre Shale, Morrison, Spearfish, and Minnelusa Formations. Typically, these wells are of very low yield, produce poor to very poor quality water, and are generally used as stock wells. The Minnelusa Formation locally produces good quality water from sands on the periphery of the Black Hills, but permeability decreases rapidly downdip from the outcrop.

URANIUM OCCURRENCES

Uraninum ore has been mined in Custer, Fall River, and Pennington Counties. The Edgemont mining district in the southwestern corner of the study area has a history of production since 1952, primarily from sandstones of the Inyan Kara Group. The host rocks are sandstones, siltstones, and interbedded carbonaceous shales deposited on floodplains (Gott and Schnable, 1963). A relationship has been shown between the distribution of uranium deposits and tectonic structure. Large minable deposits are preferentially located near areas with an abrupt change of dip (Bell, et al, 1956), such as on the west flank of the Chilson Anticline.

The Deadwood, Minnelusa, Spearfish Formations, and the Pierre Shale and Newcastle Sandstone, have shown anomalous concentrations of uraninum and are possible host units (Bell and Post, 1971).

SAMPLE COLLECTION

CHRONOLOGY OF THE SURVEY

Sampling in the Hot Springs Quadrangle began in April 1979 and was completed in June 1979. Laboratory analyses, as well as compilation and verification of all field and laboratory data, were completed by November 1979. The final field and laboratory data base used to illustrate the statistical and areal distribution of uranium and uranium-related parameters for this report was completed in December 1979.

FIELD PROCEDURES

Stream sediment and well water sampling was conducted by the South Dakota Geological Survey. A total of 340 groundwater and 394 stream sediment samples were collected within the boundaries of the Hot Springs Quadrangle. Large areas not sampled within the quadrangle included the Badlands National Monument, Mount Rushmore National Memorial, Jewel Cave National Monument, and Wind Cave National Park. The Pine Ridge Indian Reservation, which occupies Shannon, Washabaugh, and Bennett Counties was not sampled.

Spring and well water samples are reported together as groundwater. Plates 1 and 4 are overlays at a scale of 1:250,000 showing sample locations for groundwater sites and stream sediment sites, respectively. Drainage basins are drawn on Plate 4 to indicate the area represented by the stream sediment samples.

Detailed information regarding techniques in sample collection, recording site data, field equipment, and field measurements may be found in the following reports: "Hydrogeochemical and Stream Sediment Reconnaissance Procedures of the Uranium Resource Evaluation Project" (Arendt, et al, In Press), "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 C.

CONTAMINATION

Precautions were taken to avoid collecting of 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 long enough to flush the system. The fact that it had no recent use was noted on the field form. Any wells that the samplers felt might be contaminated were noted as such on the field forms. Sediment samples were collected upstream from road crossings wherever possible. Visible signs of contamination or the presence of cultivated areas or oil fields upstream from a sample site were noted on the field form.

Only eastern Fall River County and southeastern Custer County are under cultivation, principally with alfalfa and some corn. These areas are irrigated with waters from the Angostura Reservoir Project. Agricultural extention agents indicated that little, if any, fertilizer is used. These farming districts and some parts of the southern Black Hills in Custer and Fall River Counties presented the problem of overgrown streams due to the lack of runoff. Many sediment samples taken here are probably soil samples. Another source of contamination are the many small pegmatite mines that dot the Black Hills. These mines are small pit operations that were mined for feldspar and rare pegmatite minerals.

Groundwaters and stream sediments in the Edgemont district may reflect the presence of known uranium deposits in that location. This area was heavily stip mined in the 1950's. Abandoned mines are concentrated directly east of Edgemont, and west of the Angostura Dam and extend northwestward through the Black Hills National Forest in Fall River County and into the far southwestern corner of Custer County near Burdock. These abandoned open-pit mines have not been reclaimed or refilled.

CHEMICAL ANALYSIS

All samples collected in the field geology program 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 may have values reported below these limits. All water samples were received unacidified in polyethylene bottles and were filtered through 0.45-μm cellulose acetate paper before analysis. Stream sediments were received in Kraft paper envelopes, dried overnight at 85°C, and sieved to collect the <150-μm fraction. This fraction was used in all chemical analyses. The analytical procedures which were used have been described by Cagle (1977) and Arendt, et al (In Press). All observed data from all samples are included in the microfiche in Appendix C.

QUALITY CONTROL

MEASUREMENTS CONTROL

The procedures used to analyze URE Project reconnaissance samples require that calibration standards, check samples, and blanks be run

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	0.2
Ag	Plasma Source Emission Spectrometry	2	2
Al	Plasma Source Emission Spectrometry	0.05[a]	10
B	Plasma Source Emission Spectrometry	10	8
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	4
Mg	Plasma Source Emission Spectrometry	0.09[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
Sc	Plasma Source Emission Spectrometry	1	1
Si	Plasma Source Emission Spectrometry	--	0.1[b]
Sn	Flameless Atomic Absorption	<5	--
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.

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. Control samples of two water batches and two sediment batches are submitted anonymously along with routine samples on a daily basis. A statistical summary of results reported on control samples, which were analyzed along with the samples included in this survey, is given in Table 2. 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 (1979).

PRINCIPAL COMPONENT ERROR ANALYSIS

A principal component analysis of data from well water 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 unusual 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 unusual samples identified by this procedure were reviewed. Six well water samples (401299, 401900, 402146, 402471, 402918, and 404143) and four stream sediment samples (402518, 402051, 402485, and 402525) which appeared to be the most unusual were submitted for reanalysis. The original results were compared to the results from reanalysis. Of the more than 150 individual analyses that were compared, the only results which were considered to be in error in the original analysis and thus require corrections were one U-FL value and one value each for sulfate and chloride in one groundwater sample. The U-FL and multielement procedure for one sediment sample were also corrected. This low error rate for the unusual samples indicates a high level of reliability for the laboratory measurements.

GEOCHEMICAL RESULTS

GEOCHEMICAL DISTRIBUTIONS IN GROUNDWATER

The sample site locations for groundwater samples collected in the Hot Springs Quadrangle are shown on Plate 1 at the 1:250,000 scale. Symbol plots for uranium and specific conductance are presented at this same scale on Plates 2 and 3 and at the 1:1,000,000 scale in Figures A-1b and A-2b, respectively. A map of the major producing horizons sampled and the samples noted as having hydrogen sulfide odor at the time of sampling is presented in Figure 4. The number of groundwater samples collected from each of the major producing units is presented in Table 3.

Observed data for the variables uranium, specific conductance, calcium, potassium, lithium, molybdenum, selenium, sodium, sulfate, strontium,

Table 2

SUMMARY OF MEASUREMENTS CONTROL RESULTS OBTAINED WITH SAMPLES FROM THE HOT SPRINGS QUADRANGLE

Measurements Control Results for Water

Element	Method	Batch L-4 No. of Samples	Batch L-4 Mean (ppb)	Batch L-4 Standard Deviation (ppb)	Batch L-4 Coefficient of Variation	Batch H-4 No. of Samples	Batch H-4 Mean (ppb)	Batch H-4 Standard Deviation (ppb)	Batch H-4 Coefficient of Variation
U	MS[a]	1	0.52	0.0	0.0	8	9.92	0.496	0.05
U	FL[b]	21	0.72	0.221	0.31	22	10.24	0.679	0.07
As	AA[c]	23	3.3	0.68	0.21	33	0.7	0.32	0.46
Se	AA	27	1.2	0.19	0.15	33	0.8	0.28	0.35
Al	PS[d]	25	96.0	17.8	0.18	25	351.0	19.9	0.06
B	PS	22	1,580.0	76.7	0.05	23	72.0	2.6	0.04
Ba	PS	22	138.0	5.2	0.04	27	32.0	1.4	0.04
Ca	PS	24	10,100.0	480.0	0.05	25	99,100.0	413.0	0.04
Co	PS	25	20.0	2.3	0.11	25	96.0	4.3	0.04
Cr	PS	20	95.0	6.6	0.07	29	19.0	3.9	0.20
Cu	PS	24	66.0	16.9	0.25	28	207.0	19.4	0.09
Fe	PS	25	81.0	21.4	0.26	25	984.0	50.6	0.05
K	PS	25	1,860.0	411.0	0.22	29	20,210.0	2,557.0	0.13
Li	PS	25	17.0	2.3	0.13	28	102.0	8.9	0.09
Mg	PS	22	9,200.0	410.0	0.04	25	72,900.0	3,160.0	0.04
Mn	PS	25	20.0	1.7	0.08	25	103.0	4.4	0.04
Mo	PS	22	36.0	6.8	0.19	29	6.0	6.0	0.95
Na	PS	24	160.0	230.0	0.15	28	45.1	4.01	0.09
Ni	PS	22	192.0	8.7	0.05	27	39.0	3.7	0.09
P	PS	22	116.0	15.0	0.13	27	4,853.0	363.8	0.07
Sc	PS	22	62.0	3.9	0.06	26	12.0	0.7	0.06
Si	PS	20	900.0	69.0	0.08	29	7,930.0	974.0	0.12
Sr	PS	25	[illegible]3.40	4.500	0.08	25	5,157.60	168.964	0.03
Ti	PS	22	112.0	6.0	0.05	27	40.0	1.8	0.04
V	PS	20	10.0	3.1	0.29	25	41.0	5.3	0.13
Y	PS	25	9.0	1.1	0.11	27	47.0	2.1	0.04
Zn	PS	22	500.0	26.4	0.05	23	48.0	23.3	0.48

Measurements Control Results for Stream Sediments

Element	Method	Batch R-3 No. of Samples	Batch R-3 Mean (ppm)	Batch R-3 Standard Deviation (ppm)	Batch R-3 Coefficient of Variation	Batch S-2 No. of Samples	Batch S-2 Mean (ppm)	Batch S-2 Standard Deviation (ppm)	Batch S-2 Coefficient of Variation
U	FL	38	4.06	0.542	0.13	18	9.70	0.628	0.06
U	NT[e]	34	4.81	0.148	0.03	23	10.11	0.233	0.02
As	AA	26	3.6	0.44	0.12	15	10.1	0.51	0.05
Se	AA	27	0.5	0.24	0.50	20	0.8	0.26	0.32
Al	PS	29	31,100.00	1,620.00	0.05	17	52,900.00	1,950.00	0.04
B	PS	35	11.0	4.0	0.34	17	42.0	5.5	0.13
Ba	PS	29	415.0	14.4	0.03	19	380.0	18.3	0.05
Be	PS	35	1.0	1.4	0.79	20	2.0	0.8	0.34
Ca	PS	33	2,500.00	410.00	0.16	20	3,200.00	420.00	0.13
Ce	PS	25	58.96	11.724	0.20	21	91.62	42.324	0.46
Co	PS	33	14.0	1.5	0.10	17	25.0	1.3	0.05
Cr	PS	33	26.0	1.8	0.07	15	58.0	3.7	0.06
Cu	PS	33	22.0	3.8	0.17	15	47.0	2.4	0.05
Fe	PS	29	17,500.00	1,170.00	0.07	15	32,700.00	1,450.00	0.04
K	PS	31	9,900.0	700.0	0.07	17	20,100.0	1,200.0	0.06
Li	PS	33	22.0	1.4	0.06	17	33.0	3.3	0.10
Mg	PS	33	2,000.00	190.00	0.09	19	5,300.00	360.00	0.07
Mn	PS	29	1,885.0	124.3	0.07	15	764.0	39.5	0.05
Mo	PS	35	2.0	1.2	0.46	15	27.0	2.6	0.10
Na	PS	33	1,500.00	120.00	0.08	19	2,100.00	210.00	0.10
Nb	PS	33	13.0	2.2	0.17	20	14.0	2.9	0.21
Ni	PS	33	17.0	2.2	0.12	15	54.0	2.4	0.04
P	PS	31	1,651.0	156.6	0.09	15	730.0	36.6	0.05
Sc	PS	33	5.0	0.5	0.09	21	10.0	2.4	0.22
Sr	PS	29	54.07	1.361	0.03	19	80.63	4.810	0.06
Th	PS	35	5.0	4.6	0.80	21	7.0	2.1	0.26
Ti	PS	31	3,208.0	244.2	0.08	21	2,897.0	267.0	0.09
V	PS	31	52.0	4.4	0.09	15	151.0	13.7	0.09
Y	PS	33	19.0	1.7	0.09	17	27.0	1.2	0.04
Zn	PS	31	87.0	8.5	0.10	15	97.0	5.4	0.06
Zr	PS	29	130.0	7.7	0.06	17	113.0	7.2	0.06

(a) Mass spectrometry.
(b) Fluorometric analyses.
(c) Atomic absorption.
(d) Plasma source emission spectroscopy.
(e) Neutron activation delayed neutron count.

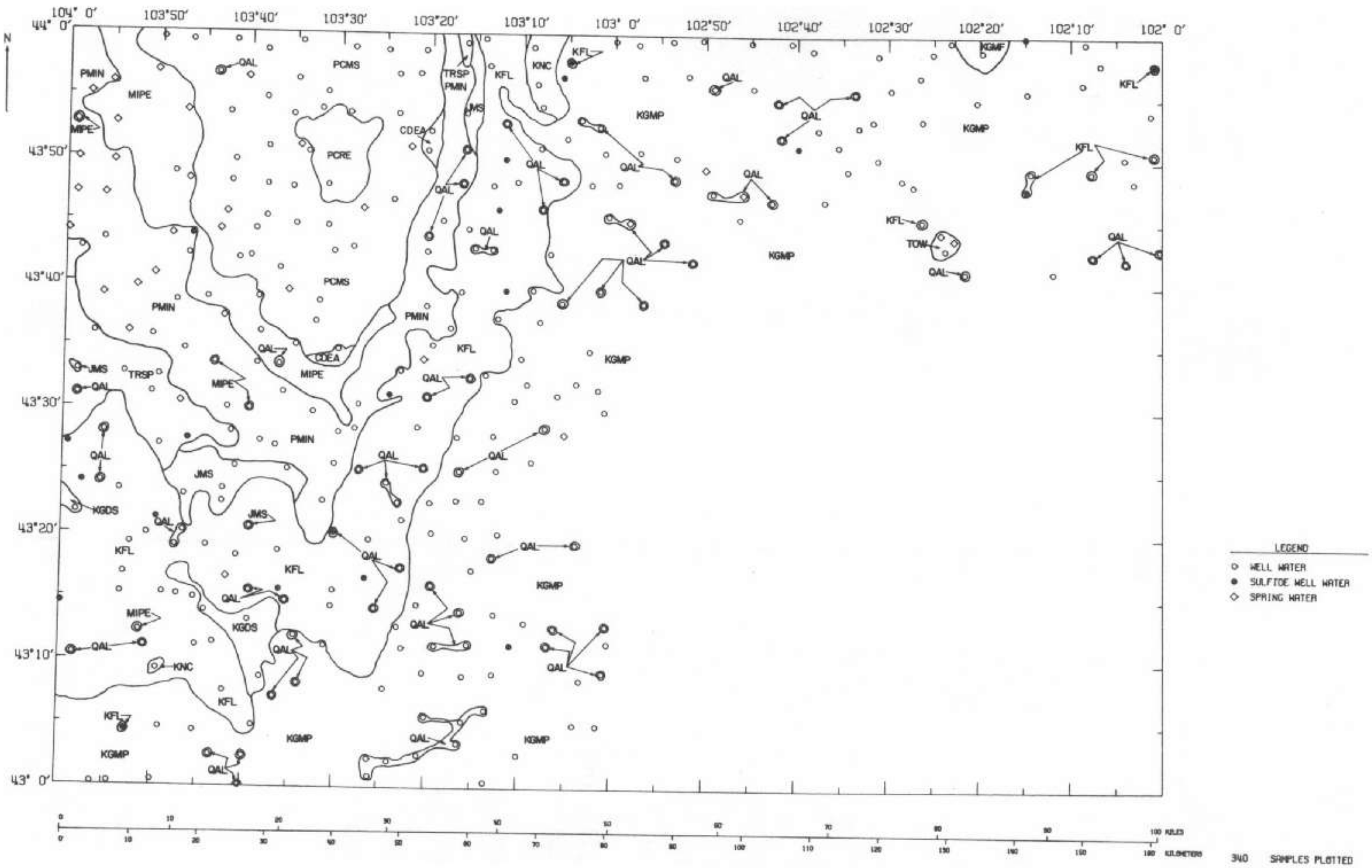

Figure 4

PRODUCING HORIZON MAP FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

Table 3

DISTRIBTUION OF SAMPLES BY GEOLOGIC UNIT FROM THE HOT SPRINGS QUADRANGLE

Geologic Unit	Geologic Unit Code	No. of Groundwater Samples	No. of Sediment Samples
Alluvium	QAL	78	2
Arikaree Group	TMPA	0	0
White River Group	TOW	3	78
Fox Hills Formation	KGMF	1	2
Pierre Shale	KGMP	91	117
Niobrara Formation and Carlile Formation	KNC	4	16
Greenhorn Formation	KGCG	0	0
Graneros Group	KGDS	4	10
Inyan Kara Group	KFL	48	20
Morrison Formation and Sundance Formation	JMS	7	6
Spearfish Formation	TRSP	10	8
Minnekahta Limestone and Opeche Shale	PEMO	0	5
Minnelusa Formation	PMIN	34	24
Pahasapa and Englewood Limestones	MIPE	13	16
Deadwood Formation	CDEA	3	0
Harney Peak Granite, Granites Undifferentiated, and Pegmatite	PCRE	1	4
Metamorphic Rock	PCMS	43	50
Total		340	358

and total alkalinity are listed in Table A-3. The figures in Appendix A present log frequency, lognormal probability, percentile and areal symbol plots for these variables plus boron, chloride, iron, magnesium, manganese, pH, silicon, and vanadium.

Uranium

The distribution of uranium in groundwater of the Hot Springs Quadrangle (Plate 2 and Figure A-1b) indicates three areas in which uranium concentrations above 30.92 ppb (the 85th percentile) occur. A major area of high concentrations of uranium in groundwater is the northeastern corner of the quadrangle in Pennington and Custer Counties. Most of these samples were produced from the Pierre Shale or from alluvium, though a few were from the White River Group. A smaller cluster of high uranium groundwaters occurs slightly west of this major trend, in the north central section of the Hot Springs Quadrangle. The majority of these samples were produced from alluvium. This second trend appears to follow the circumference of the Black Hills and joins a third trend south of the Black Hills. This third trend extends in a northwesterly direction from southeastern Fall River County into southwestern Custer County. This group of groundwaters was produced from aquifers of Triassic, Jurassic, Cretaceous, and Quaternary age.

The percentile plot (Figure A-1a) shows that the groundwaters with the highest uranium background ranges (50th through 85th percentiles) occur in waters from the Jurassic Morrison and Sundance Formations, the Cretaceous Pierre Shale, the Tertiary White River Group, and the alluvium.

Groundwaters containing less than 0.46 ppb uranium (15th percentile) occur in two major groups. One group clusters in the northwestern section of the Hot Springs Quadrangle in Pennington and Custer Counties. These groundwaters are from the Precambrian metamorphic rocks and granites of the Black Hills. The other trend runs northwest to southeast through Fall River County, and the waters are mainly from the Inyan Kara Group.

The correlation matrix (Table A-2) indicates a significant positive correlation coefficient of ≥ 0.30 for both Pearson and Spearman correlations between uranium, specific conductance, boron, calcium, potassium, lithium, magnesium, sodium, selenium, strontium, sulfate, and total alkalinity. There is a significant negative correlation between uranium and barium.

Specific Conductance

The areal distribution plots (Plate 3 and Figure A-2b) for specific conductance in groundwaters of the Hot Springs Quadrangle indicate that waters with specific conductance values higher than 3,507 μmhos/cm (85th percentile) are produced primarily from Cretaceous and Quaternary aquifers. Anomalous groundwaters are concentrated in the southwestern corner of the study area in Fall River County and extends through Custer into Pennington County to the northeastern corner of the quadrangle.

The percentile plot (Figure A-2a) shows that the waters produced from the Jurassic Morrison and Sundance Formations, the Cretaceous Graneros Group, Niobrara and Carlile Formations, Pierre Shale, and alluvium have the highest specific conductance background levels.

Groundwaters with specific conductance values below 580 μmhos/cm (15th percentile) are produced primarily from the Precambrian metamorphic rocks and granites, the Mississippian Pahasapa and Englewood Limestone and the Pennsylvanian-Permian Minnelusa Formation. The majority of these waters occur in and around the Black Hills.

The correlation matrix (Table A-2) indicates a significant positive correlation coefficient of ≥0.3 for both Pearson and Spearman correlations between specific conductance and uranium, boron, calcium, chloride, postassium, lithium, magnesium, sodium, strontium, sulfate, and total alkalinity and a significant negative correlation with arsenic and barium.

<u>Related Variables</u>

From the areal distribution and percentile plots for uranium, it appears that all geologic units containing aquifer systems from the Triassic to the end of the Cretaceous have potential for uranium mineralization. However, certain parameters must be considered in evaluation of each geologic unit.

Groundwaters from the Pierre Shale were taken from shallow wells generally less than 15 m in depth, hand-dug and cased with concrete, therefore they are susceptible to surface contamination. These groundwaters are also probably produced from a weathered fracture zone within the shale. These altered shales have been noted (Tourtelot, 1956) as having anomalous uranium content, the uranium is believed to have been leached of the overlying ash in the White River Group. The percentile plot of uranium indicates high uranium background values for the Pierre Shale. Variables associated with uranium in the Pierre Shale are boron, chloride, potassium, lithium, molybdenum, sodium, selenium, vanadium, and total alkalinity.

The Graneros Group and the Niobrara Formations are represented by only a few groundwater samples. Uranium values vary widely, but the high values correspond areally with calcium, iron, lithium, magnesium, and molybdenum.

The Inyan Kara Group has known uranium deposits in the area north and east of the town of Edgemont. From the uranium percentile plot, it can be noted that groundwaters from the Inyan Kara have the lowest uranium values of the Mesozoic units. Most of the groundwaters sampled from the Inyan Kara Group were south of Edgemont where the unit is overlain by the Graneros Group and the Niobrara and Carlile Formations. North and east of Edgemont, Inyan Kara groundwaters have high uranium values in a pattern that appears to follow the mining district. High vanadium values appear to be associated with the low uranium values to the south of Edgemont. Molybdenum has an areal association with uranium in the Inyan Kara groundwaters east of Edgemont. Other variables that have slight associations with uranium are potassium and lithium.

The Jurassic Morrison and Sundance, and the Triassic Spearfish Formations have a limited number of groundwater samples taken from them but areal distribution plots indicate high uranium values for them. Variables that associate with uranium in waters for the Morrison and Sundance Formations are specific conductance, calcium, potassium, lithium, magnesium, strontium, and sulfate. There is some areal association of the uranium in the Morrison and Sundance Formations with molybdenum. In the Spearfish Formation there is a close areal association of uranium with molybdenum and vanadium.

Summary of Groundwater Data

There are three trends of high uranium concentrations in groundwaters in the Hot Springs Quadrangle. In the northeast, a trend of high uranium values corresponds to groundwaters produced from the marine Pierre Shale. Owing to the nature of marine shales, and the altered zone in which these groundwaters are produced their anomalous values may not be related to potential uranium mineralization. In the north central section, a smaller trend of high uranium groundwaters are produced primarily from alluvium draining the White River Group and from the Niobrara Formation. The trend in the southwestern portion of the quadrangle produces from many geologic units including the Graneros Group, the Pierre Shale, and sandstones of the Inyan Kara Group, Morrison, Sundance, and Spearfish Formations. These last two trends form a ring around the southern flank of the Black Hills and indicate the Precambrian granites and Tertiary ash-rich units which once covered most of this area may be a source of the uranium. The Inyan Kara Group and the Morrison, Sundance, and the Spearfish Formations appear to be the most favorable for potential uranium mineralization because of their comparatively high uranium values for waters produced from sandstones and the presence of high vanadium and molybdenum values.

GEOCHEMICAL DISTRIBUTIONS IN STREAM SEDIMENT

The sample site locations for stream sediments collected in the Hot Springs Quadrangle are shown on Plate 4 at the 1:250,000 scale. The symbol plot for the hot-acid-soluble uranium as determined by flourometric analysis (U-FL) and thorium is presented at this scale in Plates

5 and 6, respectively, and at the 1:1,000,000 scale in Figures B-1b and B-4b, respectively. The stream sediment data subset used to generate Tables B-1 and B-2 and the figures in Appendix B includes all stream sediment samples collected from basins in the Hot Springs Quadrangle that average approximately 25 km^2 (10 mi^2). Samples which were collected from basins larger than 50 km^2 (Phase G) were not included. The number of stream sediment samples (358) in this subset which were collected from the major stratigraphic units of the survey area are presented in Table 3. Results from all stream sediment samples collected from the Hot Springs Quadrangle are included in Table B-3 and in the microfiche in Appendix C.

Observed data for the variables hot-acid-soluble uranium (U-FL), total uranium as determined by neutron activation (U-NT), U/U-NT, thorium, arsenic, copper, lithium, nickel, phosphorus, selenium, and vanadium are listed in Table B-3. The figures in Appendix B represent log frequency, lognormal probability, percentile, and areal symbol plots for these same variables, plus cerium, chromium, cobalt, molybdenum, sodium, titanium, yttrium, zinc, zirconium, and thorium/U-NT.

Uranium

The areal distribution of uranium (Plate 4 and Figure B-1b) and U-NT (Figure B-2b) indicate two trends in which uranium concentrations above the 85th percentile (4.24 and 4.60 ppm, respectively) occur. One trend forms a belt along the periphery of the Black Hills. Most stream sediments from this group were derived from Cretaceous rocks, the Inyan Kara Group, Graneros Group, and Niobrara Formation. The other group of uranium values above the 85th percentile occur in the Black Hills. These stream sediments are derived from the Precambrian granites. Stream sediments below the 15th percentile (2.12 ppm) are concentrated in the Pahasapa and Englewood Limestones, Minnelusa Formation, Opeche Shale, and Minnekahata Limestone. Two small groups of sediment samples with uranium values below the 15th percentile are located in the northeast section of the Hot Springs Quadrangle where the sediments are derived from the Pierre Shale and White River Group.

The areal distribution of U/U-NT (Figure B-2b) corresponds approximately to the uranium patterns. The 85th percentile (1.03) for U/U-NT matches the high uranium values for some wells in the grouping in northeastern Fall River and southern Custer Counties, and also in the large cluster in south central Fall River County. Clusters of low U/U-NT values are located in the Precambrian granites, the Pierre Shale, and the White River Group.

The correlation matrix (Table B-2) shows a significant positive correlation coefficient $\geq$0.40 for both Pearson and Spearman correlations between U-FL and U-NT, vanadium, selenium, chromium, nickel, copper, zinc, lithium, and phosphorus. U-NT shows significant positive correlation with all the above plus arsenic.

Thorium

Areal distribution of thorium in stream sediments from the Hot Springs Quadrangle shown in Figure B-3b and the geologic distribution shown in Figure B-3a (percentile plot) indicate most thorium concentrations greater than the 85th percentile (11 ppm) are found in sediments from the Precambrian metamorphic rocks, all Cretaceous rock units, and the White River Group. Thorium values less than the 15th percentile (5 ppm) occur in many of the same units - the Precambrian metamorphic rocks, the Inyan Kara Group and the Pierre Shale.

The correlation matrix (Table B-2) shows a significant positive correlation coefficient of ≥0.40 for both Pearson and Spearman correlations between thorium, cerium, and yttrium.

Related Variables

Variables associated with uranium in sediments from the Hot Springs Quadrangle must be broken down into two groups; those associated with the Precambrian granites and those associated with the Cretaceous rock units.

Elements occurring with uranium in sediments derived from granite are potassium, lithium, manganese, sodium, phosphorus, titanium, and zirconium. This assemblage of elements suggests that uranium is associated with residual minerals such as zircon and apatite. This is also indicated by low values (15th percentile) of U/U-NT.

The largest number of anomalous sediments were derived from the Niobrara and Carlile Formations throughout their outcrop pattern. Marls are present in the Niobrara Formation. Associated elements are arsenic, calcium, chromium, copper, lithium, molybdenum, nickel, phosphorus, selenium, vanadium, yttrium, and zinc. Marls sampled in the Austin Quadrangle, Texas (Uranium Resource Evaluation Project, 1978) had anomalous values for uranium and associations with arsenic, phosphorus and vanadium. This is an indication that marls consistently show high background levels of uranium.

Sediments with high uranium values from the Graneros Group are geochemically similar to the high uranium samples from the Niobrara and Carlile Formations.

Summary of Stream Sediment Data

Areal distribution and percentile plots for uranium in stream sediments indicate four rock units as having potential for uranium mineralization; the Precambrian granites, Inyan Kara Group, Graneros Group, and marls of the Niobrara Formation.

Uranium in sediments derived from granites seems to be associated with resistate minerals. Uranium in sediments derived from the Niobrara and Carlile Formations appear to be associated with heavy minerals including apatite. Sediments from the Inyan Kara Group contain a few moderate to high values for uranium, but there seems to be no obvious associations with other elements.

ACKNOWLEDGMENTS

The URE Project would like to acknowledge the work of Dr. Duncan McGregor, Robert Stach, Richard Bretz, and the personnel of the South Dakota Geologic Survey in planning and conducting the well water and stream sediment sampling program. Familiarizing the Project's field geologists with the paleodepositional and geochemical environments of the geologic rock units of the Hot Springs Quadrangle was also appreciated.

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APPENDIX A

GROUNDWATER

APPENDIX A

GROUNDWATER

LIST OF TABLES

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LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

Table A-1

STATISTICAL SUMMARY FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

	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	312	28	<0.20	<0.20	190.50	17.13	7.64	0.56	24.413	1.426	1.94	1.54	1.70	1.91
SP	340			107	14856	2089	1451	775	1870.2	0.9	7.29	0.87	7.30	0.84
U/SP	340			0.01	148.10	8.71	5.06	0.28	14.032	1.612	1.20	1.74	1.30	1.88
U/B	340			0.07	1421.64	100.22	65.59	3.91	137.858	1.376	3.66	1.81	3.78	1.86
U/SO	340			0.04	5591.25	273.71	34.24	5.83	704.791	2.575	3.55	2.34	3.62	2.58
AG	96	244	<2	<2	6	2	<2	<2	1.1	0.4	1.02	0.34		
AL	122	218	<10	<10	124	29	<10	<10	21.2	0.7	3.18	0.62		
AS	183	157	<0.5	<0.5	124.5	5.6	<0.5	<0.5	15.18	2.69	0.78	1.17		
B	339	1	<4	<4	3770	279	140	12	361.3	1.3	4.85	1.38	4.86	1.29
BA	338	2	<2	<2	850	36	13	7	66.5	1.8	2.82	1.18	2.77	1.14
BE	5	335	<1	<1	33	8	<1	<1	14.0	1.8	0.98	1.53		
CA	340			1.8	577.7	128.3	71.0	54.9	130.89	1.02	4.32	1.13	4.38	1.10
CO	115	225	<2	<2	21	3	<2	<2	2.4	0.7	1.13	0.47		
CR	40	300	<4	<4	25	6	<4	<4	4.6	0.7	1.77	0.46		
CU	105	235	<2	<2	473	18	<2	<2	68.7	3.7	1.56	1.14		
FE	210	130	<10	<10	56037	332	12	<10	3906.1	11.8	3.08	0.88		
K	340			0.3	44.5	9.1	7.3	3.6	7.15	0.79	1.88	0.86	1.91	0.85
LI	337	3	<2	<2	1007	114	75	13	135.9	1.2	4.08	1.28	4.09	1.22
MG	340			0.2	360.1	48.1	26.1	11.4	59.45	1.24	3.17	1.36	3.23	1.37
MN	226	114	<2	<2	3563	108	3	<2	323.3	3.0	2.80	1.82		
MO	182	158	<4	<4	461	14	<4	<4	37.9	2.5	2.26	0.69		
NA	340			0.1	1179.0	147.8	92.2	7.6	172.62	1.17	3.94	1.78	3.99	1.52
NI	73	267	<4	<4	17	6	<4	<4	3.0	0.5	1.79	0.39		
P	26	314	<40	<40	979	229	<40	<40	258.3	1.1	4.94	0.97		
SC	65	274	<1	<1	5	1	<1	<1	0.8	0.6	0.16	0.38		
SE	285	55	<0.2	<0.2	4.1	0.6	0.4	0.5	0.53	0.88	-0.69	0.54	-0.88	0.65
SI	340			0.2	21.2	6.9	6.1	4.2	3.41	0.49	1.81	0.55	1.83	0.47
SR	340			11	13328	1931	1021	85	2390.1	1.2	6.75	1.44	6.79	1.47
TI	92	248	<2	<2	2281	40	<2	<2	259.5	6.4	1.55	1.00		
V	109	231	<4	<4	57	9	<4	<4	7.3	0.8	2.10	0.55		
Y	103	237	<1	<1	15	1	<1	<1	1.5	1.2	0.08	0.36		
ZN	321	19	<4	<4	63403	328	27	8	3548.9	10.8	3.68	1.48	3.46	1.59
ZR	95	245	<2	<2	80	4	<2	<2	9.2	2.0	1.16	0.57		
T-AK	338			21	928	267	258	201	124.8	0.5	5.48	0.52	5.51	0.56
M-AK	338			20	958	267	254	197	124.8	0.5	5.48	0.52	5.51	0.56
P-AK	337			0	98	1	0	0	9.1	5.2				
CL	174	164	<10	<10	708	55	11	<10	75.0	1.4	3.55	0.89		
NA/C	338			0.03	107.18	9.41	3.33	1.03	14.251	1.515	1.32	1.42	1.32	1.33
PH	340			4.7	10.1	7.3	7.3	7.5	0.62	0.09				
SO4	311	29	<5	<5	5365	625	254	29	797.7	1.3	5.32	1.86	5.11	2.09

NOTE: Refer to Table 1, Page 24 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table A-2

CORRELATION MATRIX FOR GROUNDWATER
OF THE HOT SPRINGS QUADRANGLE

	L-U	LTAK	L-SE	L-MO	L-CL	L-SP	LSO4	L-LI	L-NA	L-B
L-U	1.00 (312)									
LTAK	0.44*** 0.35*** (310)	1.00 (338)								
L-SE	0.31*** 0.35*** (268)	0.24*** 0.25*** (285)	1.00 (285)							
L-MO	0.10 0.20*** (169)	0.11 0.15** (183)	0.10 0.07 (151)	1.00 (183)						
L-CL	0.21*** 0.21*** (159)	0.04 0.01 (173)	0.16** 0.13* (157)	0.10 0.11 (88)	1.00 (174)					
L-SP	0.48*** 0.51*** (312)	0.45*** 0.40*** (338)	0.31*** 0.27*** (285)	0.11 0.13* (183)	0.37*** 0.36*** (174)	1.00 (340)				
LSO4	0.34*** 0.41*** (286)	0.31*** 0.30*** (309)	0.22*** 0.23*** (266)	0.06 0.07 (165)	0.26*** 0.25*** (173)	0.86*** 0.90*** (311)	1.00 (311)			
L-LI	0.44*** 0.48*** (309)	0.37*** 0.40*** (335)	0.32*** 0.29*** (282)	0.19** 0.19** (180)	0.33*** 0.31*** (174)	0.83*** 0.85*** (337)	0.82*** 0.81*** (311)	1.00 (337)		
L-NA	0.42*** 0.46*** (312)	0.46*** 0.50*** (338)	0.34*** 0.32*** (285)	0.16** 0.16** (183)	0.33*** 0.30*** (174)	0.81*** 0.83*** (340)	0.76*** 0.74*** (311)	0.90*** 0.87*** (337)	1.00 (340)	
L-B	0.45*** 0.49*** (311)	0.49*** 0.48*** (337)	0.34*** 0.34*** (285)	0.18** 0.21*** (183)	0.32*** 0.28*** (174)	0.83*** 0.83*** (339)	0.76*** 0.73*** (310)	0.87*** 0.86*** (336)	0.89*** 0.86*** (339)	1.00 (339)
L-K	0.39*** 0.43*** (312)	0.17*** 0.17*** (338)	0.31*** 0.30*** (285)	0.05 0.10 (183)	0.42*** 0.44*** (174)	0.61*** 0.63*** (340)	0.60*** 0.59*** (311)	0.72*** 0.70*** (337)	0.67*** 0.63*** (340)	0.65*** 0.63*** (339)
L-BA	-0.19*** -0.25*** (310)	-0.15*** -0.23*** (336)	-0.08 -0.06 (283)	-0.17** -0.16** (181)	-0.06 -0.06 (172)	-0.58*** -0.64*** (338)	-0.70*** -0.68*** (309)	-0.64*** -0.67*** (335)	-0.63*** -0.63*** (338)	-0.59*** -0.61*** (337)
L-CA	0.41*** 0.40*** (312)	0.11** 0.11* (338)	0.14** 0.17*** (285)	-0.09 -0.02 (183)	0.20*** 0.20*** (174)	0.58*** 0.64*** (340)	0.52*** 0.66*** (311)	0.39*** 0.48*** (337)	0.24*** 0.29*** (340)	0.36*** 0.41*** (339)
L-MG	0.36*** 0.39*** (312)	0.13** 0.18*** (338)	0.12** 0.11* (285)	-0.11 0.03 (183)	0.19** 0.19** (174)	0.55*** 0.64*** (340)	0.51*** 0.69*** (311)	0.39*** 0.50*** (337)	0.24*** 0.32*** (340)	0.35*** 0.44*** (339)
L-SR	0.46*** 0.47*** (312)	0.31*** 0.21*** (338)	0.28*** 0.26*** (285)	-0.01 0.07 (183)	0.25*** 0.22*** (174)	0.78*** 0.79*** (340)	0.73*** 0.79*** (311)	0.67*** 0.69*** (337)	0.56*** 0.54*** (340)	0.66*** 0.65*** (339)
L-AS	0.04 -0.08 (175)	-0.13* -0.18** (183)	0.01 -0.00 (156)	0.09 -0.04 (117)	-0.00 -0.04 (81)	-0.34*** -0.37*** (183)	-0.36*** -0.44*** (158)	-0.29*** -0.36*** (180)	-0.25*** -0.33*** (183)	-0.23*** -0.30*** (183)
L-FE	-0.12* 0.23*** (191)	-0.22*** 0.17** (208)	0.06 0.34*** (173)	0.20** 0.16* (109)	-0.06 0.10 (119)	0.23*** 0.34*** (210)	0.29*** 0.40*** (200)	0.31*** 0.42*** (209)	0.27*** 0.37*** (210)	0.25*** 0.40*** (210)
L-MN	-0.15** -0.09 (204)	-0.14** -0.03 (223)	-0.03 -0.02 (187)	-0.13 -0.18* (115)	-0.04 -0.03 (137)	0.12* 0.16** (225)	0.19*** 0.25*** (221)	0.16** 0.16** (225)	0.11 0.15** (225)	0.01 0.06 (224)
L-ZN	-0.13** -0.10* (295)	-0.18*** -0.15*** (319)	0.07 0.03 (271)	0.04 -0.00 (171)	-0.10 -0.06 (169)	0.03 -0.01 (321)	-0.00 -0.00 (295)	-0.06 -0.08 (318)	-0.02 -0.02 (321)	-0.02 -0.04 (320)
L-SI	0.22*** 0.19*** (312)	0.00 -0.10* (338)	0.05 0.11* (285)	0.12 0.08 (183)	0.18** 0.16** (174)	-0.14** -0.13** (340)	-0.17*** -0.20*** (311)	-0.04 -0.08 (337)	0.03 -0.02 (340)	-0.02 -0.07 (339)
PH	0.06 0.05 (312)	0.26*** 0.20*** (338)	0.16*** 0.13** (285)	-0.03 -0.04 (183)	0.02 -0.02 (174)	0.21*** 0.15*** (340)	0.17*** 0.09 (311)	0.23*** 0.18*** (337)	0.32*** 0.27*** (340)	0.30*** 0.25*** (339)

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%.

	L-K	L-BA	L-CA	L-MG	L-SR	L-AS	L-FE	L-MN	L-ZN	L-SI	PH
L-K	1.00 (340)										
L-BA	-0.39*** -0.38*** (338)	1.00 (338)									
L-CA	0.48*** 0.50*** (340)	-0.23*** -0.30*** (338)	1.00 (340)								
L-MG	0.48*** 0.50*** (340)	-0.25*** -0.37*** (338)	0.90*** 0.88*** (340)	1.00 (340)							
L-SR	0.65*** 0.60*** (340)	-0.43*** -0.50*** (338)	0.81*** 0.84*** (340)	0.75*** 0.81*** (340)	1.00 (340)						
L-AS	-0.16** -0.26*** (183)	0.30*** 0.38*** (181)	-0.21*** -0.29*** (183)	-0.20*** -0.24*** (183)	-0.27*** -0.33*** (183)	1.00 (183)					
L-FE	0.21*** 0.34*** (210)	-0.11 -0.17** (210)	0.12* 0.30*** (210)	0.14** 0.32*** (210)	0.21*** 0.35*** (210)	-0.38*** -0.45*** (93)	1.00 (210)				
L-MN	0.11 0.11* (225)	-0.12* -0.19*** (224)	0.08 0.12* (225)	0.08 0.11 (225)	0.05 0.13* (225)	-0.06 -0.11 (94)	0.17** 0.02 (171)	1.00 (225)			
L-ZN	0.03 0.00 (321)	0.06 0.06 (319)	0.10* 0.05 (321)	0.05 -0.02 (321)	0.05 -0.01 (321)	-0.03 -0.02 (170)	0.23*** -0.10 (202)	0.29*** 0.28*** (222)	1.00 (321)		
L-SI	0.09* 0.06 (340)	0.09 0.20*** (338)	-0.04 -0.14*** (340)	-0.17*** -0.27*** (340)	-0.13** -0.16*** (340)	0.26*** 0.24*** (183)	-0.23*** 0.01 (210)	-0.26*** -0.19*** (225)	-0.24*** -0.17*** (321)	1.00 (340)	
PH	0.15*** 0.12** (340)	-0.14*** -0.11** (338)	-0.14** -0.09 (340)	-0.11** -0.04 (340)	0.09 0.05 (340)	-0.11 -0.10 (183)	-0.04 0.11 (210)	-0.14** -0.10 (225)	-0.09* -0.02 (321)	-0.13** -0.18*** (340)	1.00 (340)

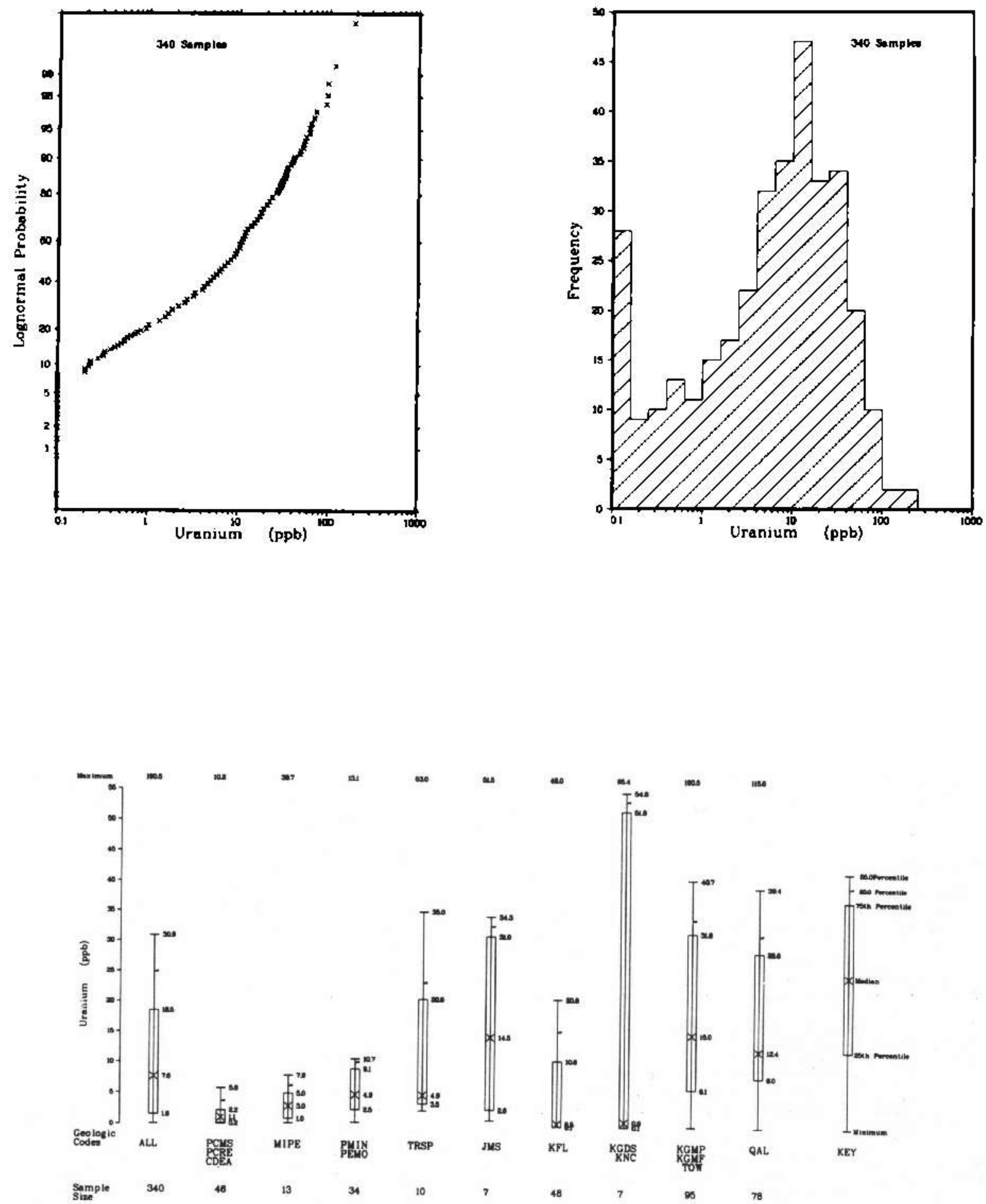


Figure A-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM (PPB)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

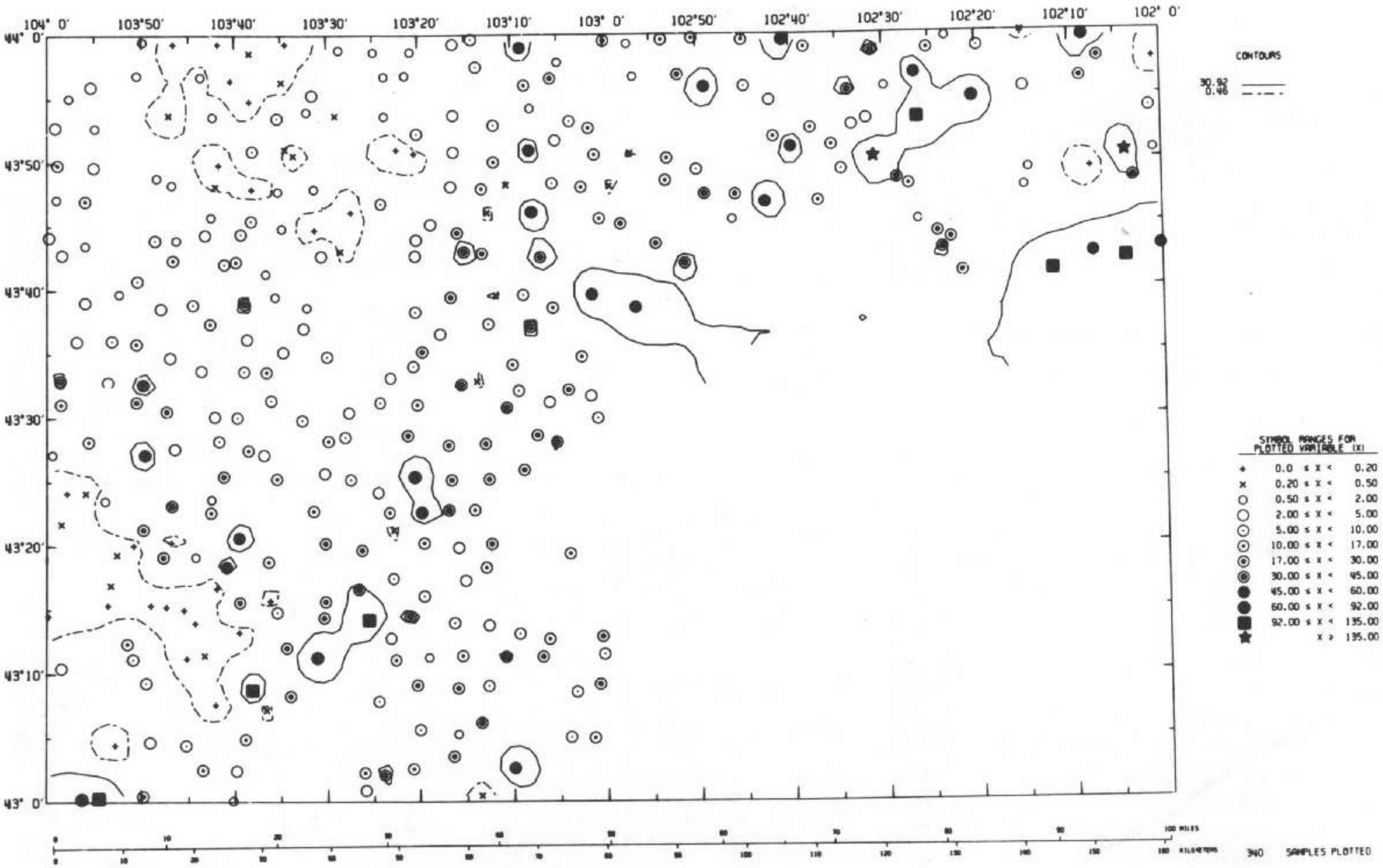


Figure A-1b

GEOCHEMICAL DISTRIBUTION OF URANIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

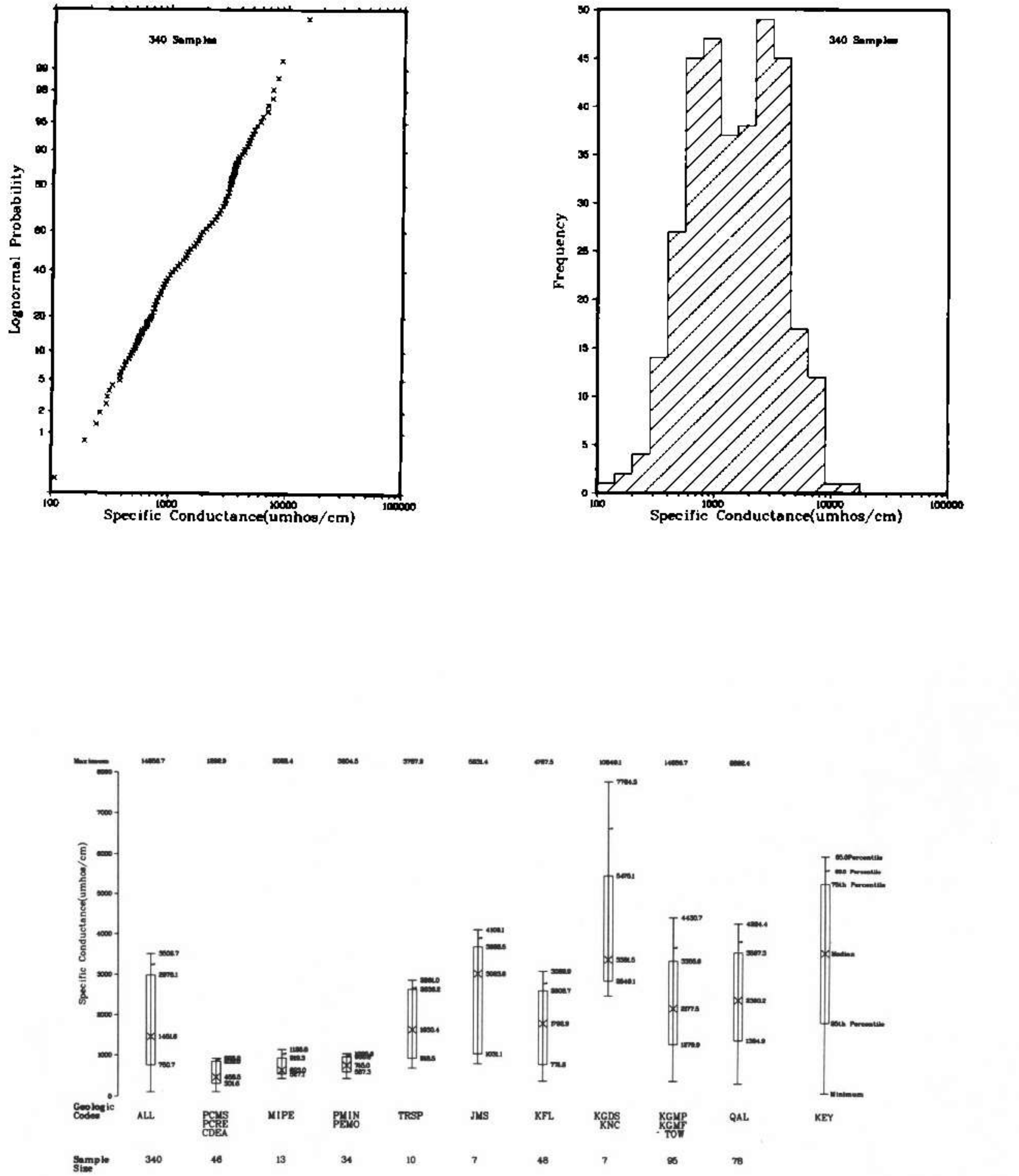


Figure A-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SPECIFIC CONDUCTANCE (μMHOS/CM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

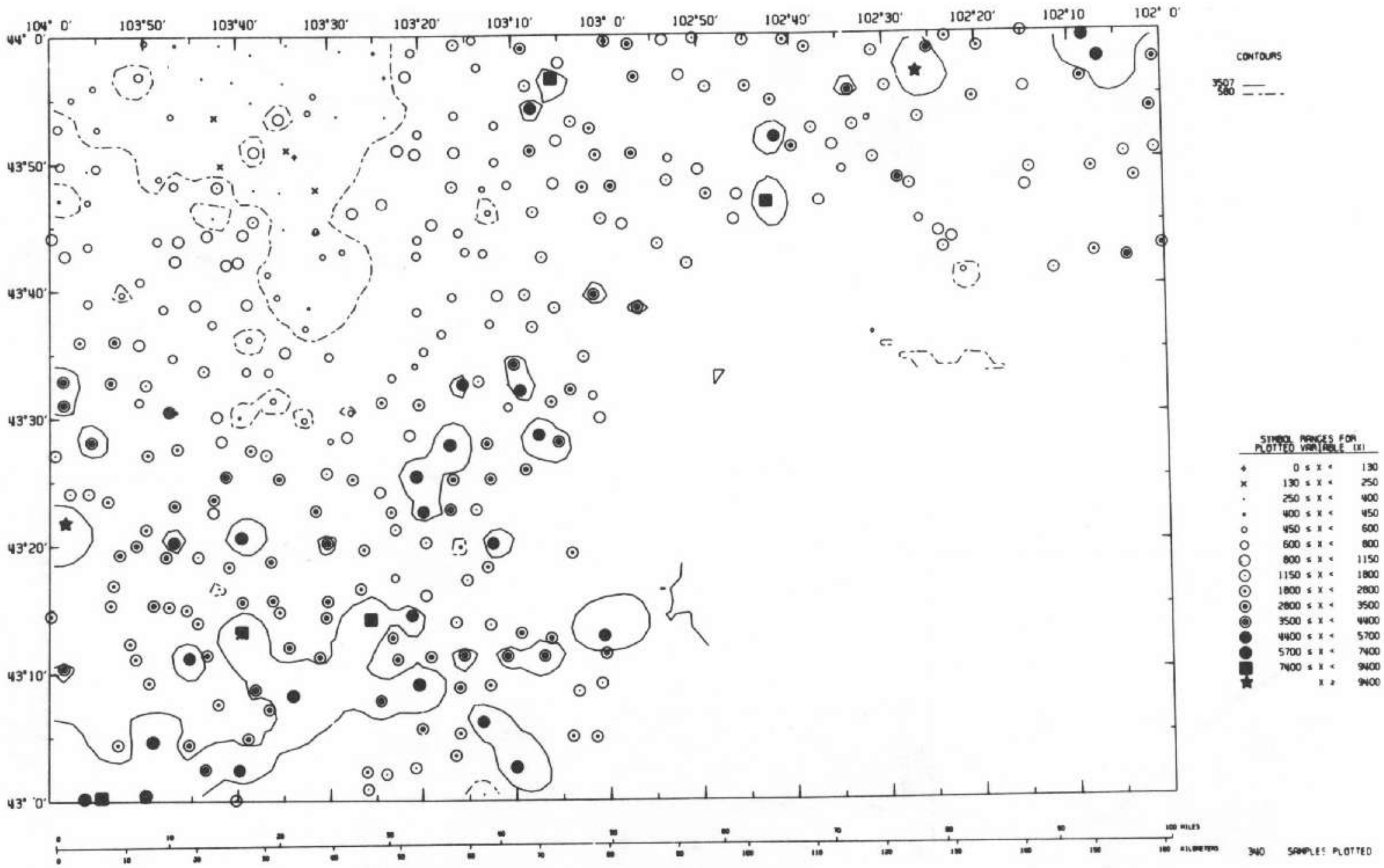


Figure A-2b

GEOCHEMICAL DISTRIBUTION OF SPECIFIC CONDUCTANCE (μMHOS/CM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

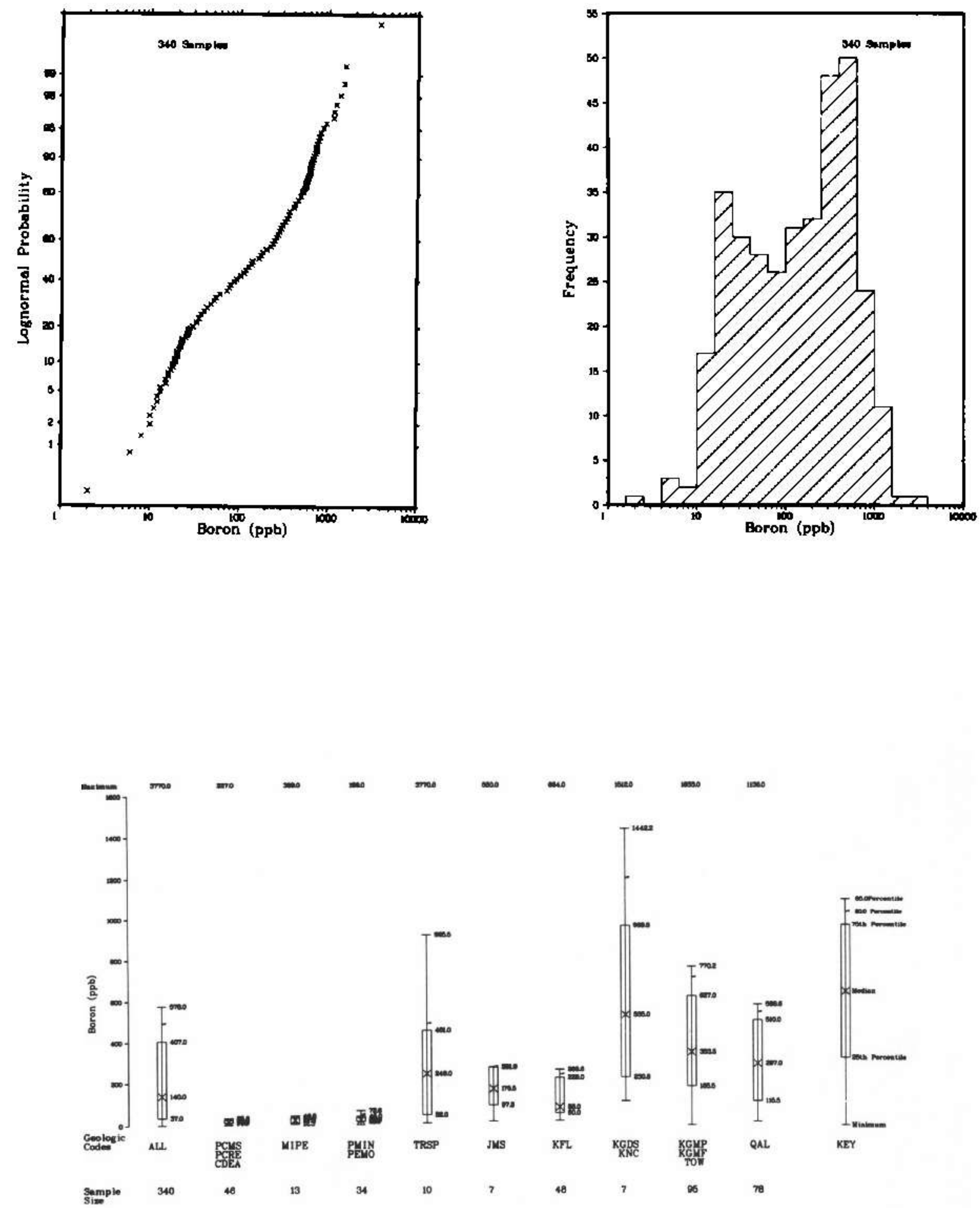


Figure A-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR BORON (PPB)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

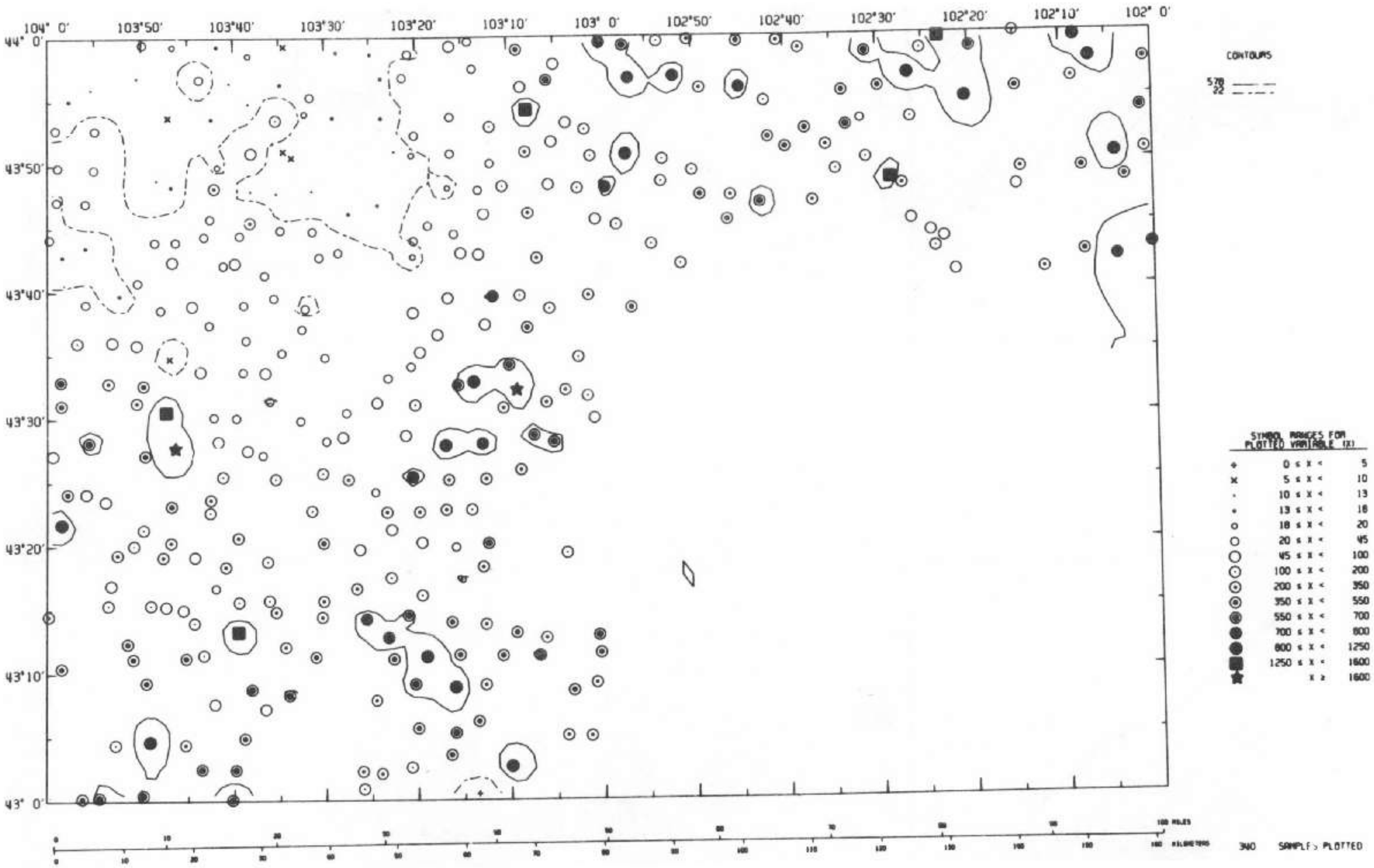
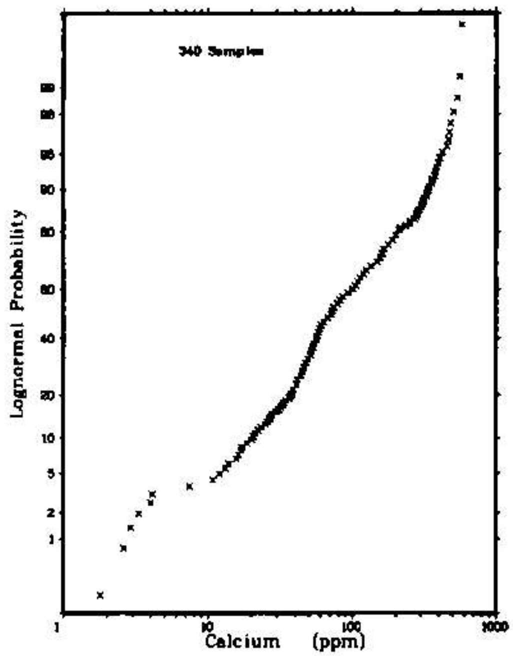
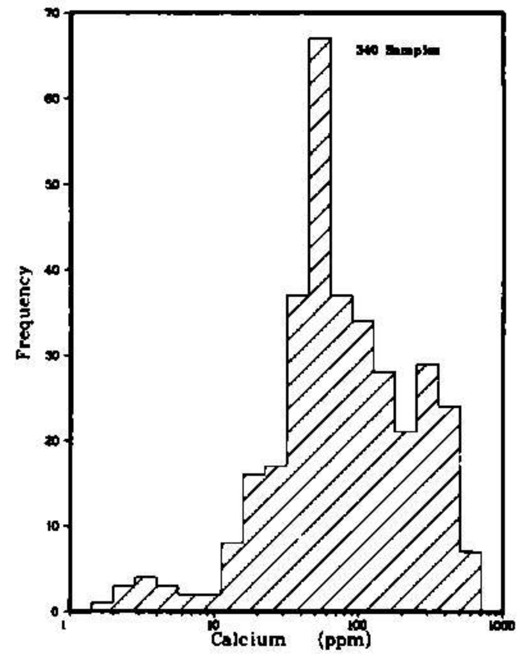


Figure A-3b

GEOCHEMICAL DISTRIBUTION OF BORON (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE





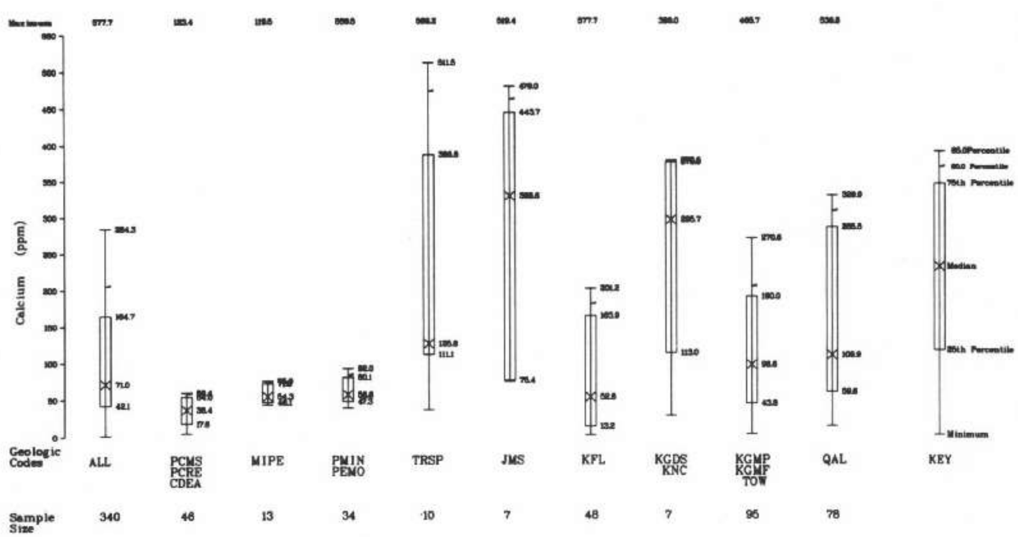


Figure A-4a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CALCIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

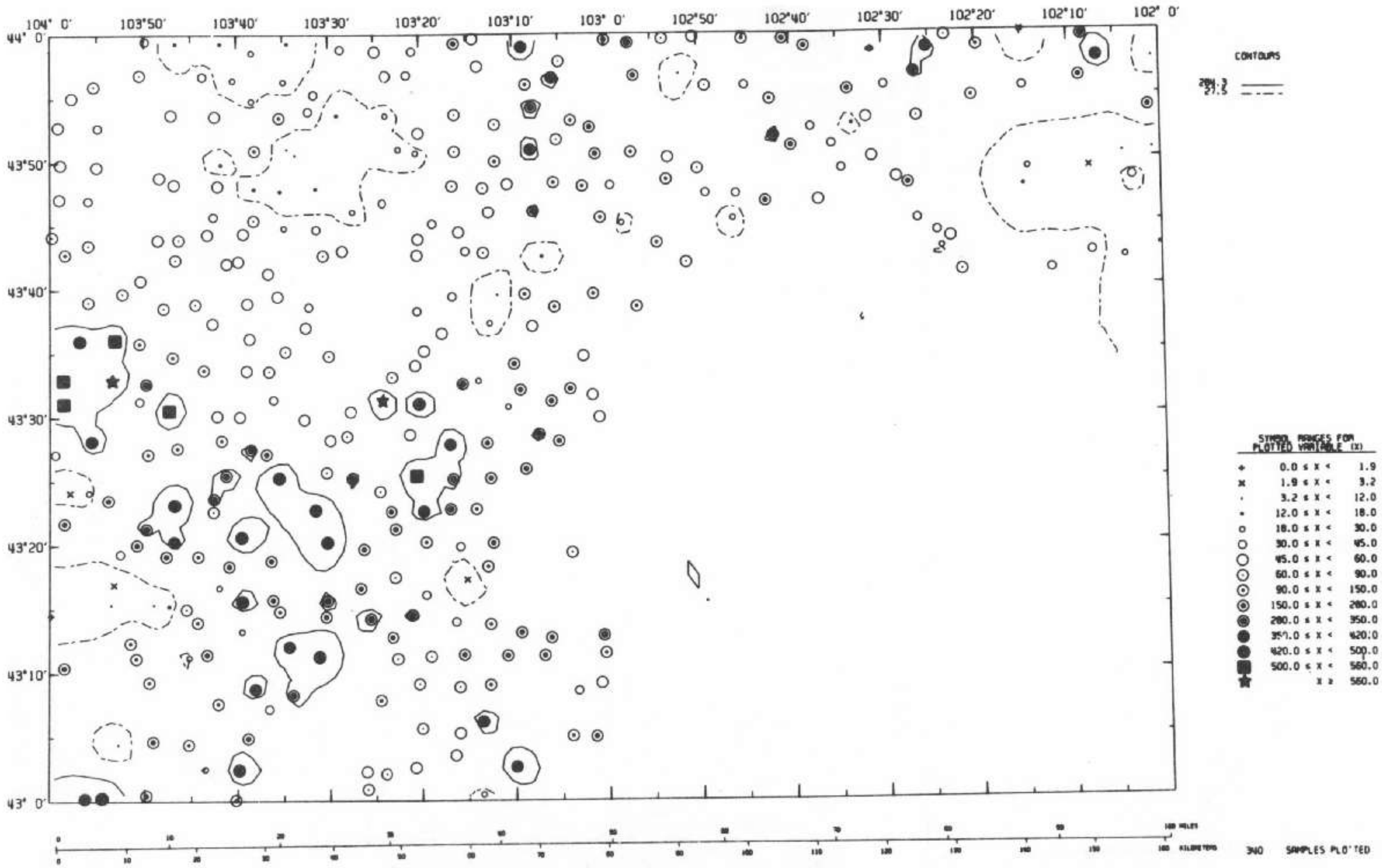


Figure A-4b

GEOCHEMICAL DISTRIBUTION OF CALCIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

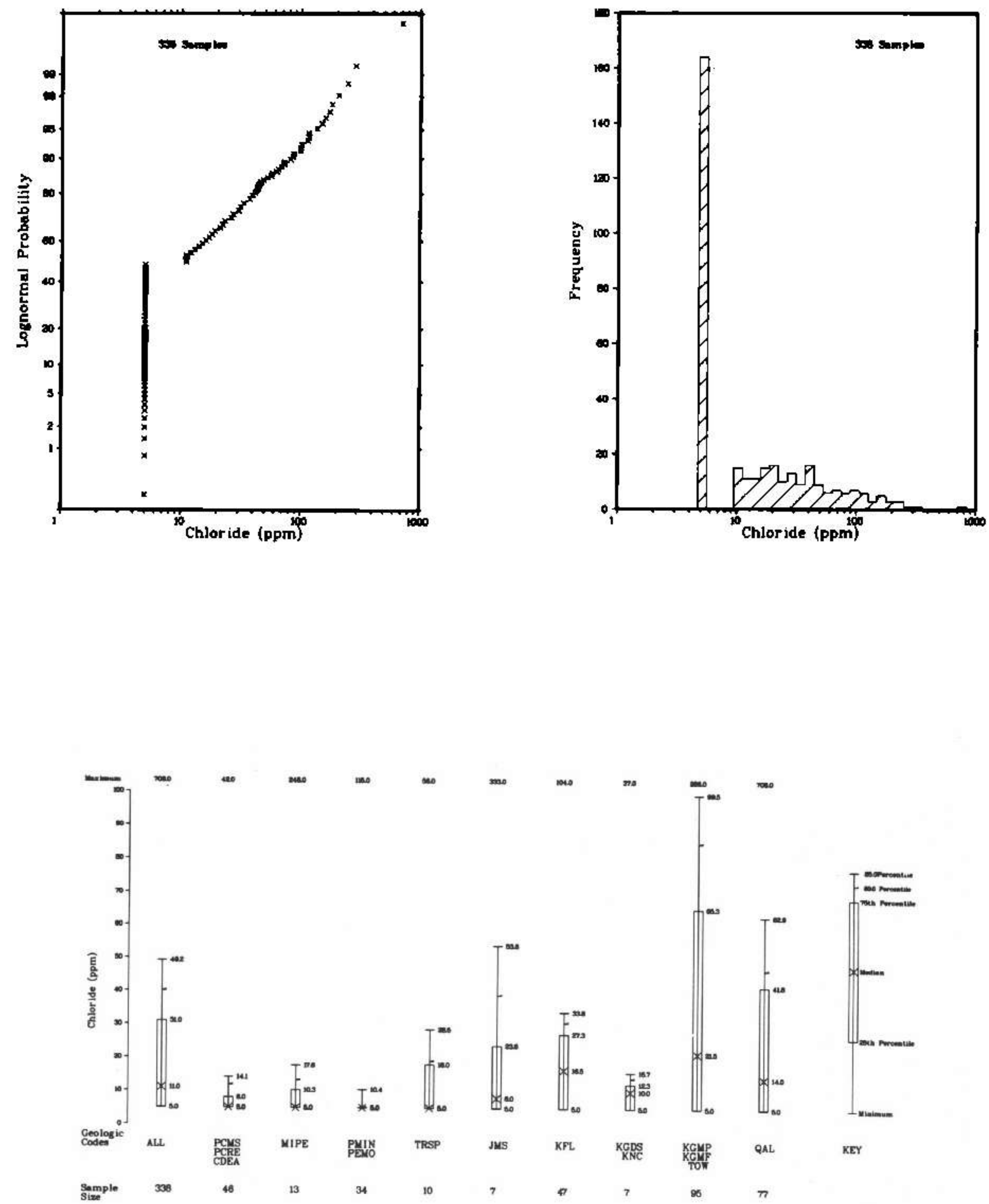


Figure A-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CHLORIDE (PPM)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

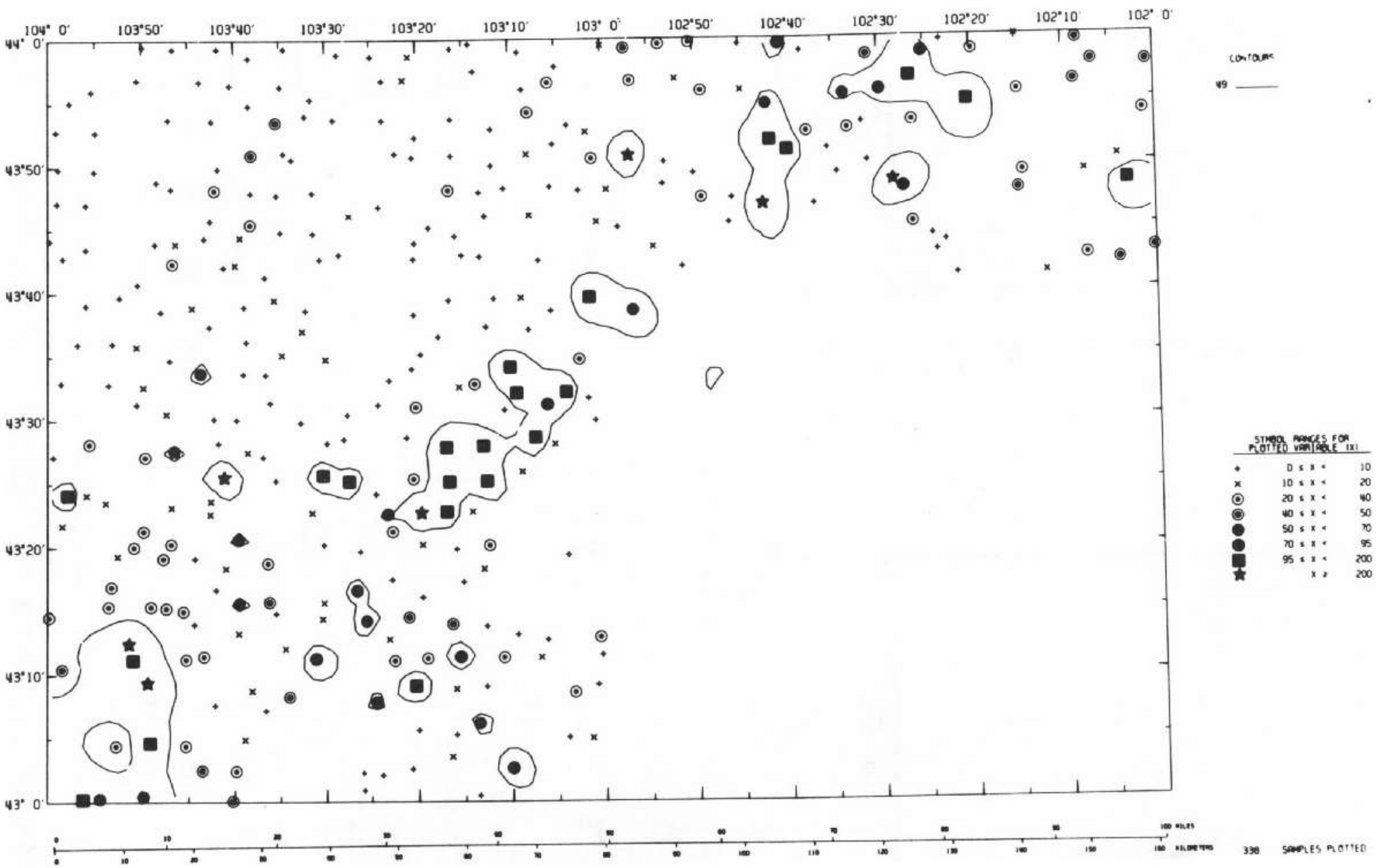


Figure A-5b

GEOCHEMICAL DISTRIBUTION OF CHLORIDE (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

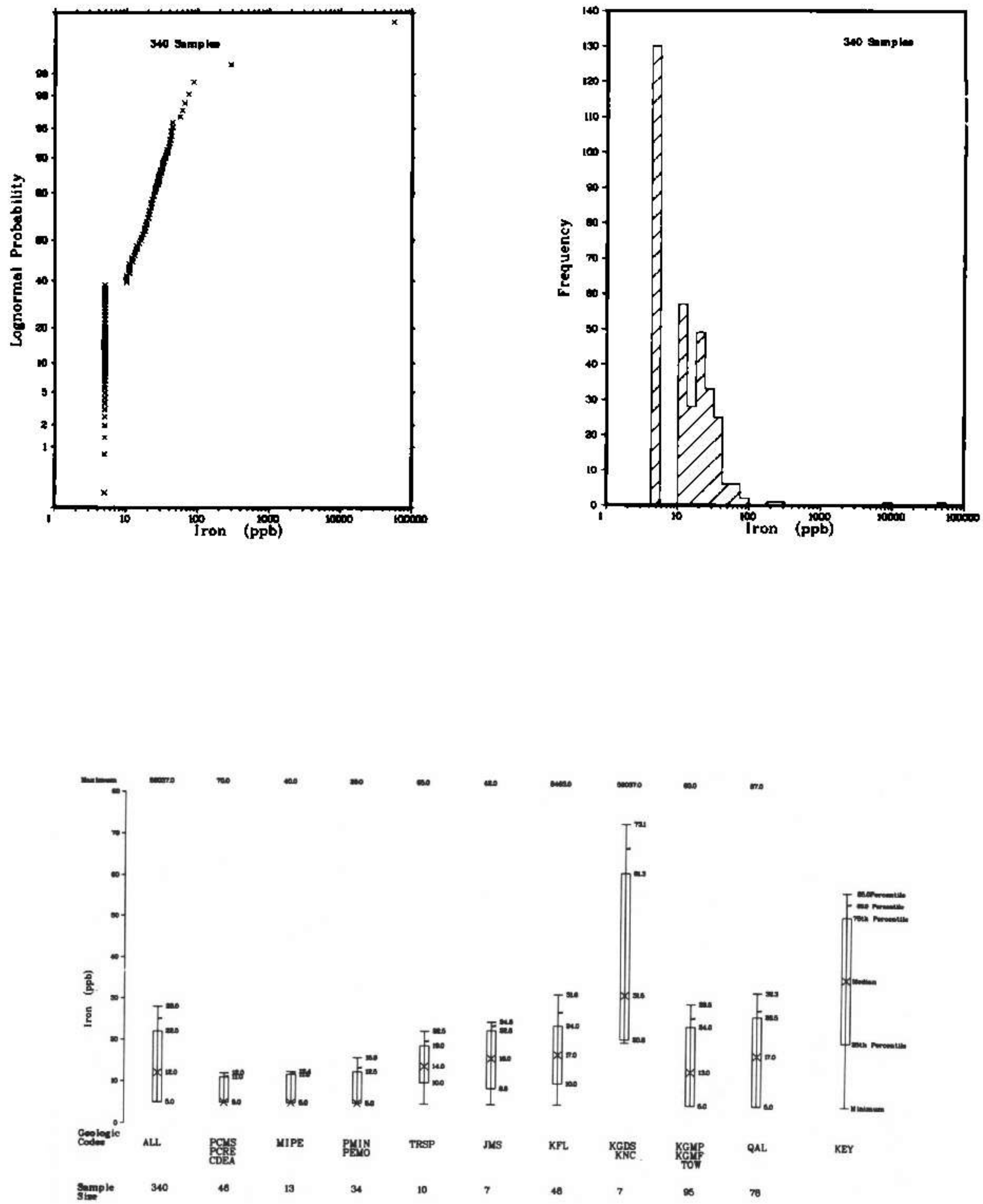


Figure A-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR IRON (PPB)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

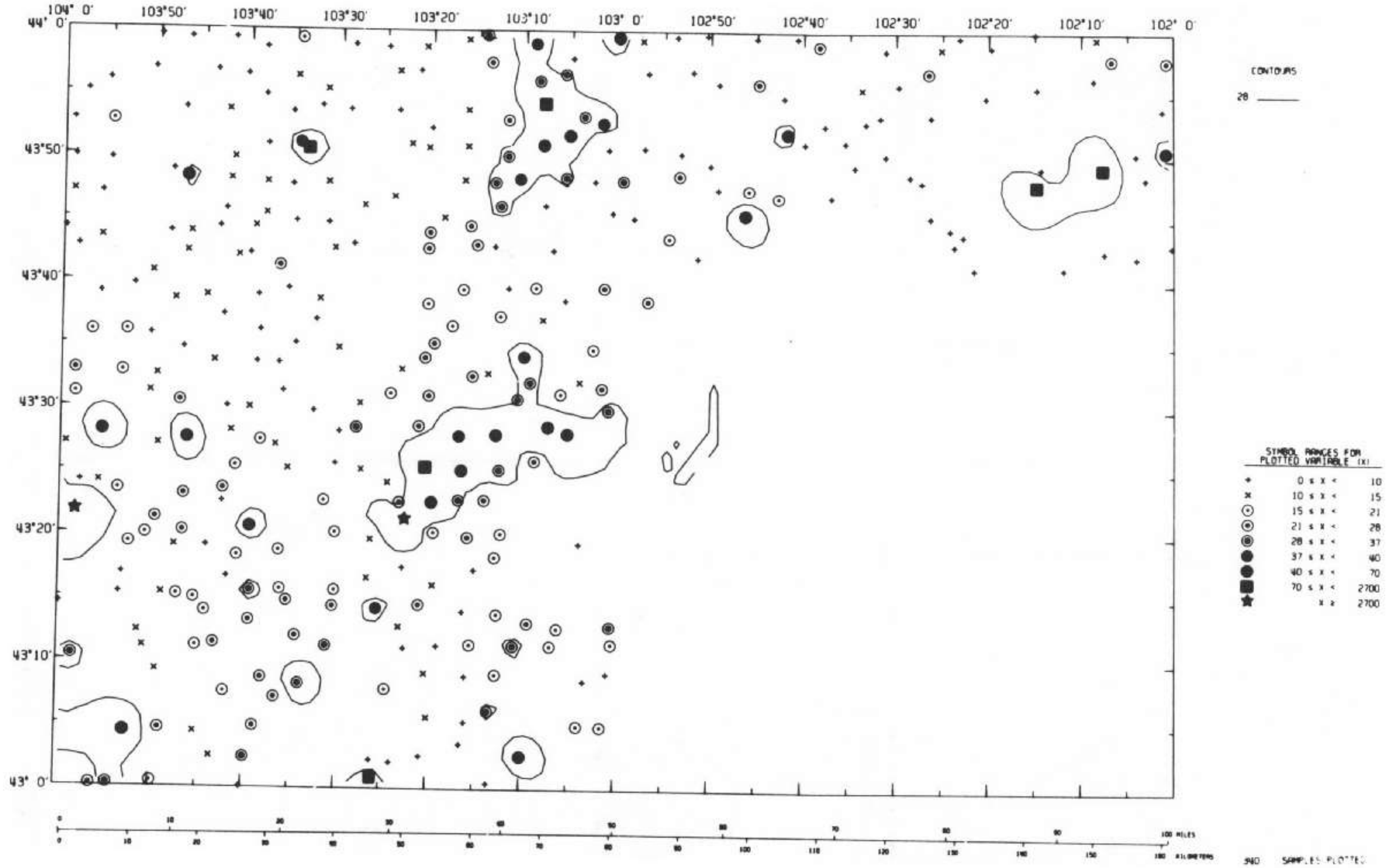
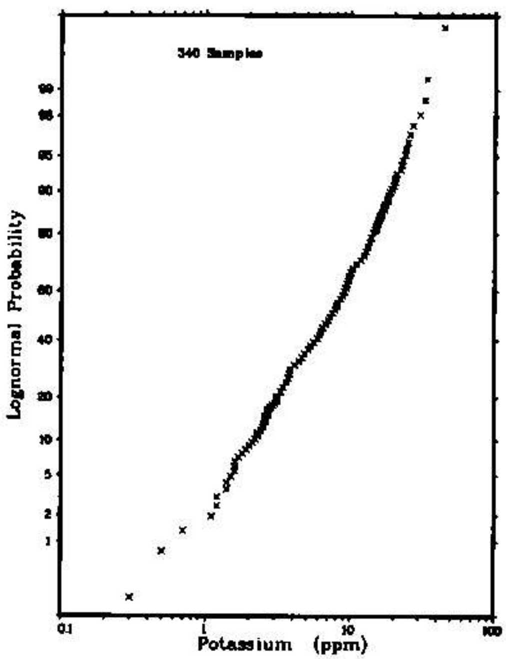
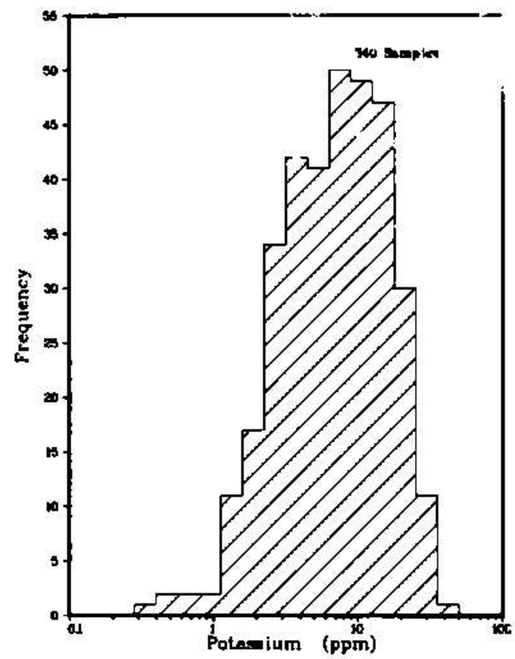


Figure A-6b

GEOCHEMICAL DISTRIBUTION OF IRON (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE





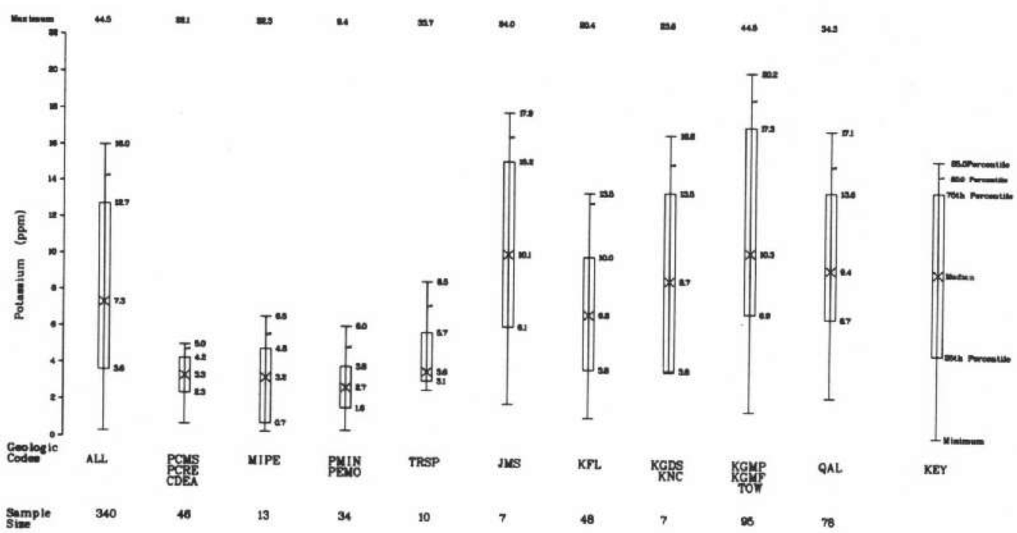


Figure A-7a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR POTASSIUM (PPM)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

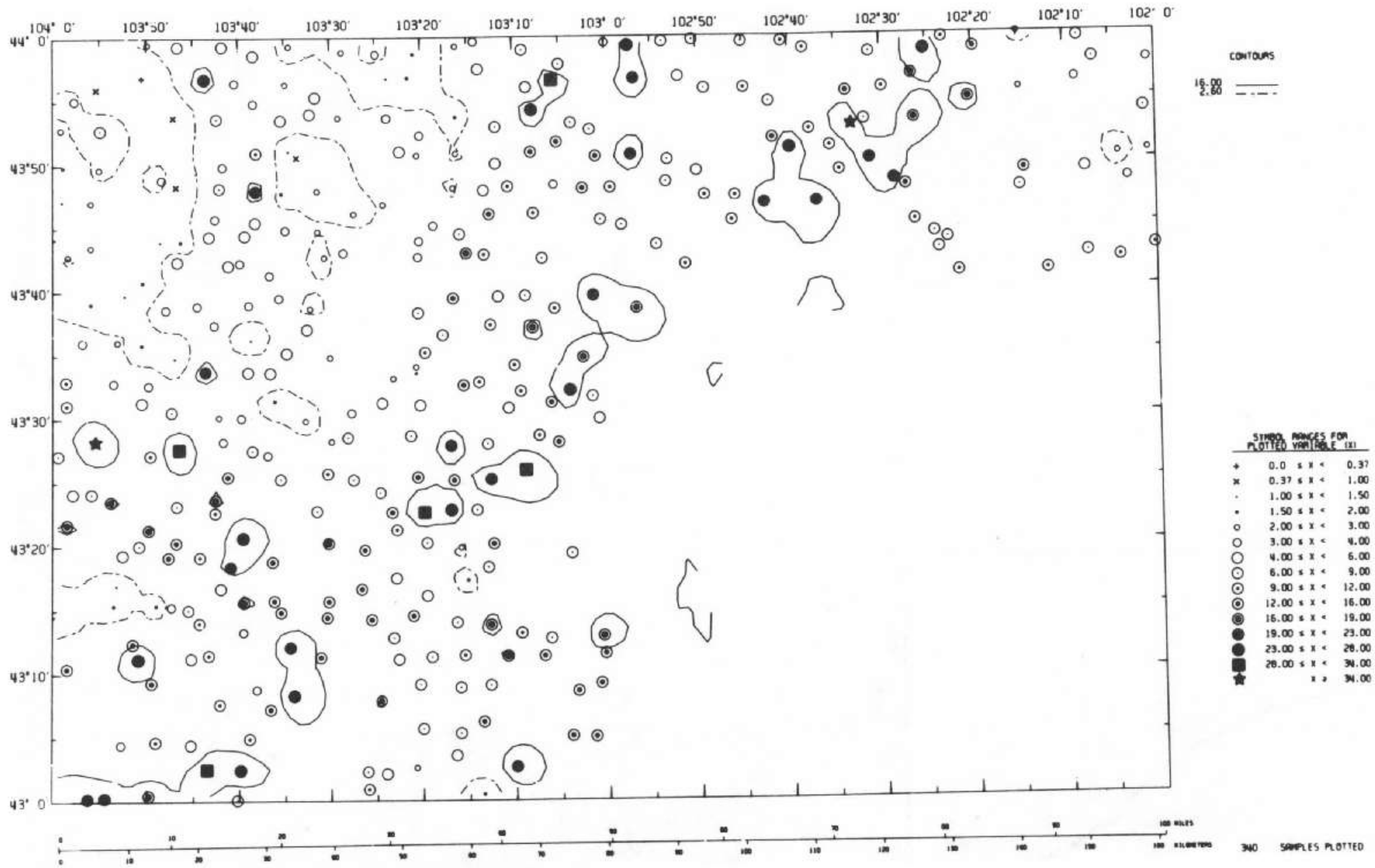


Figure A-7b

GEOCHEMICAL DISTRIBUTION OF POTASSIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

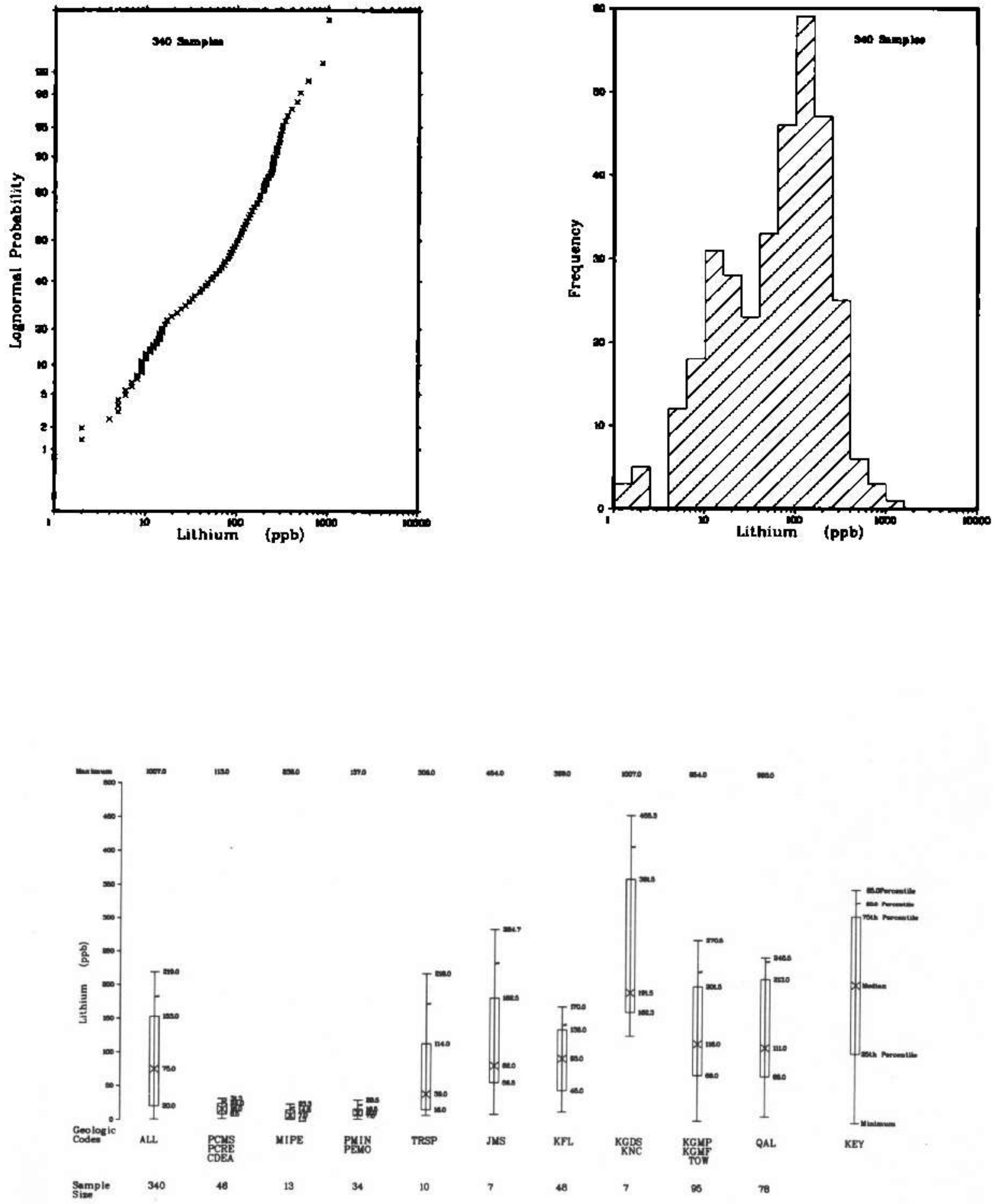


Figure A-8a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR LITHIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

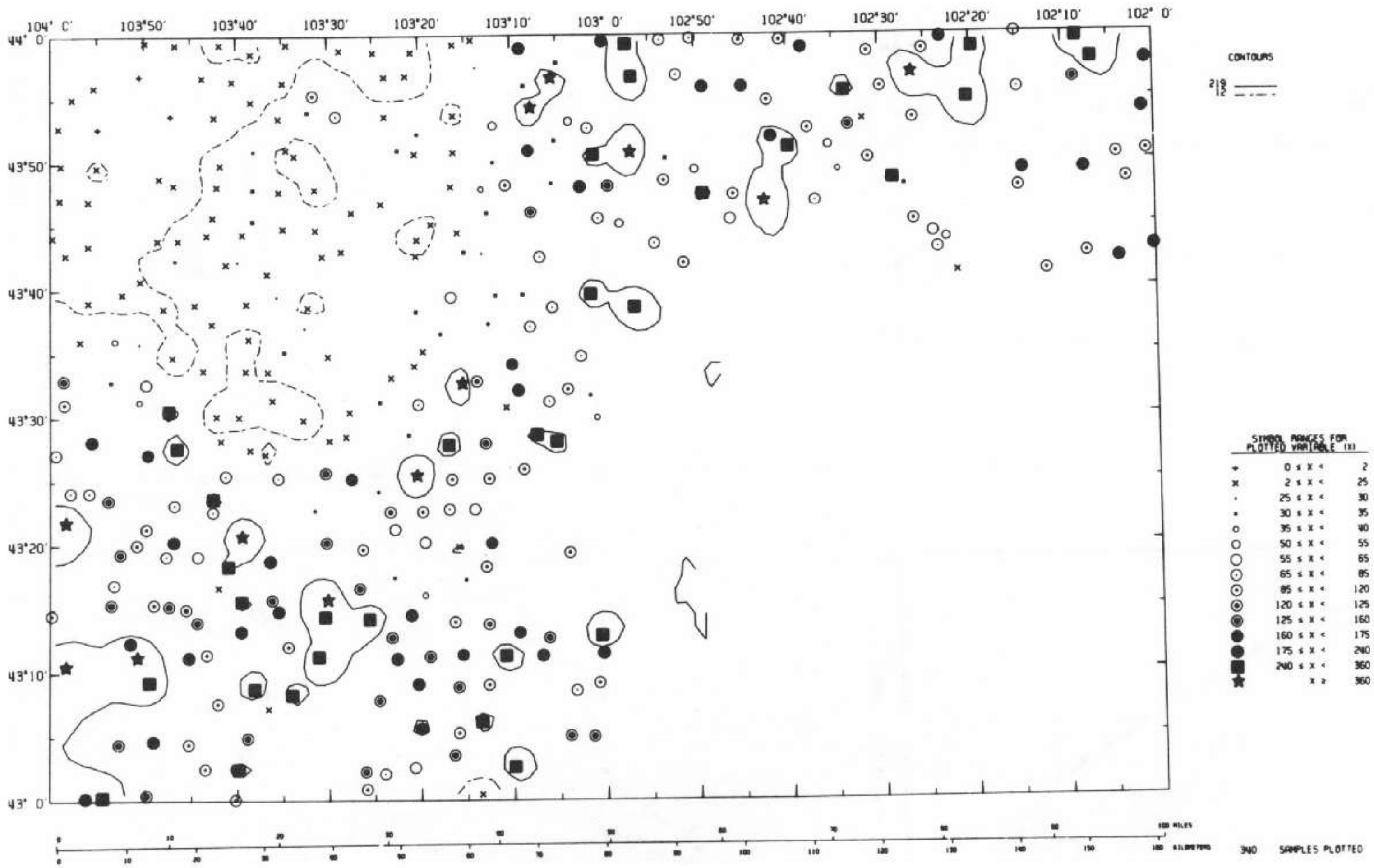


Figure A-8b

GEOCHEMICAL DISTRIBUTION OF LITHIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

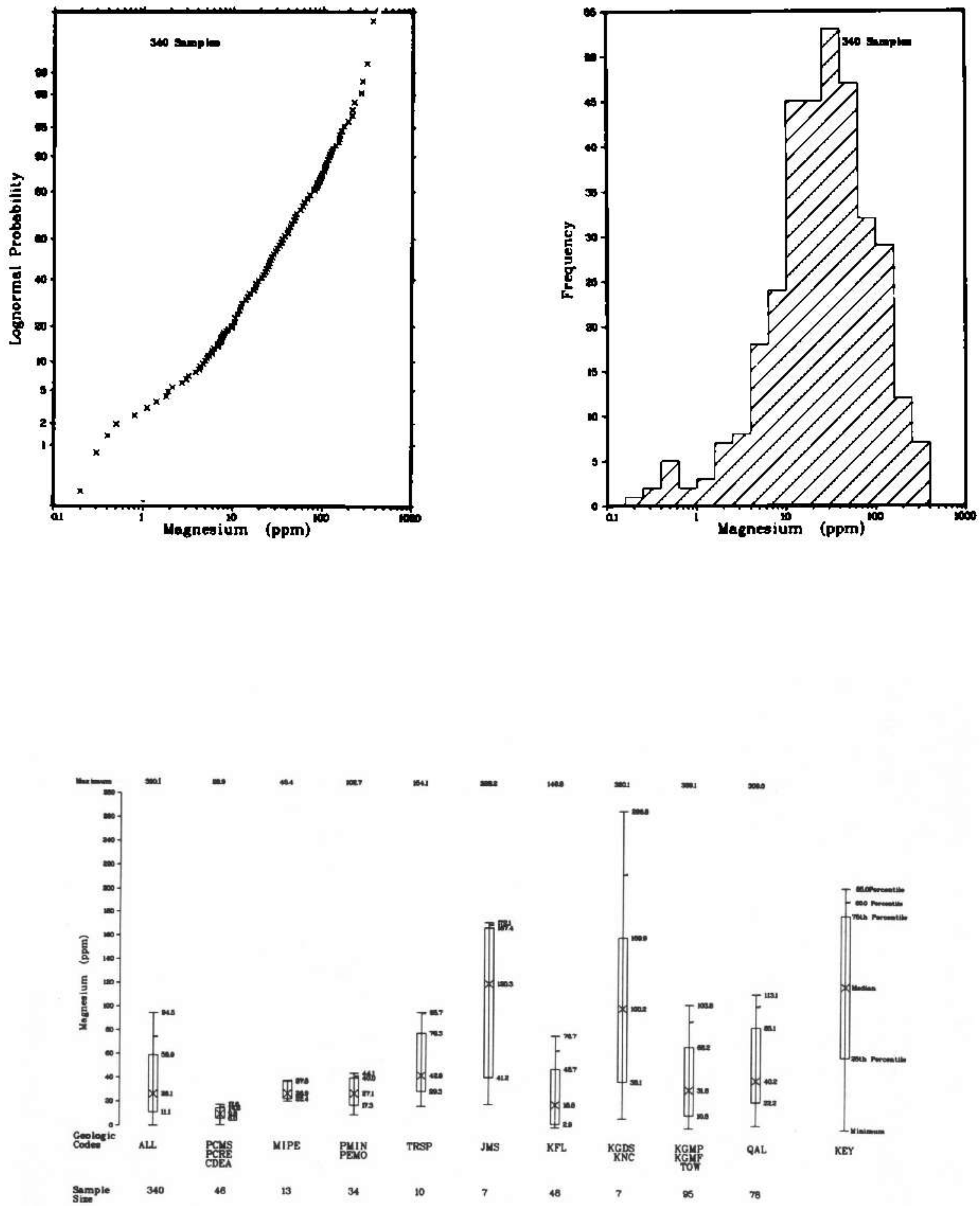


Figure A-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MAGNESIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

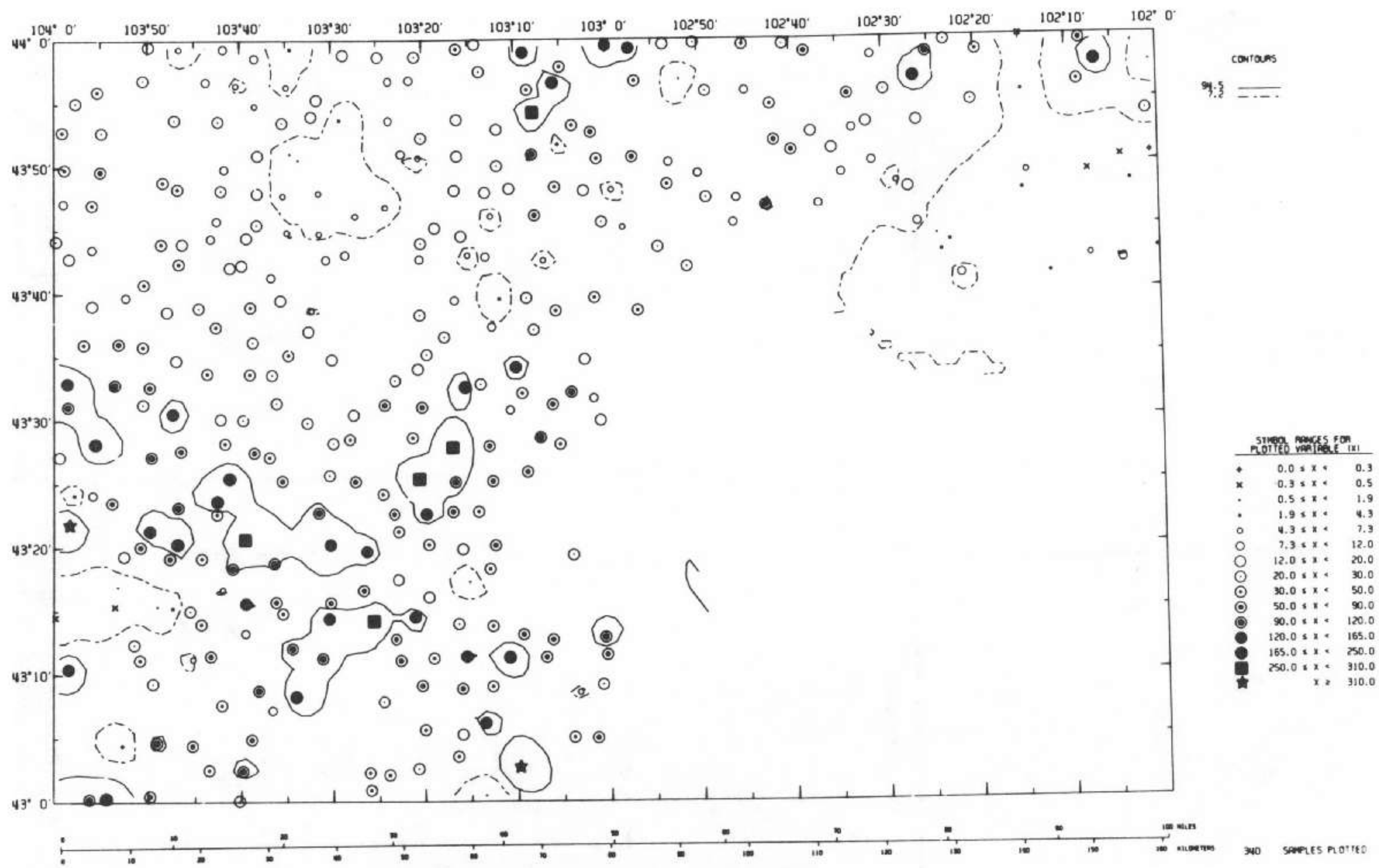


Figure A-9b

GEOCHEMICAL DISTRIBUTION OF MAGNESIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

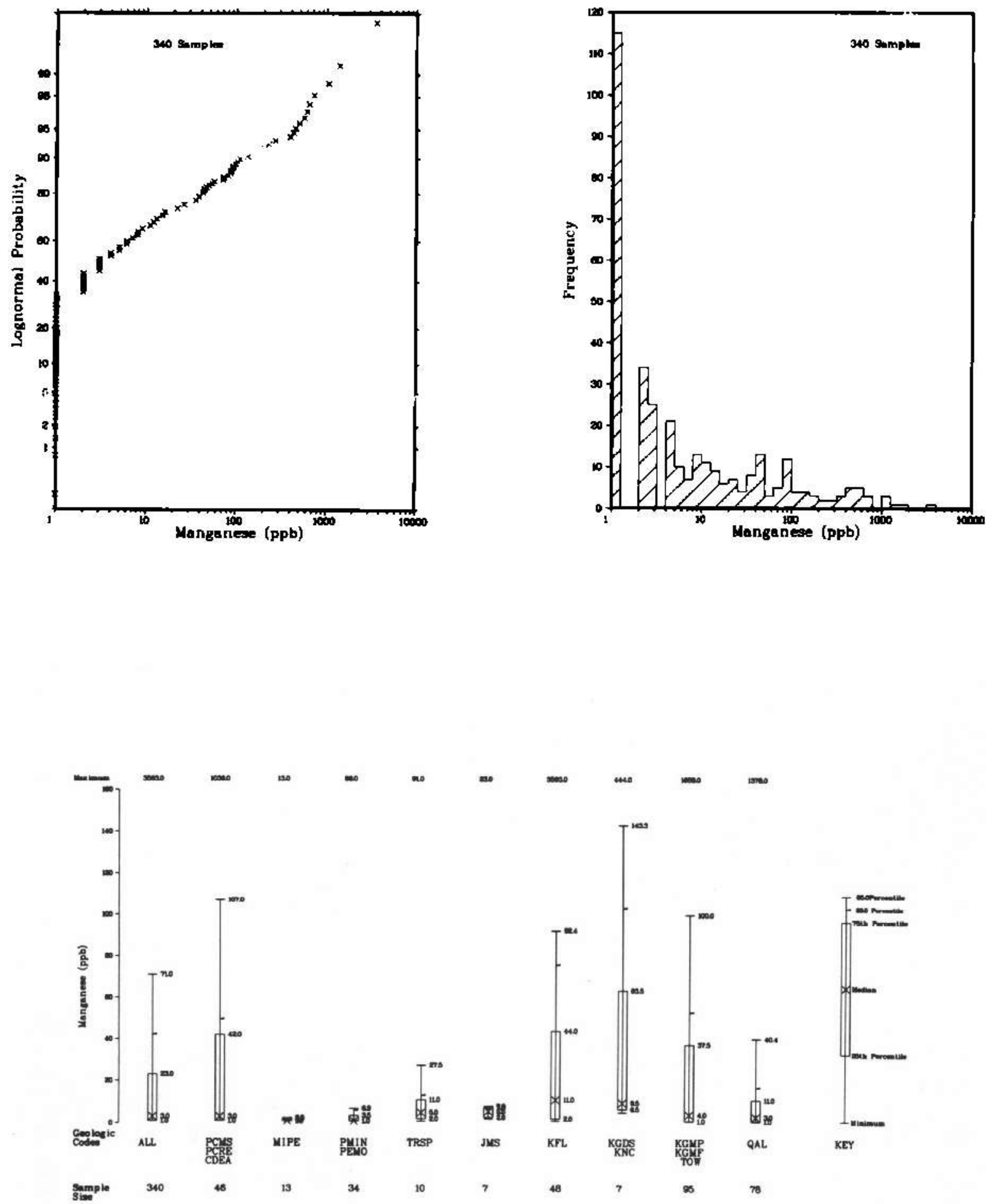


Figure A-10a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MANGANESE (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

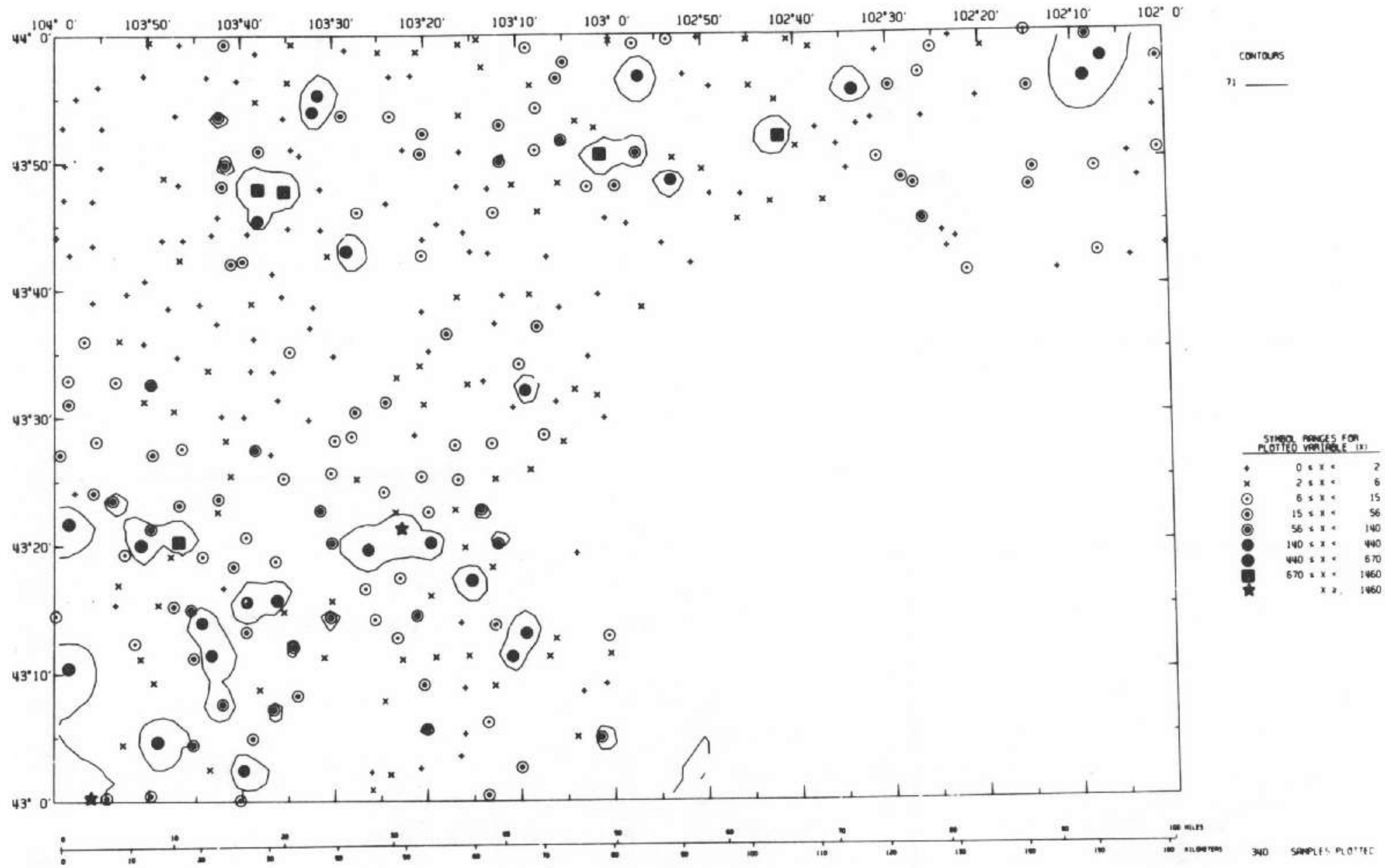


Figure A-10b

GEOCHEMICAL DISTRIBUTION OF MANGANESE (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

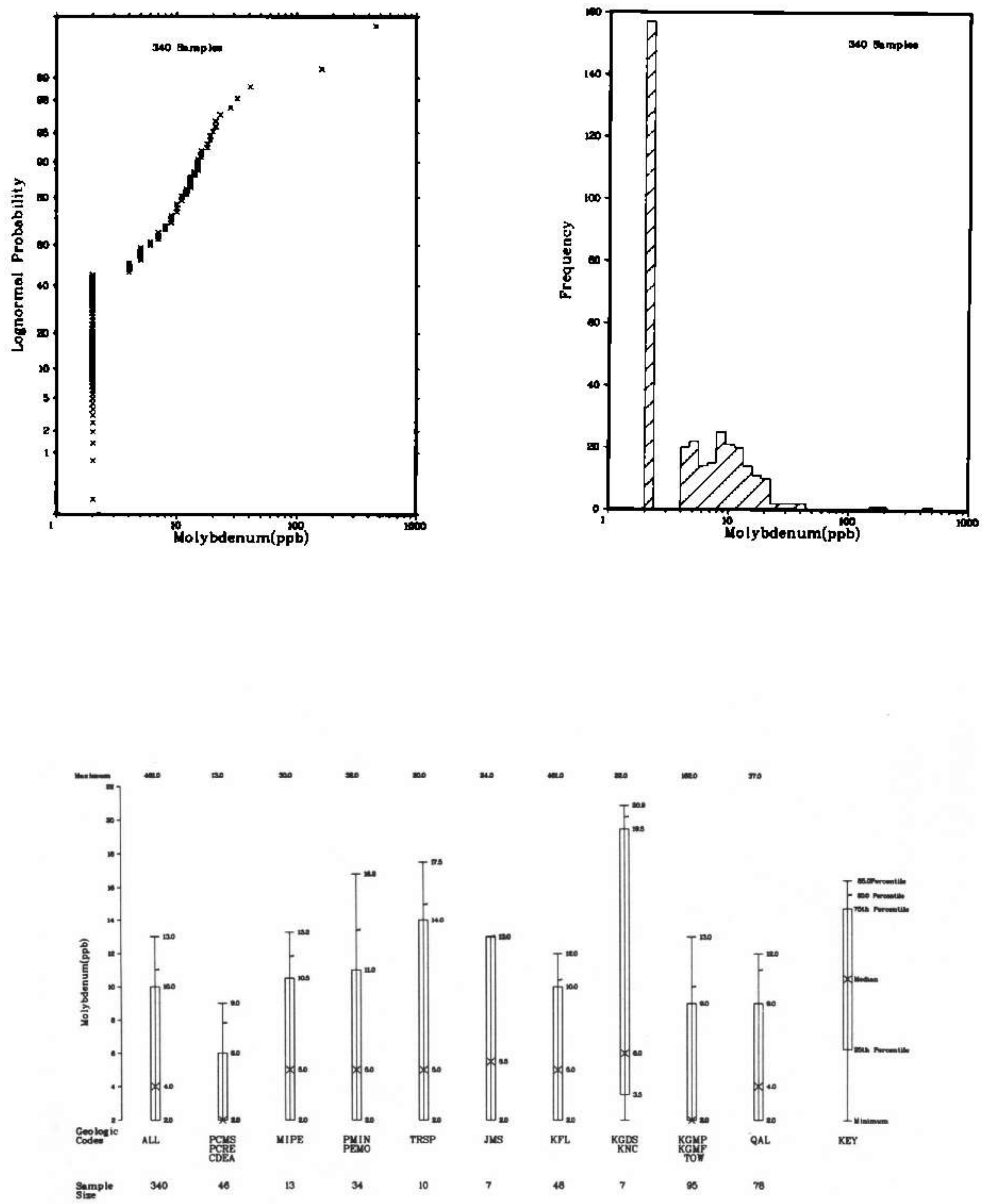


Figure A-11a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MOLYBDENUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

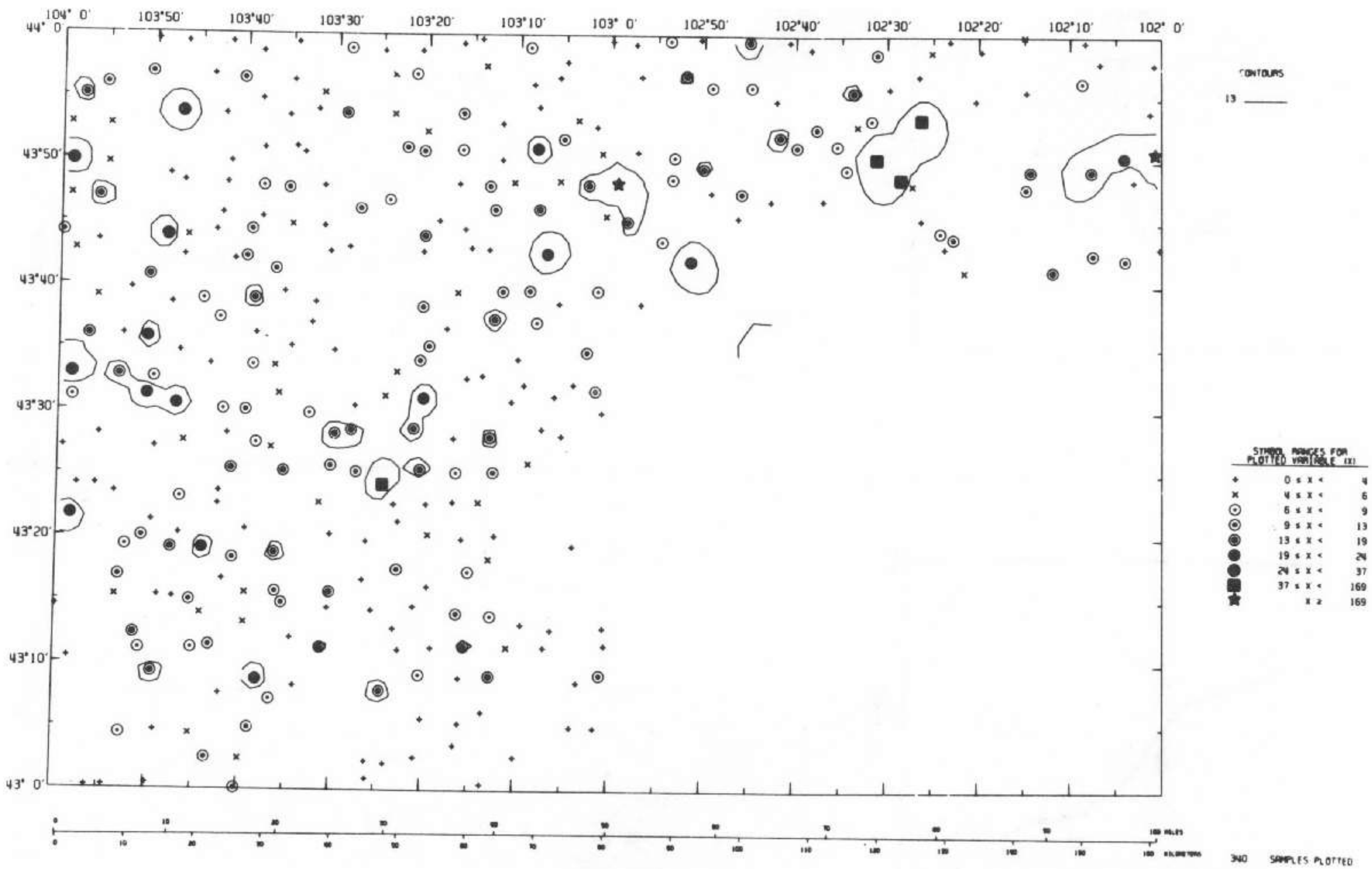


Figure A-11b

GEOCHEMICAL DISTRIBUTION OF MOLYBDENUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

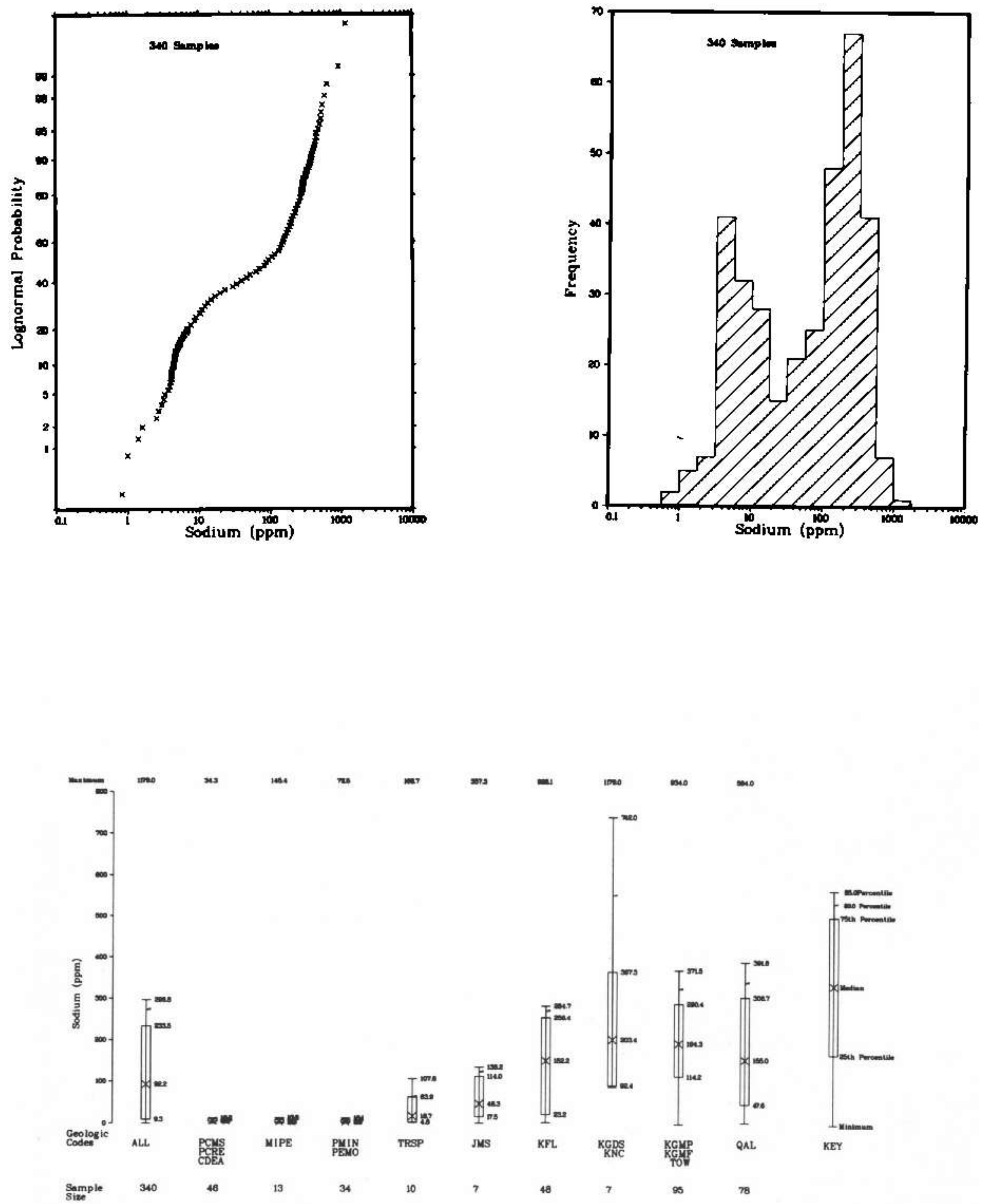


Figure A-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SODIUM (PPM)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

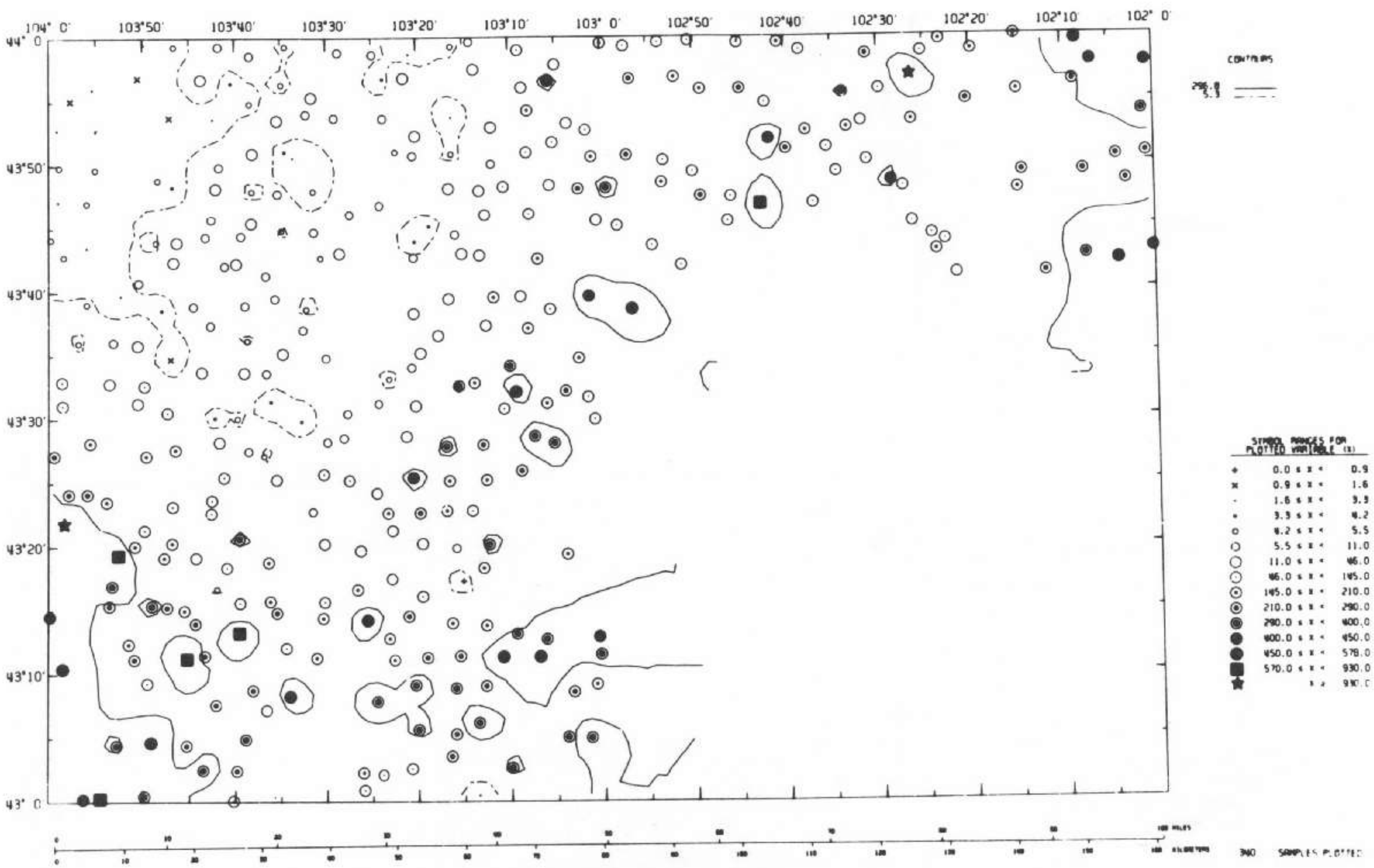


Figure A-12b

GEOCHEMICAL DISTRIBUTION OF SODIUM (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

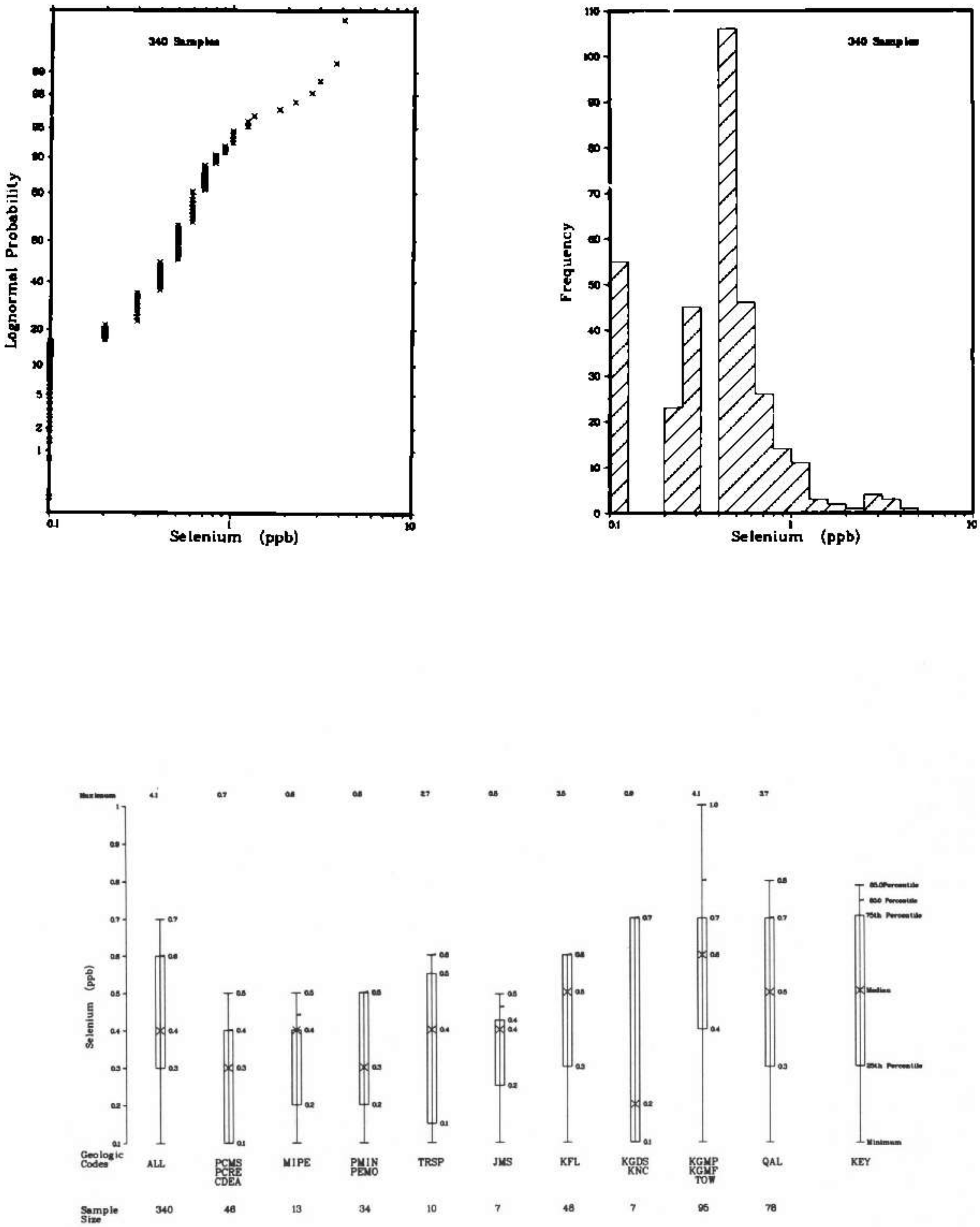


Figure A-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SELENIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

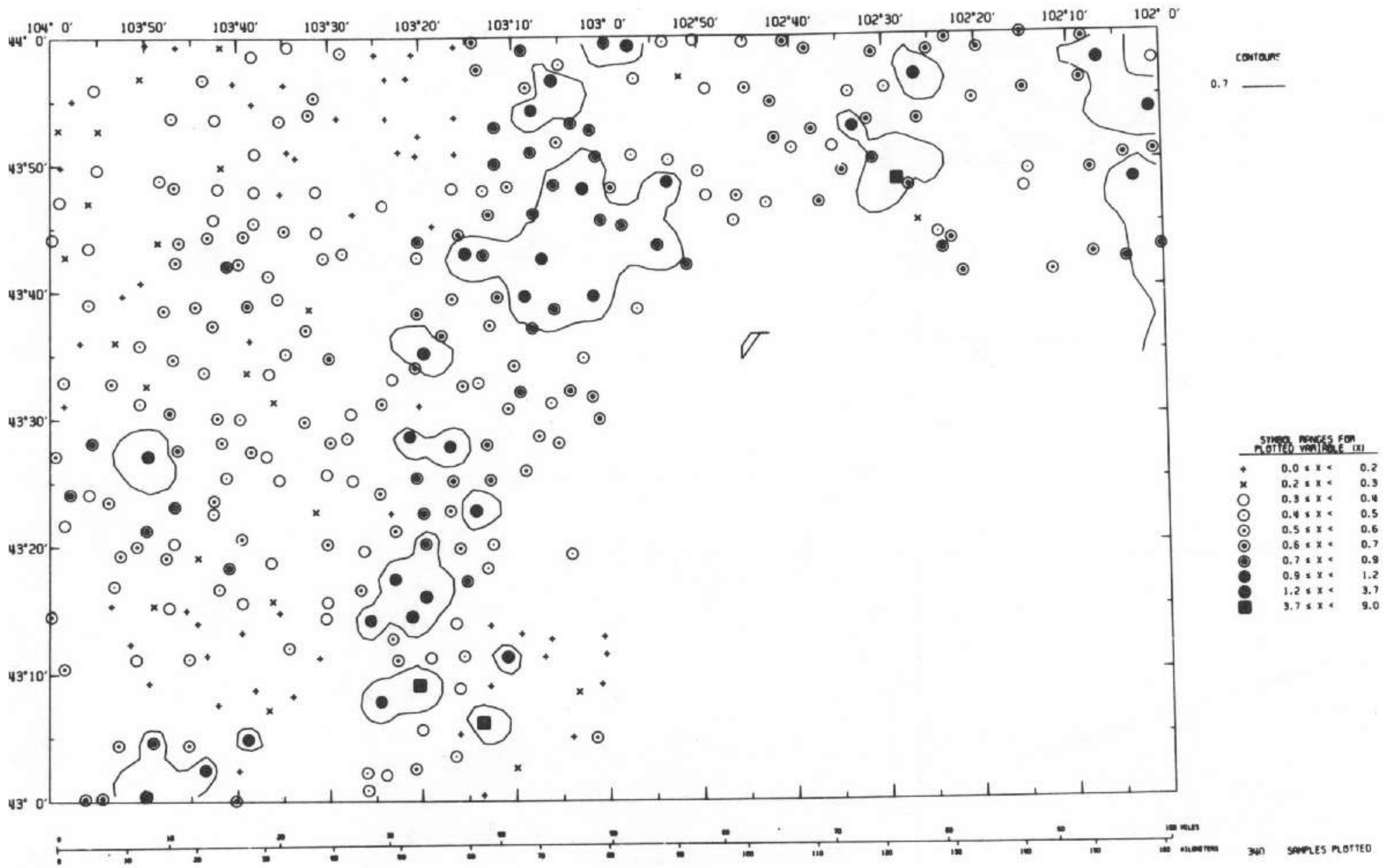


Figure A-13b

GEOCHEMICAL DISTRIBUTION OF SELENIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

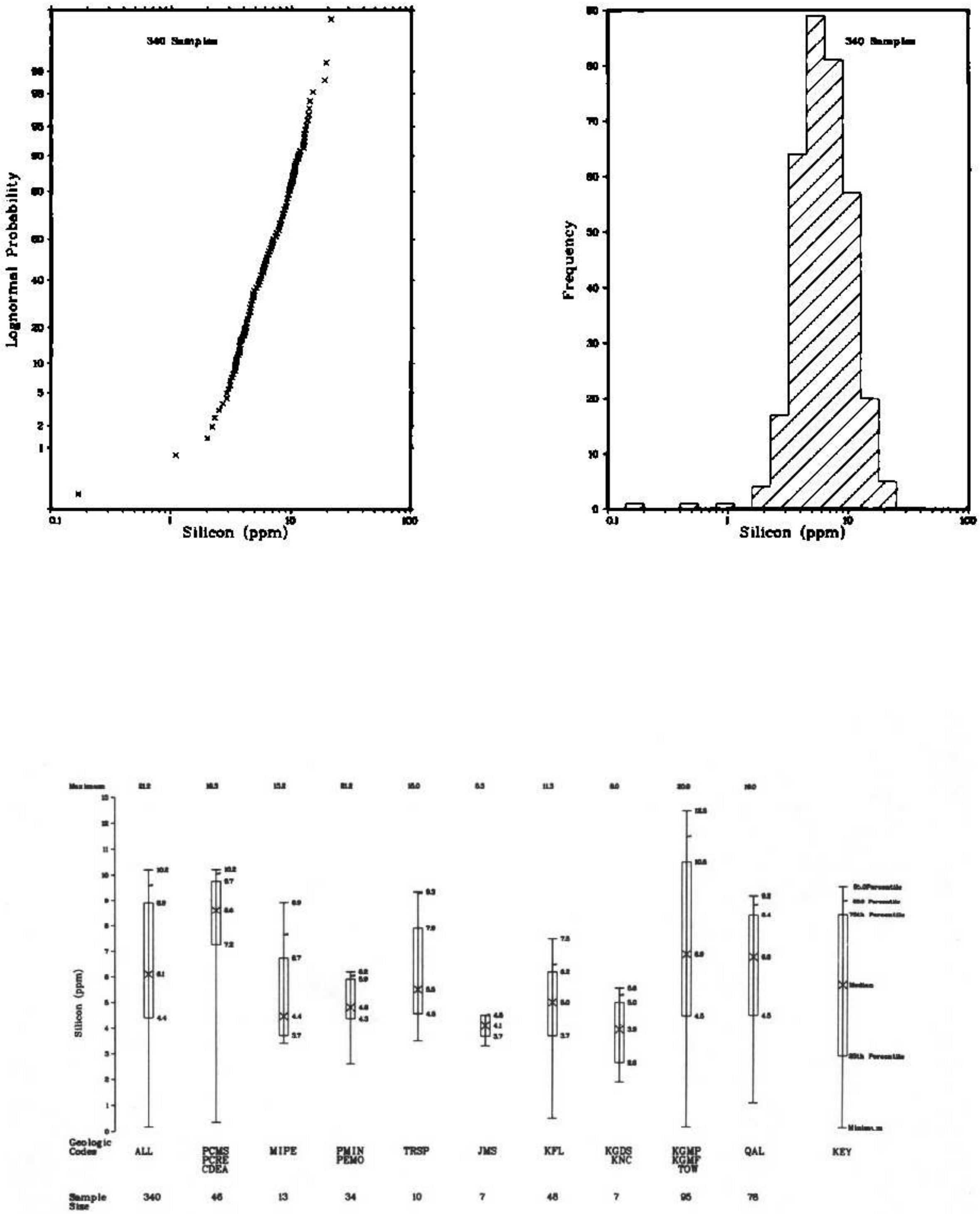


Figure A-14a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SILICON (PPM)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

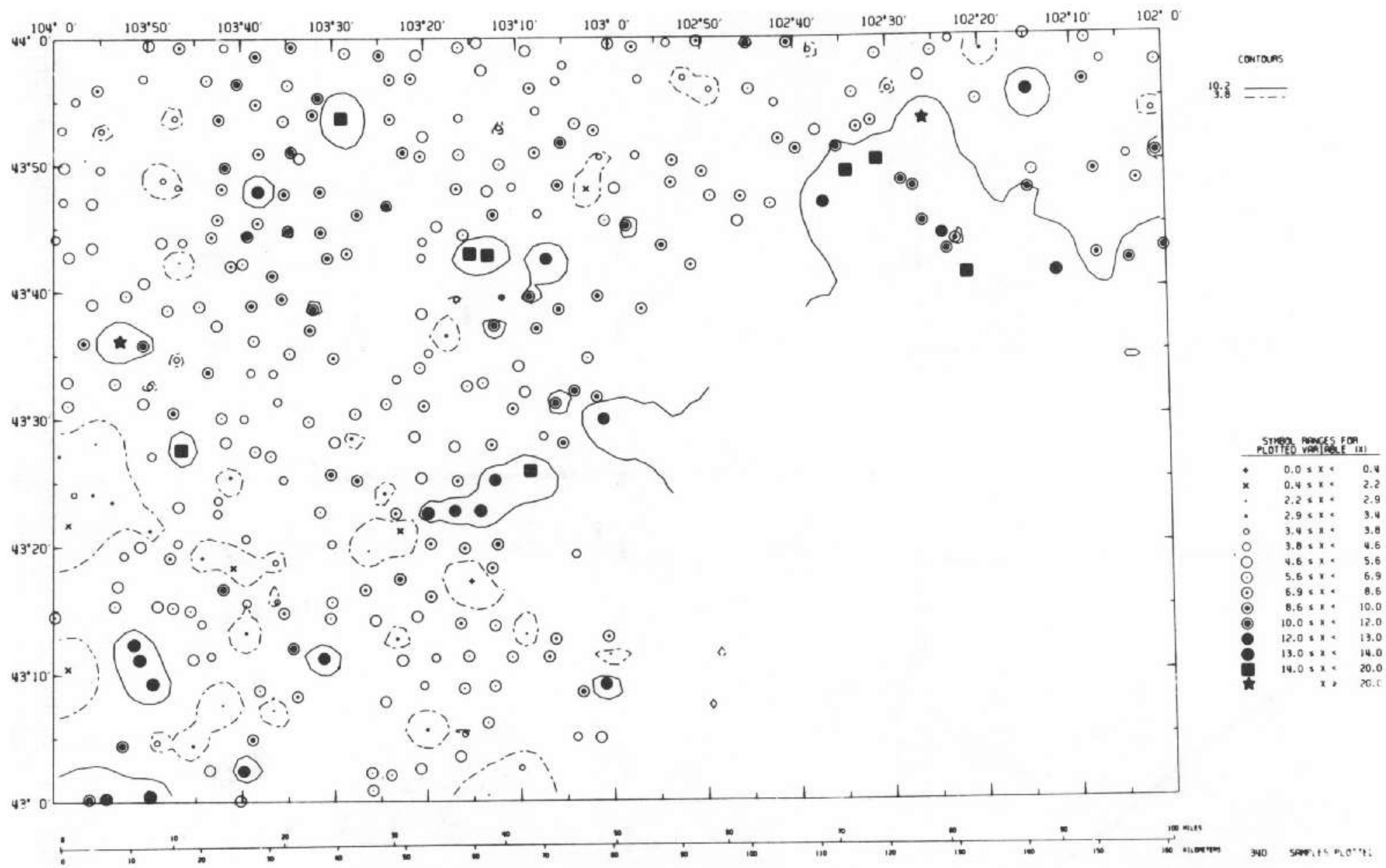
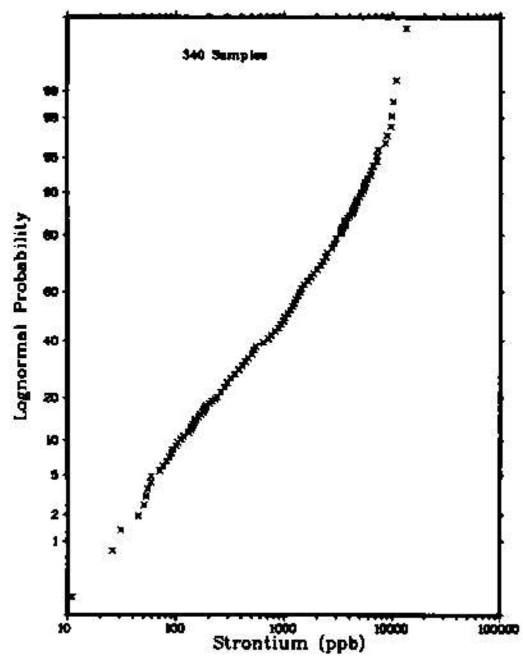
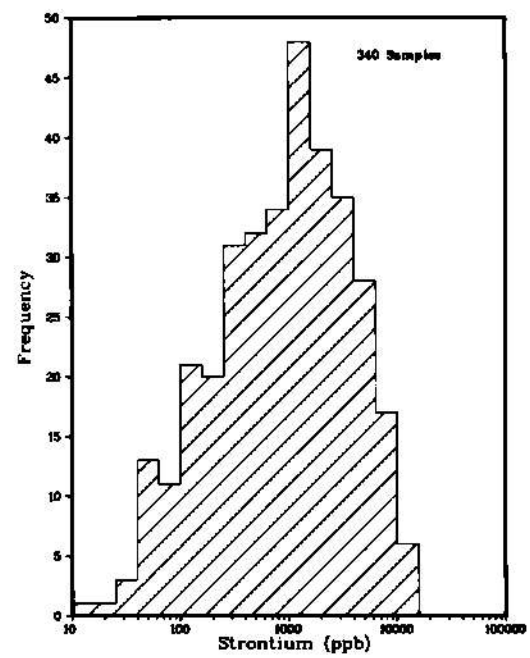


Figure A-14b

GEOCHEMICAL DISTRIBUTION OF SILICON (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE





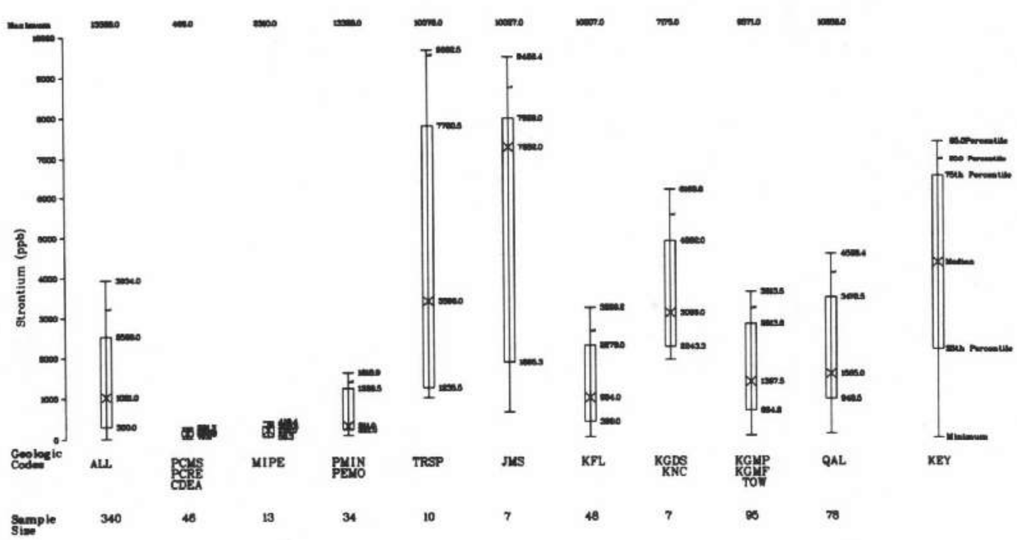


Figure A-15a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR STRONTIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

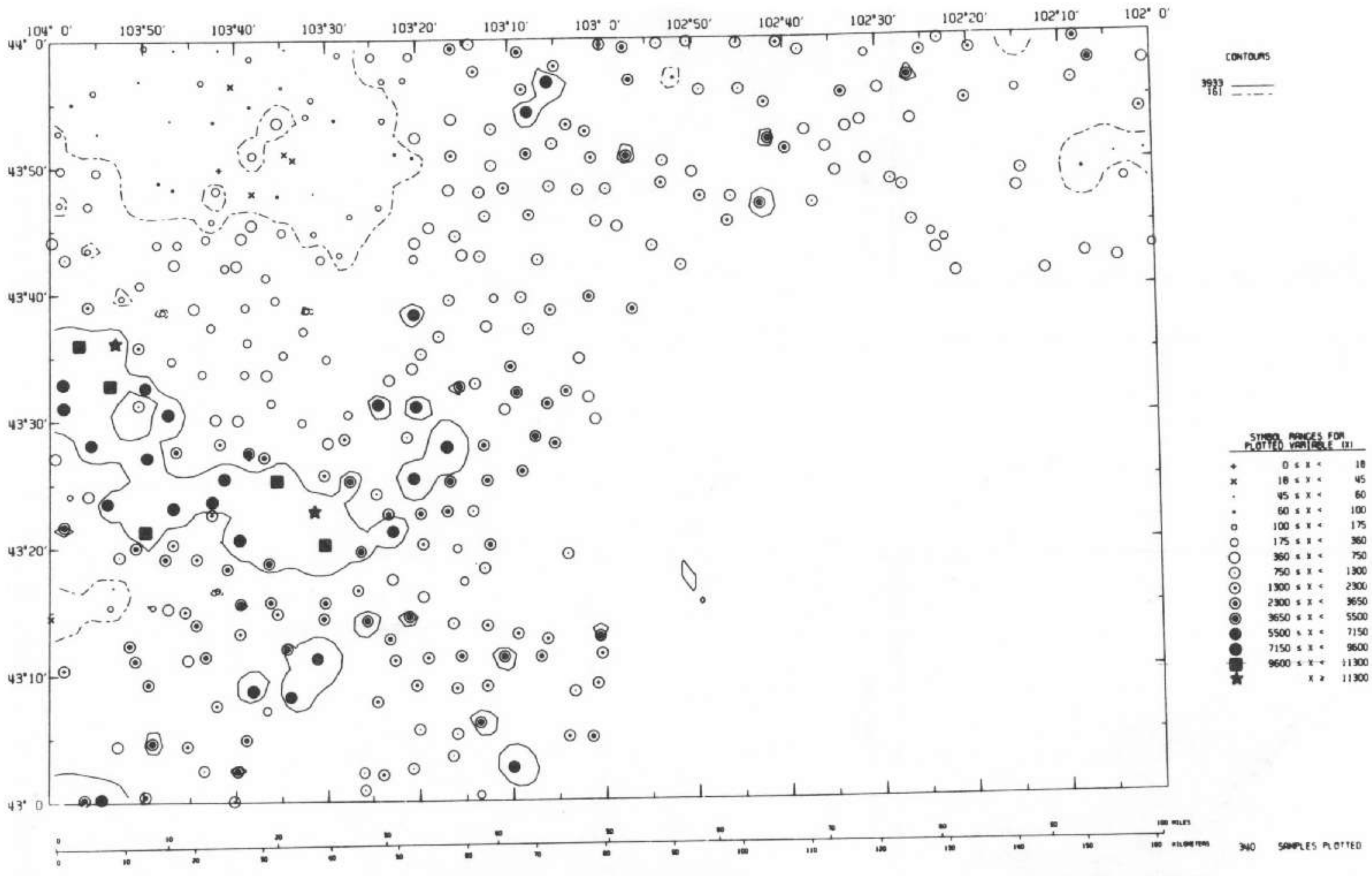


Figure A-15b

GEOCHEMICAL DISTRIBUTION OF STRONTIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

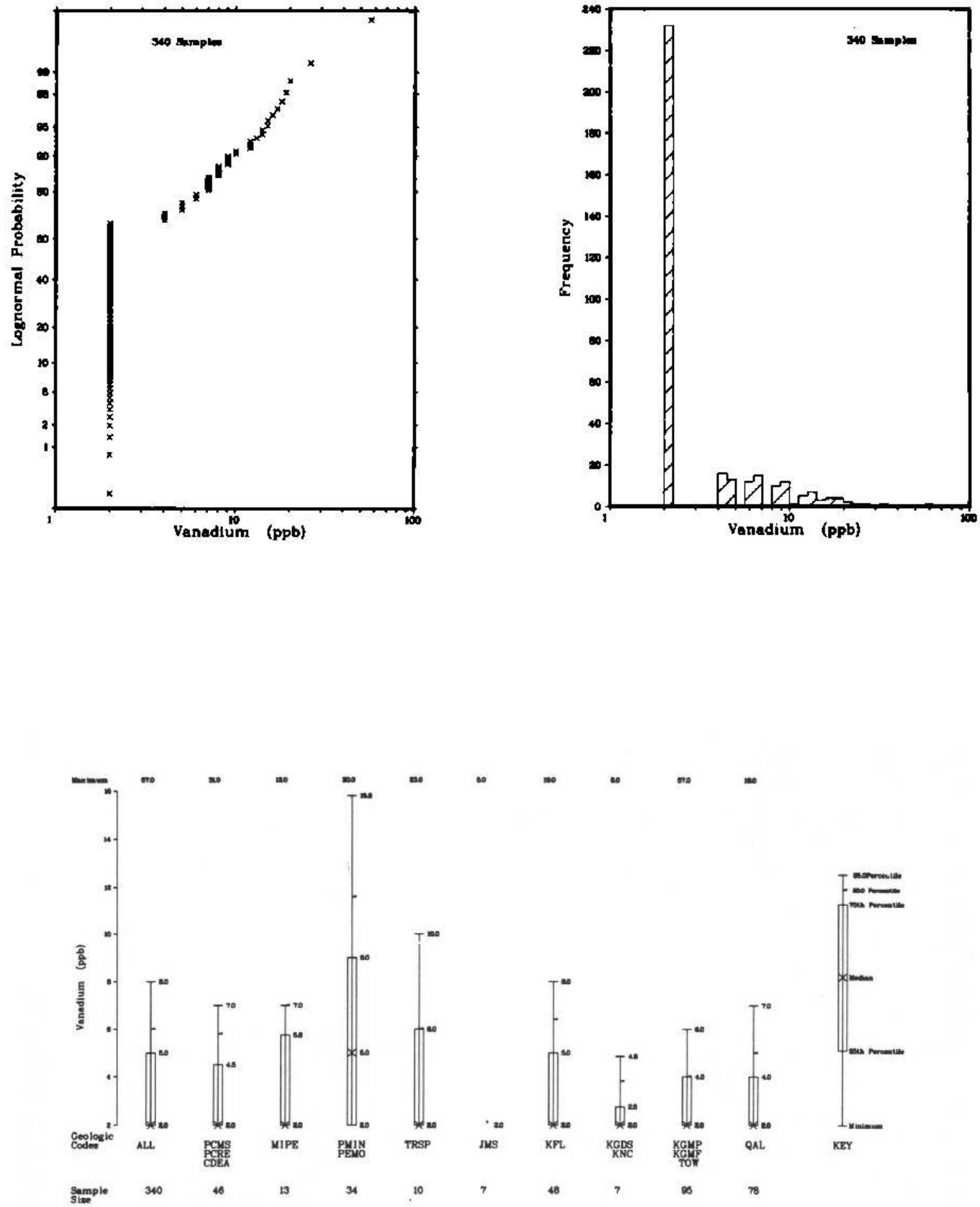


Figure A-16a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR VANADIUM (PPB)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

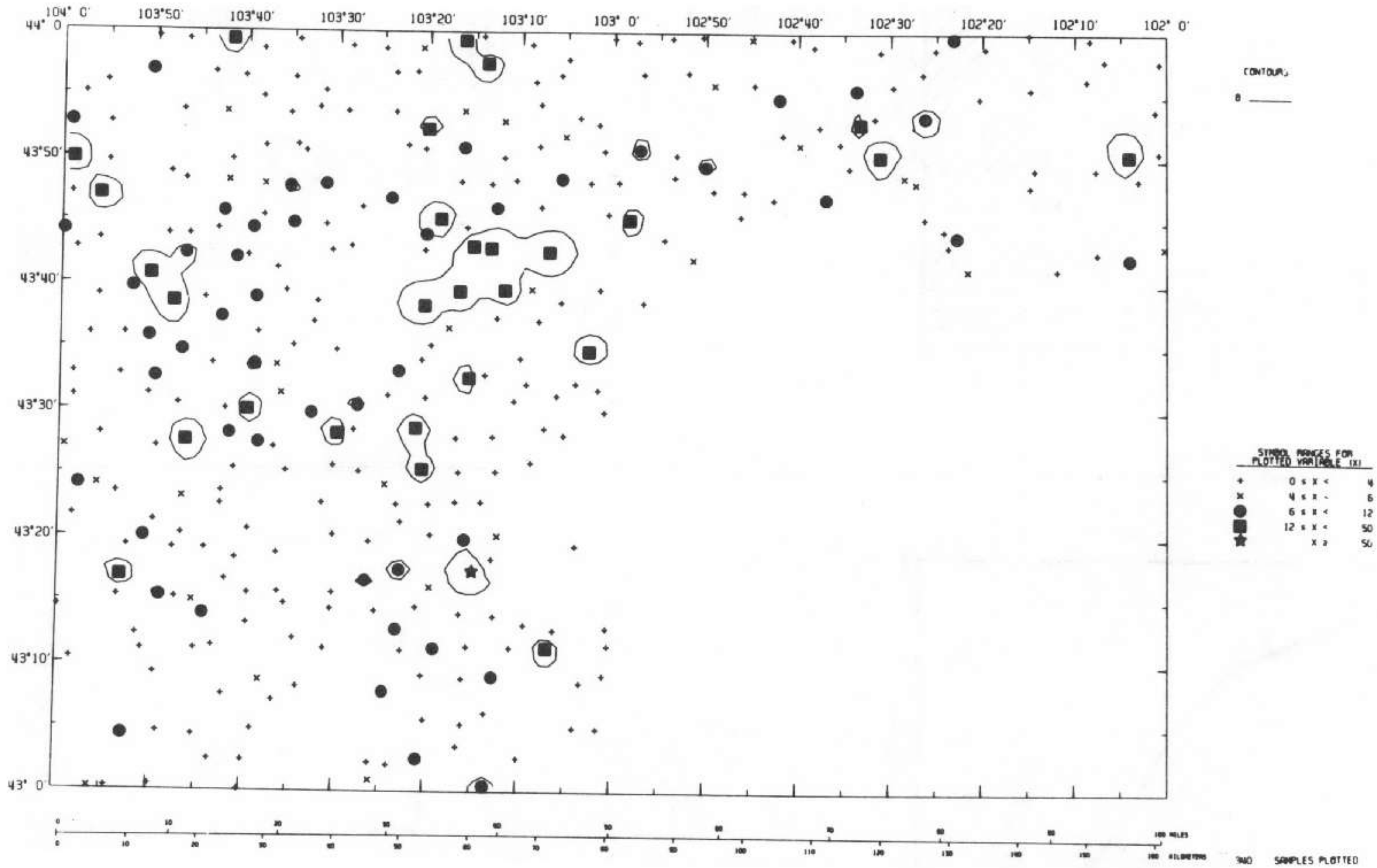


Figure A-16b

GEOCHEMICAL DISTRIBUTION OF VANADIUM (PPB) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

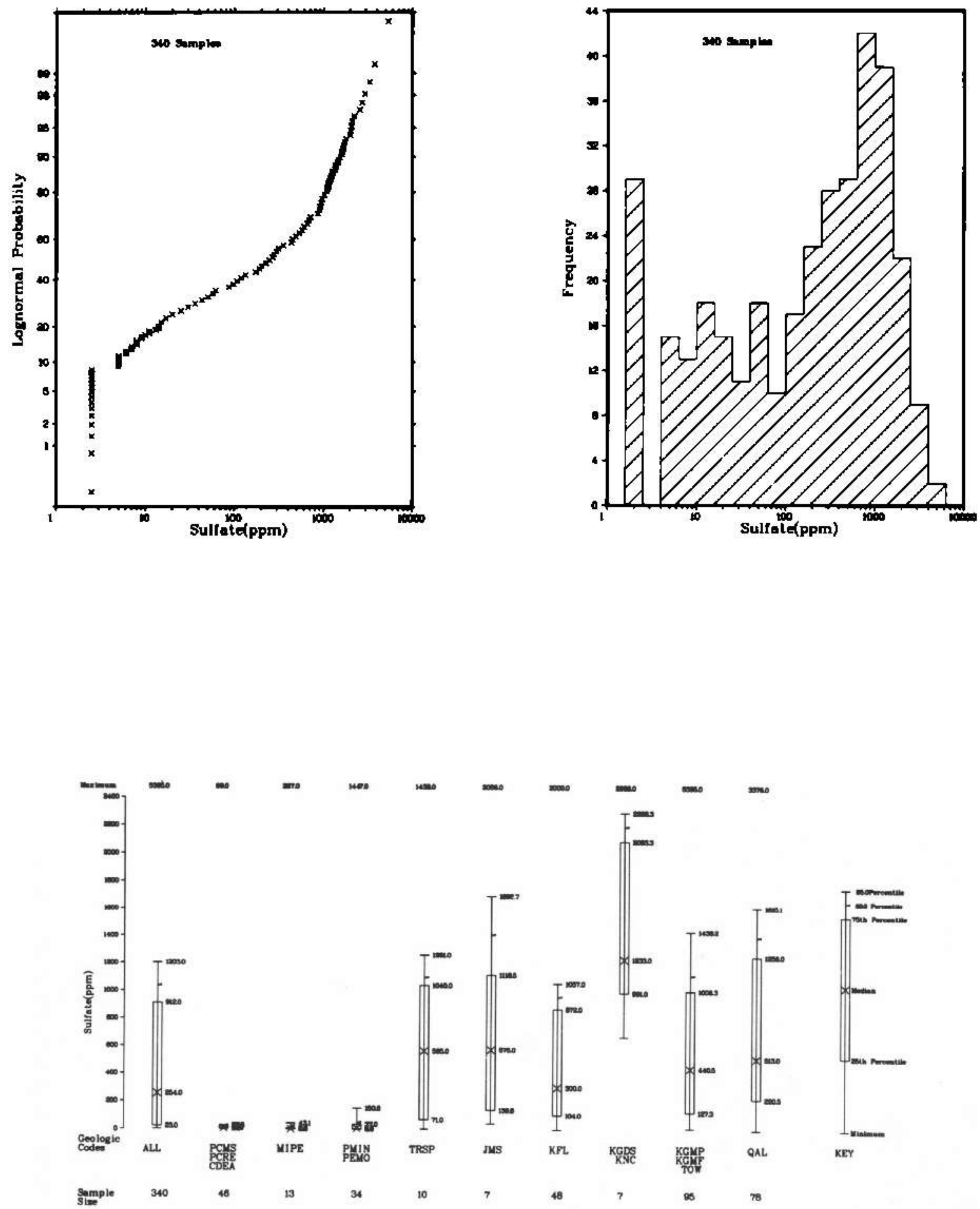


Figure A-17a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SULFATE (PPM)
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

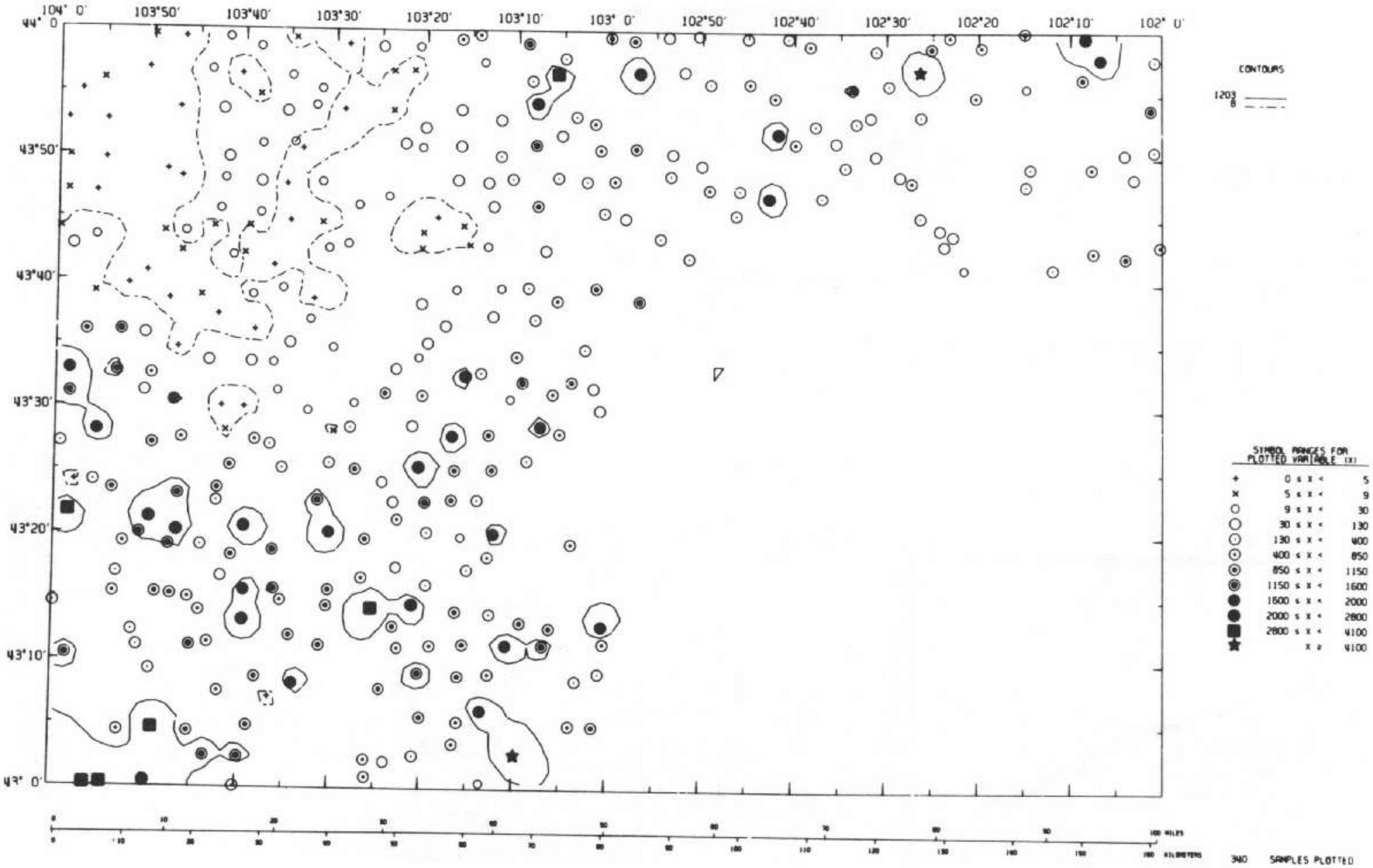


Figure A-17b

GEOCHEMICAL DISTRIBUTION OF SULFATE (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

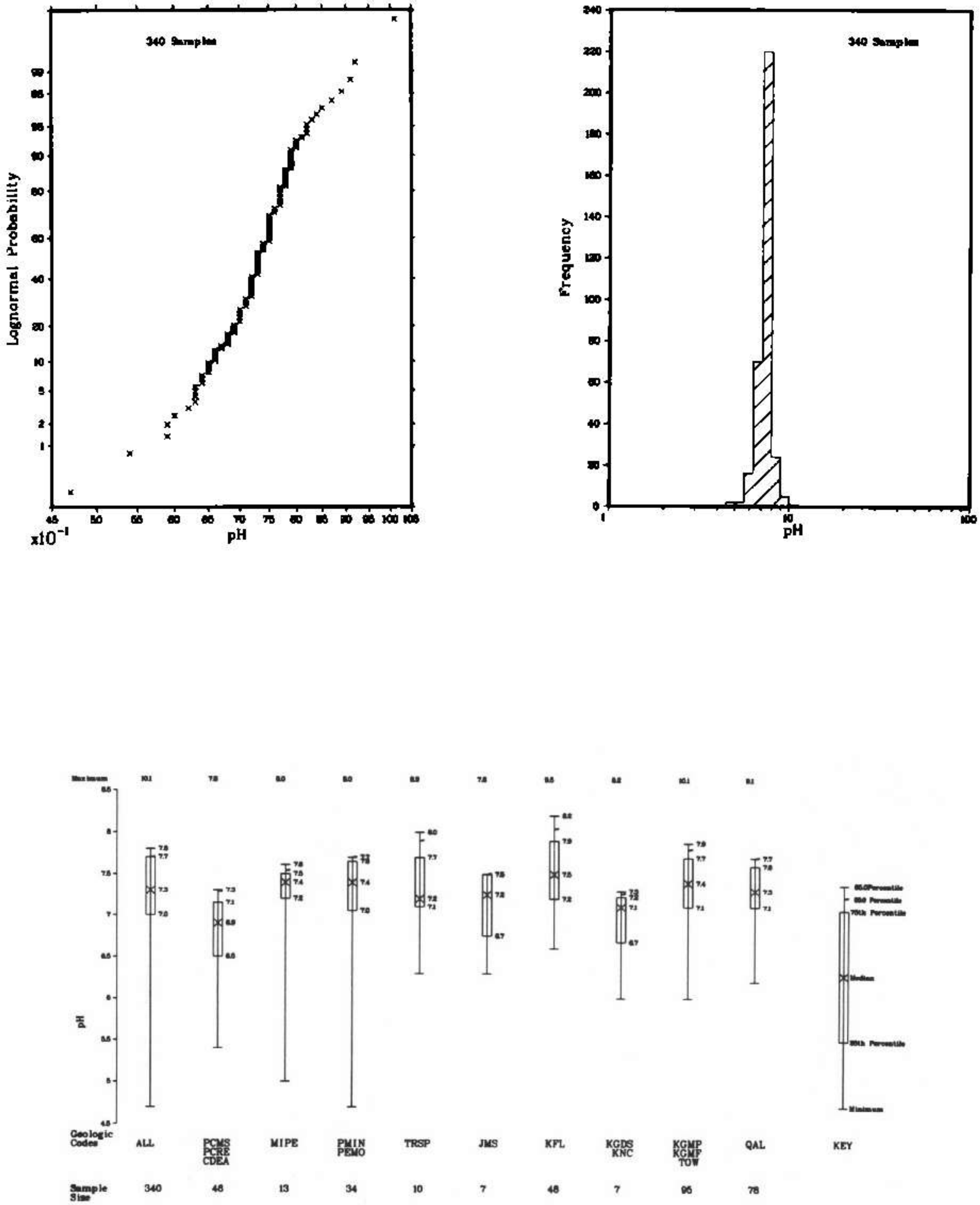


Figure A-18a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR pH
IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

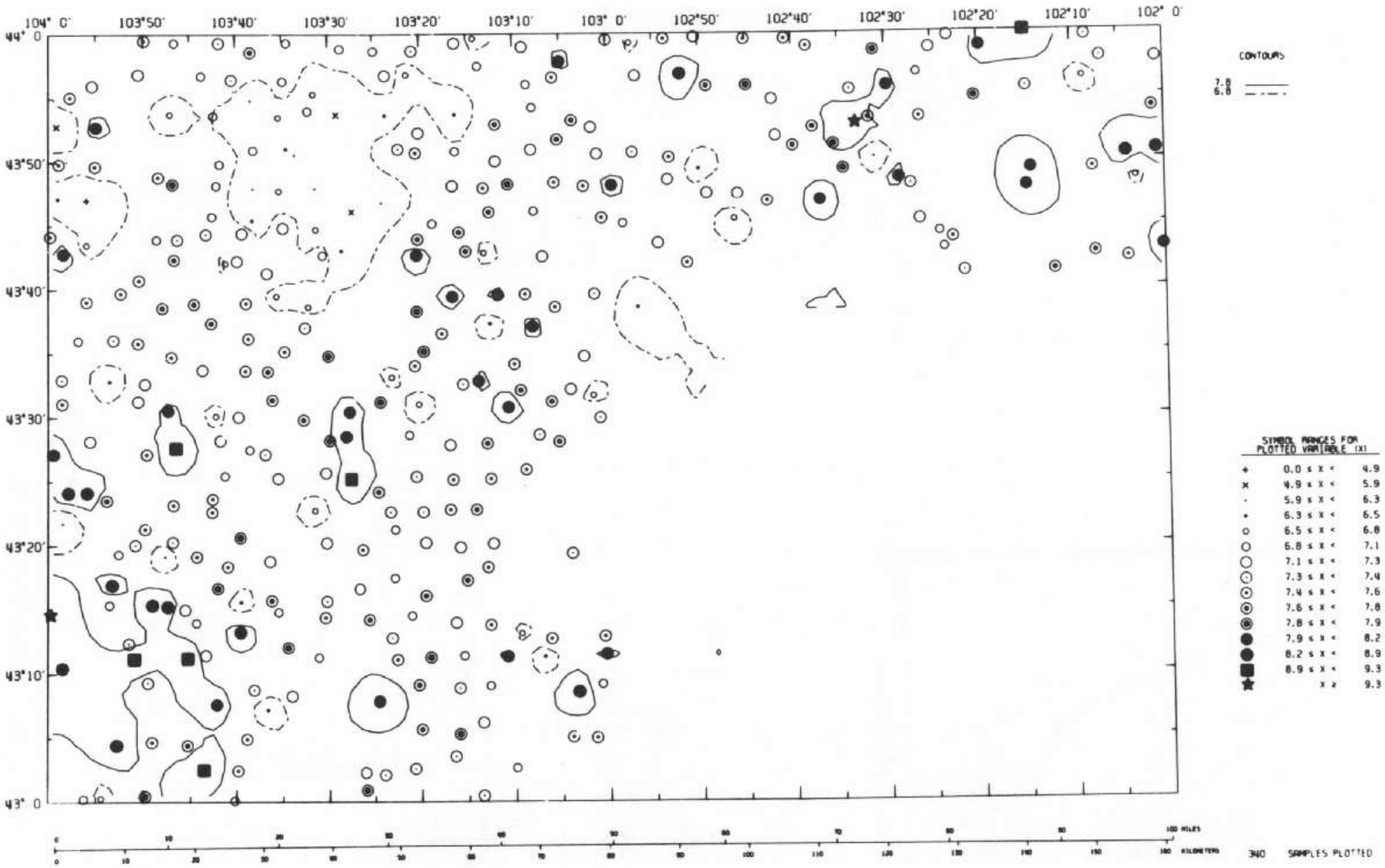


Figure A-18b

GEOCHEMICAL DISTRIBUTION OF pH IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

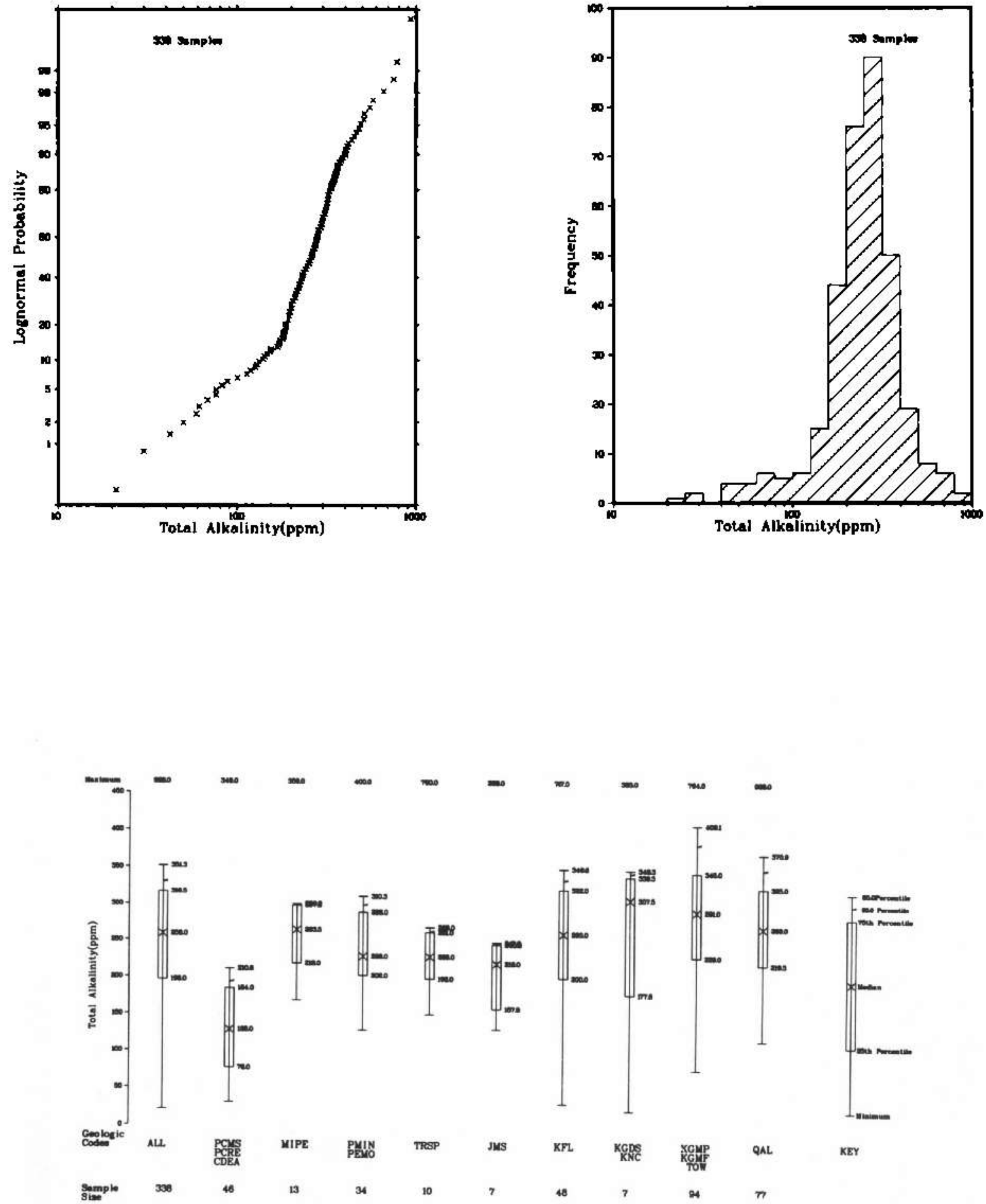


Figure A-19a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR TOTAL ALKALINITY (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

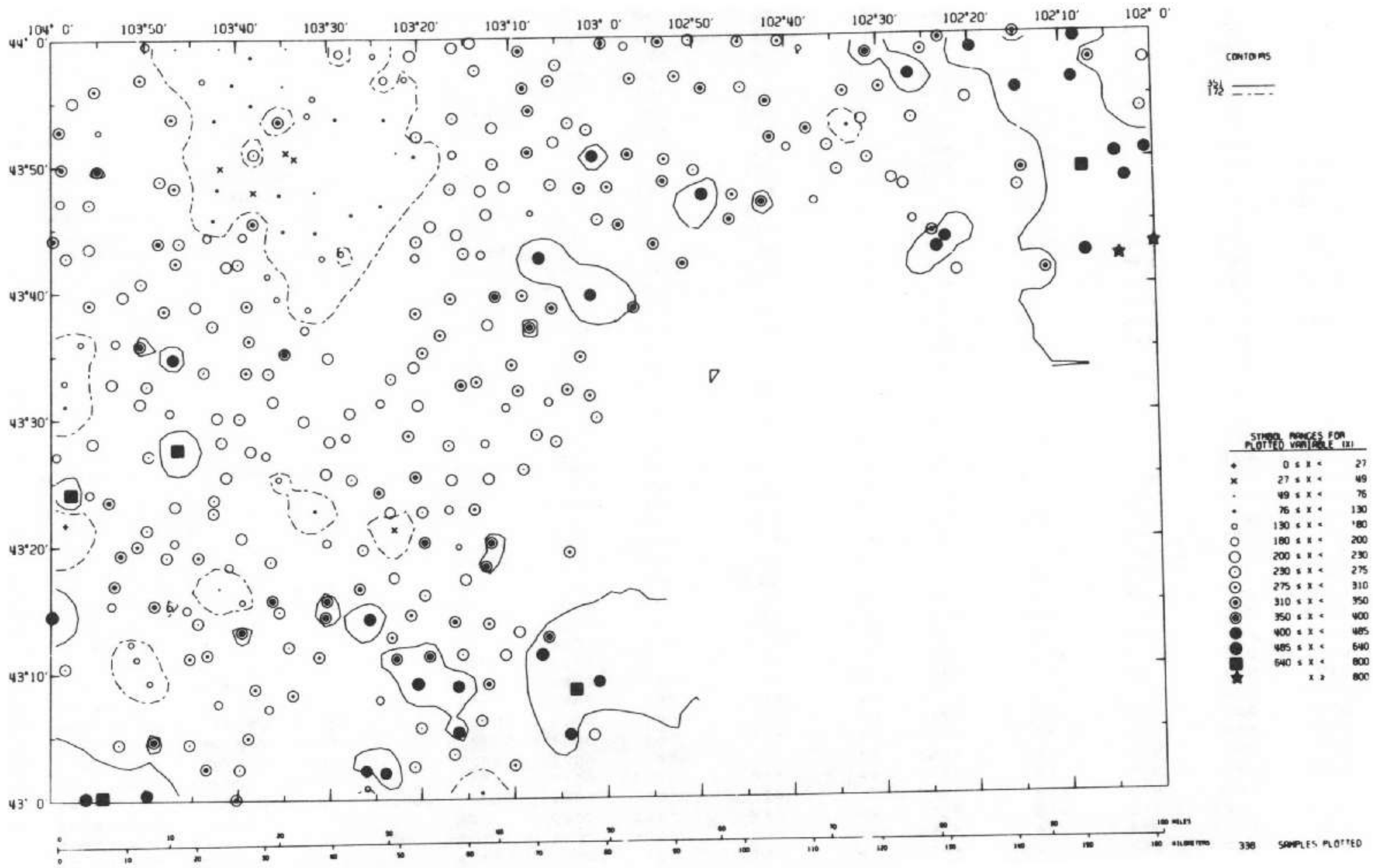


Figure A-19b

GEOCHEMICAL DISTRIBUTION OF TOTAL ALKALINITY (PPM) IN GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

Table A-3

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

DR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
401287	46-43.808	-102.052	-3-03-	32.	2100	38.	120	<4	260.	3.2	1.0	50	330	470
401288	46-43.840	-102.069	-3-03-	180.	1200	4.0	89	19	220.	2.0	0.6	91	55	490
401289	46-43.844	-102.015	-3-03-	1.3	1400	3.3	110	460	260.	2.9	0.6	220	53	420
401290	46-43.963	-102.014	-3-03-	<0.20	3300	12.	190	<4	410.	3.8	0.3	270	450	230
401291	46-43.965	-102.113	-3-03-	20.	6800	380.	290	<4	440.	8.2	1.8	1600	3800	310
401292	46-43.993	-102.140	-3-03-	92.	6100	280.	270	<4	500.	6.4	0.6	2700	2800	510
401293	46-44.000	-102.250	-3-03-	0.32	1300	2.0	60	5	230.	2.3	0.6	920	51	340
401294	46-43.981	-102.329	-3-03-	9.7	2400	130.	270	<4	200.	14.	0.6	440	1700	480
401296	46-43.821	-102.129	-3-03-	<0.20	1800	2.9	180	16	290.	4.1	0.6	680	87	690
401297	46-43.821	-102.240	-3-03-	0.55	1600	19.	180	13	240.	13.	0.4	200	1200	310
401298	46-43.798	-102.248	-3-03-	0.83	1100	13.	100	10	170.	6.8	0.3	200	500	260
401299	46-43.710	-102.126	-3-03-	56.	2400	33.	120	11	320.	8.5	0.6	450	520	630
401900	46-43.837	-102.520	-3-03-	190.	1400	48.	120	160	140.	20.	0.7	130	610	260
401901	46-43.822	-102.575	-3-03-	6.1	770	39.	39	7	65.	9.7	0.6	220	430	250
401902	46-43.854	-102.592	-3-03-	17.	1000	41.	54	8	110.	9.7	0.3	50	510	250
401903	46-43.852	-102.665	-3-03-	47.	2900	210.	310	10	270.	24.	0.4	530	2500	190
401904	46-43.781	-102.617	-3-03-	15.	1000	54.	71	<4	110.	19.	0.6	240	1200	200
401905	46-43.739	-102.404	-3-01-	23.	840	38.	56	6	110.	6.7	0.4	96	260	330
401906	46-43.755	-102.439	-3-03-	0.50	770	33.	92	<4	73.	9.4	0.2	220	970	190
401907	46-43.802	-102.455	-3-03-	16.	1800	200.	44	4	94.	13.	0.6	440	930	210
401908	46-43.810	-102.476	-3-03-	34.	3600	49.	250	41	430.	20.	3.8	110	870	220
401923	46-43.718	-102.396	-3-03-	37.	1300	24.	69	<4	200.	8.9	0.7	120	370	570
401926	46-43.780	-102.712	-3-03-	51.	7500	280.	820	<4	580.	19.	0.4	2100	5300	360
401929	46-43.931	-102.819	-3-01-	51.	1800	88.	180	7	170.	7.5	0.3	230	1200	320
401933	46-43.992	-102.751	-3-03-	15.	1700	96.	97	18	130.	6.0	0.3	120	1000	280
401934	46-43.947	-102.866	-3-03-	27.	960	4.0	80	14	160.	4.5	0.2	87	92	300
401935	46-43.993	-102.895	-3-03-	11.	1100	83.	69	7	77.	7.0	0.4	110	840	330
401940	46-43.823	-102.834	-3-01-	6.4	1000	71.	54	15	83.	5.5	0.4	58	730	250
401941	46-43.791	-102.820	-3-03-	30.	2500	40.	240	<4	280.	9.4	0.3	720	1900	500
401944	46-43.838	-102.887	-3-03-	10.	800	54.	48	7	57.	6.0	0.4	97	930	280
401947	46-43.845	-102.953	-3-03-	0.41	2800	150.	570	<4	240.	22.	0.4	1000	4600	310
401955	46-43.995	-102.840	-3-03-	16.	1200	50.	81	<4	110.	7.1	0.3	110	880	230
401957	46-43.988	-102.957	-3-03-	0.78	2900	280.	310	<4	69.	23.	1.2	880	3600	190
401960	46-43.945	-102.947	-3-03-	1.7	3300	200.	310	<4	270.	21.	0.4	2000	3400	280
401963	46-43.757	-102.771	-3-03-	0.76	950	19.	58	<4	110.	9.3	0.4	130	1400	320
401965	46-43.790	-102.765	-3-01-	22.	1100	32.	110	9	130.	10.	0.5	210	940	280
401970	46-43.802	-102.991	-3-03-	0.32	3200	37.	160	180	390.	12.	0.6	580	1100	300
401972	46-43.726	-102.908	-3-03-	18.	1400	110.	73	7	94.	6.6	0.8	300	1300	310
401974	46-43.700	-102.856	-3-03-	33.	1500	71.	110	23	110.	10.	0.7	350	1300	350
401975	46-43.752	-102.971	-3-01-	17.	880	21.	52	15	98.	8.8	0.7	59	510	320
401977	46-43.809	-102.890	-3-03-	14.	1800	120.	110	7	160.	7.9	1.1	180	1800	330
401978	46-43.931	-102.747	-3-03-	5.9	2100	43.	180	6	290.	9.7	0.5	520	830	260
401979	46-43.865	-102.696	-3-03-	14.	5200	310.	240	16	450.	12.	0.6	2000	4500	320
401980	46-43.714	-103.220	-3-03-	28.	750	67.	27	<4	30.	9.9	0.8	11	910	180
401981	46-43.709	-103.115	-3-03-	40.	1400	13.	80	21	210.	7.7	0.9	120	820	520
401987	46-43.659	-103.195	-3-03-	0.32	800	3.5	47	11	150.	4.9	0.6	23	200	350
401988	46-43.660	-103.146	-3-03-	8.9	1200	94.	46	11	39.	6.2	1.0	190	1100	300
401994	46-43.934	-103.142	-3-03-	11.	1300	140.	42	<4	13.	4.6	0.5	340	1600	320
401995	46-43.904	-103.132	-3-03-	1.5	4700	340.	460	<4	180.	24.	0.9	2300	6300	350
401996	46-43.882	-103.198	-3-03-	6.7	750	75.	53	<4	16.	8.0	0.7	87	1200	200
401997	46-43.643	-103.093	-3-03-	12.	1500	100.	75	<4	81.	9.2	0.8	440	1300	330
402003	46-43.618	-103.133	-3-03-	36.	1400	57.	79	6	150.	18.	0.7	310	1200	360
402005	46-43.994	-103.237	-3-03-	9.4	620	51.	16	<4	6.9	3.8	0.6	570	890	220
402006	46-43.958	-103.229	-3-03-	7.9	710	52.	28	4	11.	4.9	0.6	17	1400	260
402009	46-43.983	-103.149	-3-03-	51.	3200	380.	210	7	89.	8.0	0.7	1200	2400	320

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT LONG L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
402010	46-43.569 -103.166 -3-03-	10.	4100	200.	160	<4	290.	10.	0.5	550	3600	280
402012	46-43.535 -103.155 -3-03-	7.4	5000	160.	230	<4	500.	12.	0.7	1400	3800	290
402013	46-43.520 -103.100 -3-03-	2.5	2400	160.	69	<4	180.	16.	0.4	570	2400	190
402014	46-43.513 -103.177 -3-03-	33.	730	30.	22	<4	46.	5.2	0.5	20	500	190
402018	46-43.622 -103.209 -3-03-	6.1	690	22.	30	16	35.	9.8	0.5	30	560	220
402020	46-43.547 -103.230 -3-03-	0.20	1400	26.	120	<4	190.	9.1	0.4	240	1000	280
402021	46-43.643 -102.945 -3-03-	60.	3600	120.	280	<4	480.	19.	0.4	1200	2600	350
402023	46-43.660 -103.023 -3-03-	52.	3800	150.	250	8	450.	20.	0.9	1100	2900	420
402024	46-43.716 -103.252 -3-03-	45.	740	35.	40	<4	39.	17.	1.3	8	690	260
402026	46-43.741 -103.264 -3-03-	23.	650	56.	20	<4	6.6	7.6	0.6	5	990	200
402027	46-43.732 -103.337 -3-03-	3.7	710	59.	9	14	4.0	3.2	0.7	5	440	240
402029	46-43.711 -103.339 -3-03-	4.1	650	46.	13	<4	6.1	3.8	0.4	8	230	190
402031	46-43.657 -103.276 -3-03-	23.	680	44.	57	5	33.	12.	0.5	20	840	280
402032	46-43.638 -103.339 -3-03-	5.2	710	41.	40	12	23.	6.8	0.6	36	5500	300
402034	46-43.528 -103.026 -3-03-	3.2	720	52.	32	12	58.	7.8	0.6	57	510	290
402035	46-43.579 -103.042 -3-03-	13.	1300	45.	66	11	180.	18.	0.4	260	730	300
402037	46-43.536 -103.066 -3-03-	26.	3300	190.	120	<4	290.	26.	0.6	1100	2800	310
402041	46-43.586 -103.327 -3-03-	27.	740	46.	23	10	16.	9.8	3.5	39	930	280
402043	46-43.567 -103.343 -3-01-	5.4	590	53.	14	12	7.0	2.4	0.6	24	430	200
402047	46-43.609 -103.295 -3-03-	3.3	750	52.	31	<4	26.	8.5	0.6	49	1100	280
402050	46-43.543 -103.258 -3-03-	38.	4700	310.	490	<4	330.	16.	0.5	2100	4700	330
402056	46-43.475 -103.468 -3-03-	6.5	850	79.	18	17	9.0	6.1	0.4	280	1300	200
402066	46-43.517 -103.336 -3-03-	10.	2800	460.	73	19	34.	5.9	<0.2	690	5600	210
402067	46-43.143 -103.055 -3-03-	6.1	1600	33.	73	<4	280.	15.	0.2	130	750	760
402068	46-43.192 -103.006 -3-03-	6.3	3200	120.	200	<4	360.	15.	<0.2	660	1800	
402069	46-43.212 -103.103 -3-03-	12.	3400	150.	140	<4	360.	8.4	<0.2	910	1800	360
402073	46-43.215 -103.009 -3-03-	24.	5100	290.	250	<4	440.	17.	<0.2	1700	4300	
402076	46-43.189 -103.115 -3-03-	26.	4200	160.	220	<4	450.	14.	<0.2	1400	3000	510
402078	46-43.153 -103.014 -3-03-	21.	1700	53.	93	12	160.	13.	<0.2	270	1600	440
402080	46-43.084 -103.066 -3-03-	8.7	2700	110.	130	<4	290.	14.	<0.2	600	1700	400
402083	46-43.083 -103.024 -3-03-	14.	2400	190.	130	<4	330.	13.	0.5	920	2500	200
402085	46-43.230 -103.211 -3-03-	2.1	1700	97.	120	6	160.	18.	<0.2	370	1500	280
402086	46-43.189 -103.181 -3-03-	34.	3900	280.	290	5	540.	17.	1.8	1800	5200	220
402087	46-43.151 -103.212 -3-03-	9.5	2000	100.	100	13	210.	8.0	<0.2	490	2100	320
402088	46-43.008 -103.225 -3-03-	0.23	380	25.	2	<4	1.6	1.6	<0.2	23	190	83
402089	46-43.044 -103.166 -3-03-	60.	6100	400.	300	<4	320.	22.	0.2	5100	6200	310
402090	46-43.103 -103.225 -3-03-	32.	5200	400.	240	<4	380.	13.	3.7	1900	5400	230
402092	46-43.219 -103.156 -3-03-	9.3	3100	160.	170	<4	300.	11.	<0.2	960	2100	230
402094	46-43.188 -103.519 -3-03-	70.	3500	420.	290	14	160.	16.	<0.2	1100	5800	290
402095	46-43.201 -103.574 -3-03-	29.	3200	390.	110	<4	130.	21.	0.4	1000	4000	240
402098	46-43.240 -103.507 -3-03-	30.	3400	280.	300	<4	190.	15.	0.3	1000	3300	360
402100	46-43.127 -103.702 -3-03-	<0.20	2300	100.	110	<4	250.	9.7	<0.2	650	1400	190
402103	46-43.221 -103.659 -3-03-	<0.20	7900	28.	180	5	770.	3.8	<0.2	2000	1900	390
402104	46-43.247 -103.591 -3-03-	8.5	2300	110.	210	11	210.	13.	<0.2	600	1600	260
402106	46-43.233 -103.739 -3-03-	<0.20	2500	140.	130	4	230.	9.4	<0.2	670	2700	230
402109	46-43.191 -103.722 -3-03-	0.22	3200	250.	110	12	260.	9.0	<0.2	830	2900	310
402113	46-43.377 -103.387 -3-03-	11.	2600	210.	120	<4	210.	15.	<0.2	100	3600	210
402114	46-43.138 -103.567 -3-03-	26.	6700	330.	250	<4	550.	24.	<0.2	1800	5600	300
402119	46-43.146 -103.635 -3-03-	95.	3600	390.	330	19	230.	3.7	<0.2	1100	7200	290
402120	46-43.082 -103.648 -3-03-	12.	3500	230.	140	9	300.	11.	1.0	940	3300	280
402121	46-43.041 -103.664 -3-03-	4.0	4500	460.	240	5	290.	26.	<0.2	1400	4200	270
402123	46-43.786 -103.983 -3-01-	1.6	430	56.	5	4	3.0	1.4	0.3	6	150	180
402125	46-43.831 -103.981 -3-01-	12.	710	47.	11	32	4.5	1.7	<0.2	5	220	310
402131	46-43.497 -103.545 -3-03-	6.1	550	47.	7	6	3.8	2.1	0.5	14	310	220
402135	46-43.617 -103.542 -3-03-	2.0	540	59.	26	<4	8.6	4.1	0.5	20	260	180

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
402137	46-43.580	-103.500	-3-03-	5.7	640	66.	16	<4	6.9	2.8	0.6	9	290	230
402138	46-43.470	-103.498	-3-03-	11.	580	47.	12	18	6.0	2.7	0.5	5	410	200
402139	46-43.291	-103.380	-3-03-	9.9	760	66.	33	9	37.	5.8	1.0	100	520	220
402140	46-43.120	-103.610	-3-03-	0.23	3300	39.	20	6	13.	14.	0.2	<5	310	180
402146	46-43.005	-103.907	-3-03-	94.	8200	470.	330	<4	590.	20.	0.6	3300	7100	660
402147	46-43.420	-103.458	-3-03-	8.4	2400	310.	170	10	88.	8.3	0.3	920	5400	240
402148	46-43.880	-103.985	-3-01-	3.1	640	56.	5	5	2.5	2.5	0.2	<5	170	340
402150	46-43.933	-103.922	-3-01-	2.4	580	63.	2	9	2.4	0.4	0.3	8	120	300
402152	46-43.784	-103.932	-3-01-	10.	600	43.	10	18	4.7	2.5	0.2	<5	250	270
402154	46-43.828	-103.917	-3-01-	4.9	720	54.	14	4	4.6	2.7	0.3	<5	260	360
402156	46-43.879	-103.915	-3-01-	1.0	520	43.	<2	5	3.5	6.1	0.2	<5	45	180
402157	46-43.918	-103.961	-3-01-	0.50	530	56.	2	15	1.4	3.4	<0.2	<5	82	220
402159	46-43.896	-103.785	-3-01-	0.29	560	56.	<2	30	1.0	0.5	0.4	<5	51	290
402160	46-43.948	-103.841	-3-01-	0.97	630	71.	<2	11	0.9	0.3	0.2	<5	55	300
402162	46-43.992	-103.831	-3-03-	1.1	480	38.	6	<4	2.7	2.8	<0.2	6	100	190
402164	46-43.989	-103.777	-3-03-	<0.20	420	12.	7	<4	4.4	4.4	<0.2	<5	53	59
402167	46-43.895	-103.484	-3-03-	0.46	380	16.	79	13	6.6	2.6	<0.2	<5	72	76
402172	46-43.894	-103.394	-3-03-	0.72	310	25.	16	4	6.9	3.1	<0.2	5	110	110
402173	46-43.946	-103.394	-3-03-	1.5	400	54.	5	5	4.1	1.0	<0.2	7	160	190
402174	46-43.981	-103.477	-3-03-	2.0	390	4.5	21	<4	0.1	1.3	0.4	<5	96	180
402177	46-43.978	-103.414	-3-03-	0.76	400	58.	5	<4	5.5	3.1	<0.2	60	190	130
402178	46-43.914	-103.639	-3-03-	<0.20	290	27.	8	<4	4.4	3.6	<0.2	6	76	130
402179	46-43.941	-103.673	-3-01-	<0.20	290	18.	6	10	4.0	3.2	<0.2	<5	44	76
402180	46-43.946	-103.728	-3-03-	0.58	330	31.	9	<4	12.	26.	0.4	14	110	140
402183	46-43.989	-103.696	-3-03-	<0.20	300	17.	17	<4	10.	5.2	0.2	25	46	61
402297	46-43.305	-103.215	-3-03-	12.	2700	130.	95	5	200.	6.7	0.4	140	1200	370
402298	46-43.190	-103.258	-3-03-	12.	3900	150.	170	15	270.	12.	0.4	110	2900	270
402299	46-43.152	-103.338	-3-03-	18.	6700	82.	220	6	330.	8.9	4.1	160	1600	510
402300	46-43.148	-103.266	-3-03-	20.	3300	77.	150	<4	290.	7.0	0.3	99	1400	450
402301	46-43.094	-103.333	-3-03-	5.8	3000	65.	230	<4	320.	6.3	0.3	100	1300	260
402302	46-43.059	-103.274	-3-03-	17.	2600	50.	130	<4	250.	4.6	0.4	73	1100	240
402303	46-43.015	-103.432	-3-03-	2.9	1700	63.	110	<4	140.	9.3	0.4	100	800	150
402304	46-43.038	-103.434	-3-03-	17.	2200	58.	140	<4	170.	6.7	0.4	100	1300	400
402305	46-43.035	-103.398	-3-03-	40.	1700	87.	82	<4	54.	5.5	0.3	110	1500	480
402306	46-43.131	-103.408	-3-03-	6.2	3800	110.	140	16	380.	16.	0.9	120	2100	180
402307	46-43.185	-103.376	-3-03-	17.	2900	71.	200	<4	190.	4.7	0.5	140	2100	390
402311	46-43.233	-103.272	-3-03-	9.5	1500	31.	89	12	150.	8.1	0.3	180	910	320
402315	46-43.237	-103.426	-3-03-	120.	8900	340.	350	<4	520.	14.	1.0	170	4900	420
402316	46-43.188	-103.317	-3-03-	1.2	2900	63.	150	<4	270.	7.1	0.3	91	1800	370
402318	46-43.088	-103.266	-3-03-	1.0	2300	52.	100	<4	270.	6.0	<0.2	450	1200	410
402343	46-43.242	-103.350	-3-03-	41.	5400	330.	220	<4	280.	14.	1.2	250	5000	310
402344	46-43.277	-103.444	-3-03-	33.	2800	210.	130	<4	150.	13.	0.5	160	2200	330
402345	46-43.261	-103.504	-3-03-	27.	3100	290.	370	14	84.	14.	0.3	120	2400	360
402346	46-43.262	-103.603	-3-03-	<0.20	3500	250.	140	9	210.	14.	0.2	140	2400	350
402347	46-43.313	-103.606	-3-03-	14.	3200	240.	190	15	160.	16.	0.3	130	4300	240
402350	46-43.337	-103.504	-3-03-	29.	3700	420.	150	<4	30.	16.	0.5	180	10000	190
402351	46-43.379	-103.525	-3-03-	12.	3200	480.	32	4	7.4	6.7	0.2	160	12000	130
402352	46-43.421	-103.591	-3-03-	16.	3200	480.	80	13	23.	7.5	0.3	170	10000	170
402353	46-43.428	-103.505	-3-03-	4.9	1300	82.	140	9	73.	9.4	0.3	160	1600	210
402354	46-43.561	-103.649	-3-03-	7.6	740	57.	10	7	15.	5.6	0.2	38	260	290
402355	46-43.560	-103.609	-3-03-	11.	640	60.	14	4	6.1	4.4	0.3	10	360	270
402359	46-43.452	-103.614	-3-03-	3.9	1500	190.	9	5	4.4	3.3	0.3	820	2800	180
402360	46-43.328	-103.438	-3-03-	18.	2400	180.	100	<4	54.	15.	0.3	210	4500	260
402361	46-43.523	-103.601	-3-03-	7.3	510	39.	6	5	3.9	1.6	0.2	20	230	210
402362	46-43.586	-103.579	-3-03-	4.5	870	72.	49	<4	13.	5.2	0.4	45	300	360

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT LONG L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
402363	46-43.213 -103.385 -3-03-	4.2	2900	160.	160	<4	190.	6.3	0.5	1000	3500	310
402371	46-43.002 -103.670 -3-03-	1.7	1700	120.	110	11	100.	7.7	0.6	330	1200	320
402372	46-43.042 -103.725 -3-03-	11.	4300	26.	120	12	360.	30.	0.9	1400	1000	320
402373	46-43.074 -103.755 -3-03-	5.4	3200	140.	85	5	230.	5.5	0.5	1100	1700	270
402374	46-43.074 -103.879 -3-03-	<0.20	2600	11.	150	7	290.	3.2	0.5	700	370	270
402375	46-43.008 -103.830 -3-03-	20.	5700	210.	150	<4	380.	19.	2.7	2200	3600	400
402376	46-43.004 -103.937 -3-03-	67.	7400	390.	220	<4	410.	19.	0.6	3800	5200	560
402377	46-43.078 -103.818 -3-03-	4.5	7400	180.	200	<4	530.	10.	0.8	2800	4600	360
402378	46-43.544 -103.830 -3-03-	47.	1200	300.	55	6	65.	3.7	0.2	660	6000	230
402379	46-43.509 -103.789 -3-01-	23.	3800	350.	260	20	63.	7.2	0.6	1400	9500	190
402380	46-43.601 -103.885 -3-01-	9.1	3000	360.	38	<4	6.2	2.7	0.2	1200	13000	190
402381	46-43.518 -103.975 -3-03-	12.	3600	540.	100	6	86.	12.	<0.2	1500	8900	120
402382	46-43.549 -103.976 -3-03-	34.	4100	520.	150	24	110.	11.	0.4	1700	9600	130
402384	46-43.732 -103.809 -3-01-	5.5	760	59.	11	28	4.6	1.2	0.2	6	190	320
402385	46-43.679 -103.840 -3-01-	9.0	660	51.	12	13	5.7	1.6	<0.2	<5	230	250
402386	46-43.662 -103.872 -3-01-	1.7	530	68.	7	<4	3.2	1.4	<0.2	<5	120	200
402388	46-43.344 -103.659 -3-03-	52.	5800	430.	450	<4	360.	24.	0.5	2100	7300	230
402424	46-43.469 -103.926 -3-03-	15.	4300	350.	220	<4	150.	34.	0.7	1700	7100	200
402428	46-43.268 -103.325 -3-03-	6.1	850	44.	36	<4	92.	5.2	2.6	230	400	260
402444	46-43.043 -103.345 -3-03-	12.	1200	46.	64	<4	99.	2.7	0.5	290	820	270
402445	46-43.336 -103.205 -3-03-	29.	4900	170.	170	<4	390.	14.	0.4	180	2700	370
402451	46-43.323 -103.065 -3-03-	11.	1800	73.	93	<4	160.	6.1	0.4	97	1100	280
402453	46-43.947 -102.442 -3-03-	60.	15000	310.	850	<4	930.	16.	1.3	5400	4700	460
402456	46-43.979 -102.419 -3-03-	11.	3700	360.	97	4	130.	27.	0.6	1100	2300	280
402457	46-43.888 -102.529 -3-03-	4.1	560	57.	14	8	13.	8.3	0.6	41	380	200
402461	46-43.687 -102.360 -3-03-	17.	520	62.	24	5	14.	11.	0.6	14	430	210
402462	46-43.731 -102.380 -3-01-	21.	920	53.	54	9	120.	7.0	0.6	30	320	400
402465	46-43.925 -102.562 -3-03-	39.	4300	270.	270	15	310.	13.	0.4	1400	3400	280
402466	46-43.880 -102.555 -3-03-	3.8	1400	17.	130	4	180.	45.	1.0	340	550	76
402467	46-43.913 -102.702 -3-03-	4.2	1800	140.	100	<4	87.	7.9	0.6	430	1900	310
402470	46-43.994 -102.386 -3-03-	0.54	1900	81.	200	<4	190.	9.3	0.6	440	1200	330
402471	46-43.889 -102.438 -3-03-	95.	1400	60.	110	41	160.	18.	0.6	260	670	270
402472	46-43.930 -102.496 -3-03-	1.6	1400	44.	110	<4	140.	12.	0.4	190	660	300
402475	46-43.876 -102.629 -3-03-	14.	1400	31.	85	10	170.	10.	0.6	250	460	330
402476	46-43.992 -102.678 -3-03-	76.	2200	160.	110	<4	150.	12.	0.6	320	1400	280
402477	46-43.982 -102.639 -3-03-	10.	1900	160.	180	<4	110.	9.7	0.6	640	1000	170
402481	46-43.976 -102.519 -3-03-	33.	1600	27.	100	10	230.	6.4	0.6	170	340	380
402482	46-43.964 -103.082 -3-03-	0.54	940	71.	45	<4	32.	6.8	0.4	200	2300	240
402487	46-43.943 -103.095 -3-03-	21.	8400	360.	600	<4	530.	34.	1.5	3300	8800	300
402496	46-43.843 -103.017 -3-03-	10.	2300	160.	270	5	150.	13.	0.7	540	1800	410
402497	46-43.801 -103.041 -3-03-	15.	2200	96.	190	16	220.	13.	3.0	350	1300	300
402498	46-43.759 -103.009 -3-03-	12.	1200	110.	67	4	46.	7.5	0.8	280	980	230
402503	46-43.768 -103.130 -3-03-	62.	1700	310.	140	13	47.	11.	0.7	930	2200	170
402506	46-43.767 -103.210 -3-03-	0.28	510	55.	45	10	25.	14.	0.6	42	1100	200
402507	46-43.799 -103.220 -3-03-	12.	580	68.	38	10	14.	5.5	0.4	54	760	200
402508	46-43.804 -103.176 -3-03-	0.38	790	59.	100	4	52.	9.7	0.5	150	1400	220
402509	46-43.849 -103.134 -3-03-	55.	3000	380.	170	22	94.	12.	0.7	1200	3400	340
402510	46-43.878 -103.027 -3-03-	10.	1800	210.	84	<4	49.	6.7	0.7	470	1900	270
402511	46-43.887 -103.061 -3-03-	7.6	1200	120.	53	5	20.	6.2	0.7	270	1400	250
402514	46-43.992 -102.999 -3-03-	18.	3000	160.	200	<4	160.	3.8	0.8	940	2400	340
402515	46-43.806 -103.093 -3-03-	9.2	910	100.	30	5	11.	3.4	0.7	200	960	230
402516	46-43.862 -103.087 -3-03-	2.3	810	73.	41	9	70.	15.	0.5	130	790	220
402517	46-43.834 -103.198 -3-03-	11.	700	130.	32	<4	8.2	5.3	0.7	140	1100	230
402526	46-43.423 -103.341 -3-03-	65.	6700	510.	990	16	420.	15.	0.7	2600	6600	320
402529	46-43.477 -103.122 -3-03-	18.	4900	310.	250	<4	380.	9.6	0.5	1700	3900	250

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
402532	46-43.499	-103.014	-3-03-	8.1	840	54.	37	<4	48.	5.4	0.6	120	530	250
402537	46-43.468	-103.087	-3-01-	33.	3900	150.	250	<4	400.	13.	0.5	710	3000	250
402538	46-43.466	-103.215	-3-03-	25.	3000	210.	130	15	270.	6.1	0.6	850	3100	180
402540	46-43.419	-103.276	-3-03-	21.	3400	300.	98	8	210.	15.	0.6	1100	3700	200
402541	46-43.477	-103.353	-3-03-	21.	880	53.	44	15	16.	8.5	0.9	100	1300	310
402542	46-43.464	-103.281	-3-03-	28.	6300	370.	280	<4	350.	21.	1.0	1700	9600	260
402543	46-43.377	-103.329	-3-03-	55.	4600	360.	88	<4	240.	33.	0.7	1200	3600	230
402544	46-43.380	-103.281	-3-03-	32.	3500	280.	79	<4	190.	27.	0.5	950	3200	180
402545	46-43.420	-103.209	-3-03-	22.	3200	250.	90	10	180.	23.	0.6	910	2900	220
402546	46-43.432	-103.146	-3-03-	29.	3200	200.	91	4	230.	32.	0.5	200	2700	270
402552	46-43.380	-103.235	-3-03-	12.	1400	100.	61	5	95.	7.3	1.2	300	1200	300
402555	46-43.331	-103.264	-3-03-	3.1	430	41.	10	<4	8.7	2.3	0.5	15	280	170
402556	46-43.288	-103.252	-3-03-	3.4	1200	2.6	30	7	0.8	1.6	0.7	240	290	210
402558	46-43.354	-103.379	-3-03-	0.20	1600	180.	59	<4	43.	10.	0.5	610	6600	30
402559	46-43.337	-103.325	-3-03-	15.	1500	130.	59	4	33.	6.2	0.8	290	1400	350
402560	46-43.703	-102.067	-3-03-	110.	3500	20.	210	12	490.	11.	0.7	910	690	850
402561	46-43.718	-102.004	-3-03-	60.	2800	14.	200	<4	440.	9.0	0.8	460	290	930
402562	46-43.688	-102.199	-3-03-	92.	1700	41.	89	13	270.	9.5	0.5	380	450	340
402563	46-43.927	-102.247	-3-03-	2.6	1100	37.	65	<4	160.	2.6	0.6	23	190	440
402564	46-43.915	-102.339	-3-03-	71.	2700	91.	340	<4	260.	17.	0.5	430	1300	200
402582	46-43.939	-102.145	-3-03-	28.	3100	160.	160	6	290.	3.8	0.6	890	1000	460
402594	46-43.899	-102.021	-3-03-	9.7	3400	160.	200	<4	350.	8.1	2.2	1200	1900	230
404007	46-43.424	-103.687	-3-03-	30.	3500	330.	84	13	51.	14.	0.4	98	7400	210
404009	46-43.319	-103.738	-3-03-	0.96	1300	110.	55	19	23.	9.5	0.2	280	1400	280
404010	46-43.278	-103.700	-3-01-	<0.20	380	27.	17	<4	4.5	4.0	0.4	86	100	61
404011	46-43.306	-103.682	-3-03-	48.	2000	160.	240	9	130.	20.	0.7	1000	3200	190
404012	46-43.260	-103.658	-3-03-	19.	2900	470.	240	5	50.	18.	0.3	1600	4400	140
404014	46-43.562	-103.727	-3-03-	2.8	1300	120.	14	<4	21.	22.	0.4	43	290	230
404017	46-43.623	-103.711	-3-01-	11.	650	51.	12	6	5.8	3.0	0.5	<5	340	250
404025	46-43.701	-103.685	-3-03-	7.0	830	59.	23	<4	11.	5.0	0.7	14	280	220
404026	46-43.704	-103.664	-3-03-	10.	1100	60.	28	12	19.	3.6	0.5	5	390	270
404027	46-43.649	-103.648	-3-03-	40.	1100	46.	22	18	9.3	3.5	0.6	9	270	300
404028	46-43.740	-103.655	-3-03-	5.4	930	58.	16	10	8.9	4.1	0.5	8	390	190
404029	46-43.739	-103.720	-3-01-	2.5	840	49.	24	<4	6.8	4.2	0.5	5	180	180
404030	46-43.648	-103.742	-3-03-	7.8	940	73.	15	6	8.0	3.4	0.5	8	500	210
404031	46-43.502	-103.703	-3-03-	4.9	1000	56.	7	8	3.9	2.6	0.5	<5	360	230
404032	46-43.732	-103.772	-3-03-	1.6	970	81.	13	5	17.	1.5	0.5	16	340	270
404033	46-43.706	-103.778	-3-03-	11.	970	79.	30	<4	11.	4.7	0.5	5	590	280
404035	46-43.643	-103.799	-3-03-	2.2	750	74.	10	<4	4.1	3.7	0.5	<5	140	280
404116	46-43.392	-103.897	-3-03-	0.64	2600	180.	140	<4	180.	17.	0.5	1100	6800	320
404118	46-43.452	-103.990	-3-03-	0.59	1500	39.	65	<4	240.	8.7	0.5	300	710	200
404120	46-43.402	-103.931	-3-03-	0.23	1500	23.	69	<4	260.	8.0	0.3	310	530	200
404122	46-43.458	-103.642	-3-03-	13.	1800	340.	21	6	9.0	8.1	0.5	460	4300	200
404123	46-43.394	-103.709	-3-03-	0.97	2800	330.	290	<4	140.	18.	0.5	910	7200	240
404124	46-43.403	-103.408	-3-03-	3.3	810	83.	33	37	11.	7.9	0.5	82	1200	320
404125	46-43.520	-103.404	-3-03-	9.0	2500	380.	41	5	10.	5.3	0.5	930	6300	190
404141	46-43.386	-103.780	-3-03-	31.	3100	500.	83	6	67.	8.8	0.7	1500	8600	220
404143	46-43.460	-103.775	-3-03-	2.4	2600	120.	310	4	150.	34.	0.6	570	3000	780
404148	46-43.579	-103.783	-3-03-	2.1	770	120.	5	<4	1.4	1.1	0.5	<5	300	400
404149	46-43.402	-103.964	-3-03-	<0.20	1800	2.6	67	<4	270.	5.1	0.7	<5	170	750
404153	46-43.501	-103.662	-3-03-	5.2	420	48.	9	9	5.0	3.0	0.4	<5	420	240
404154	46-43.603	-103.644	-3-03-	4.0	470	51.	9	<4	5.0	1.2	<0.2	<5	310	300
404157	46-43.658	-103.593	-3-01-	1.9	510	52.	27	<4	9.0	3.8	0.4	25	220	170
404160	46-43.688	-103.610	-3-03-	1.8	500	47.	17	9	7.7	3.6	0.4	<5	260	180
404161	46-43.747	-103.581	-3-03-	0.65	380	30.	17	4	5.1	3.1	0.5	<5	180	95

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
404162	46-43.644	-103.536	-3-03-	1.4	420	41.	9	<4	4.7	2.3	0.2	<5	160	140
404163	46-43.711	-103.510	-3-03-	2.7	490	61.	15	<4	5.3	2.2	0.4	13	190	150
404167	46-43.745	-103.522	-3-03-	<0.20	590	32.	18	<4	5.7	2.6	0.3	5	150	88
404172	46-43.799	-103.523	-3-03-	1.5	240	17.	9	<4	4.2	2.1	0.3	14	59	56
404173	46-43.796	-103.588	-3-03-	0.52	260	16.	24	11	5.5	1.8	<0.2	<5	90	82
404177	46-43.843	-103.560	-3-03-	0.33	110	8.4	2	<4	1.6	0.7	<0.2	<5	26	42
404178	46-43.851	-103.575	-3-01-	0.46	140	7.4	14	<4	3.3	1.3	<0.2	10	28	30
404183	46-43.892	-103.589	-3-03-	9.5	890	100.	18	<4	22.	4.8	0.4	52	440	310
404184	46-43.939	-103.581	-3-03-	0.28	370	20.	8	<4	4.6	2.9	<0.2	27	71	68
404188	46-43.989	-103.574	-3-03-	<0.20	330	13.	5	<4	5.1	2.2	0.3	7	59	50
404193	46-43.922	-103.526	-3-03-	4.0	460	34.	110	5	11.	5.0	0.5	19	140	150
404196	46-43.900	-103.536	-3-03-	1.5	480	41.	45	<4	9.8	4.2	0.5	14	150	170
404284	46-43.762	-103.709	-3-01-	1.6	300	36.	14	<4	11.	3.3	0.3	27	130	110
404294	46-43.977	-103.639	-3-03-	0.32	250	27.	13	<4	8.8	4.3	0.3	15	110	80
404296	46-43.805	-103.780	-3-01-	1.2	610	45.	4	<4	3.7	0.6	0.5	<5	79	280
404298	46-43.814	-103.806	-3-03-	0.88	550	53.	2	<4	4.2	3.5	0.4	<5	60	250
404302	46-43.894	-103.706	-3-03-	1.7	210	59.	5	<4	3.2	6.1	0.3	69	82	120
404303	46-43.831	-103.695	-3-03-	<0.20	190	17.	19	<4	6.6	3.4	0.2	32	11	44
404304	46-43.849	-103.634	-3-03-	7.6	860	120.	31	<4	34.	9.3	0.3	17	350	250
404306	46-43.799	-103.635	-3-03-	<0.20	290	14.	46	8	4.4	22.	0.3	47	21	40
404307	46-43.803	-103.701	-3-03-	0.43	1200	54.	13	<4	17.	7.7	0.3	16	250	100
404311	46-43.757	-103.636	-3-03-	7.0	1300	85.	49	<4	29.	5.9	0.4	15	470	350
404313	46-43.452	-103.827	-3-03-	53.	2700	130.	170	<4	170.	9.9	2.7	980	5700	260
404315	46-43.377	-103.710	-3-03-	13.	1100	76.	72	<4	46.	9.4	0.4	270	2300	270
404316	46-43.470	-103.695	-3-03-	6.7	900	110.	15	<4	11.	3.6	0.5	5	1400	260
404322	46-43.717	-103.475	-3-03-	0.35	460	45.	16	<4	12.	3.7	0.4	10	150	180
404323	46-43.552	-103.384	-3-03-	4.0	750	72.	20	4	4.4	2.6	0.3	35	550	260
404325	46-43.507	-103.461	-3-03-	2.6	540	46.	15	<4	8.9	3.1	0.3	11	240	220
404326	46-43.547	-103.892	-3-03-	4.8	3100	370.	49	15	19.	3.5	0.5	1400	10000	210
404331	46-43.600	-103.947	-3-03-	4.9	2300	470.	17	13	5.0	3.6	<0.2	1100	9800	150
404335	46-43.597	-103.842	-3-03-	10.	860	92.	25	21	13.	1.7	0.4	50	1300	380
404343	46-43.768	-103.456	-3-01-	<0.20	910	23.	12	10	11.	2.4	<0.2	12	100	120
404346	46-43.780	-103.401	-3-03-	7.5	890	36.	15	7	7.7	2.6	0.3	9	140	130
404347	46-43.802	-103.275	-3-03-	2.6	1200	81.	14	<4	19.	2.4	0.3	61	470	240
404349	46-43.752	-103.311	-3-03-	4.6	1000	44.	11	<4	4.1	3.9	<0.2	<5	550	230
404350	46-43.845	-103.340	-3-03-	<0.20	980	21.	22	9	5.9	2.7	<0.2	11	91	76
404351	46-43.850	-103.371	-3-01-	<0.20	980	22.	45	9	5.3	4.8	<0.2	33	91	65
404355	46-43.947	-103.356	-3-03-	0.56	1100	38.	8	7	12.	1.5	<0.2	6	160	170
404356	46-43.988	-103.270	-3-03-	2.7	1600	190.	19	<4	4.7	2.6	<0.2	560	3400	230
404358	46-43.847	-103.270	-3-03-	2.8	910	61.	15	7	4.6	2.5	<0.2	83	1500	180
404361	46-43.871	-103.335	-3-03-	7.3	770	46.	34	4	15.	3.5	<0.2	32	450	230
404363	46-43.978	-103.346	-3-03-	1.2	740	42.	9	<4	3.0	1.9	<0.2	9	180	210
404365	46-43.895	-103.270	-3-03-	3.2	800	74.	10	9	2.7	1.9	<0.2	46	640	250
404440	46-43.521	-103.842	-3-03-	18.	680	36.	39	20	28.	4.3	0.4	84	1100	230
404441	46-43.319	-103.795	-3-03-	19.	3000	170.	76	13	200.	13.	0.5	1200	2500	260
404442	46-43.256	-103.817	-3-03-	<0.20	3100	6.0	93	<4	320.	1.8	0.2	850	150	320
404443	46-43.254	-103.790	-3-03-	<0.20	2500	16.	150	<4	280.	3.1	0.3	870	400	150
404444	46-43.334	-103.847	-3-03-	<0.20	2800	180.	89	9	200.	8.9	0.5	1300	3200	280
404445	46-43.355	-103.830	-3-03-	18.	2000	340.	110	<4	140.	16.	0.7	2000	11000	270
404446	46-43.338	-103.781	-3-03-	<0.20	4600	380.	180	<4	200.	12.	0.3	2600	1700	200
404448	46-43.174	-103.974	-3-03-	4.8	3600	170.	410	<4	560.	13.	0.5	1300	2200	260
404449	46-43.242	-103.997	-3-03-	<0.20	1900	1.8	110	<4	440.	1.2	0.5	260	31	550
404452	46-43.186	-103.848	-3-03-	8.8	1900	110.	390	7	230.	25.	0.3	180	2300	140
404454	46-43.187	-103.754	-3-03-	<0.20	4800	21.	200	8	930.	4.5	0.4	1200	730	300
404456	46-43.250	-103.759	-3-03-	<0.20	2000	85.	120	9	190.	7.3	<0.2	650	2000	190

Table A-3, Continued

PARTIAL DATA LISTING FOR GROUNDWATER OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - GROUNDWATER

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPB)	SP UMHOS/CM	CA (PPM)	LI (PPB)	MO (PPB)	NA (PPM)	K (PPM)	SE (PPB)	SO4 (PPM)	SR (PPB)	T-AK (PPM)
404457	46-43.155	-103.825	-3-03-	8.4	1800	110.	250	15	140.	15.	<0.2	280	2400	140
404458	46-43.206	-103.858	-3-03-	11.	2000	110.	240	13	150.	15.	<0.2	270	2300	170
404459	46-43.256	-103.892	-3-03-	<0.20	1800	4.1	140	4	280.	1.5	<0.2	600	100	190
404531	46-43.725	-103.932	-3-03-	1.7	740	68.	6	<4	2.7	2.0	0.3	13	140	220
404532	46-43.651	-103.932	-3-01-	4.6	790	89.	11	4	5.4	1.6	0.4	8	1500	290
404534	46-43.713	-103.973	-3-03-	4.4	940	120.	8	5	4.2	2.7	0.2	58	1000	270
404535	46-43.736	-103.996	-3-01-	3.3	930	76.	9	10	4.2	1.4	0.3	7	550	340
404539	46-43.282	-103.887	-3-03-	0.20	1900	2.9	71	9	390.	1.2	0.4	190	59	330
404540	46-43.322	-103.876	-3-03-	0.22	3300	45.	130	7	640.	4.4	0.5	570	980	340
404541	46-43.362	-103.974	-3-03-	0.23	11000	250.	1000	21	1200.	17.	0.3	2900	4400	21

APPENDIX B

STREAM SEDIMENT

APPENDIX B

STREAM SEDIMENT

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LIST OF FIGURES, Continued

LIST OF FIGURES, Continued

Table B-1

STATISTICAL SUMMARY FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

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	355	2	<0.25	<0.25	16.30	3.33	2.84	2.88	1.851	0.562	1.09	0.44	1.06	0.42
U-NT	357			0.90	19.50	3.79	3.30	2.92	1.995	0.526	1.25	0.37	1.23	0.35
TH	352	5	<2	<2	19	8	8	7	2.7	0.3	2.08	0.35	2.08	0.36
U/TU	356			0.04	1.38	0.87	0.89	0.93	0.170	0.197	-0.18	0.34	-0.14	0.16
TH/U	356			0.24	6.00	2.44	2.50	2.41	0.916	0.376	0.80	0.49	0.84	0.46
AG	0	357	<2	<2	<2		<2	<2						
AL	357			0.97	6.84	4.39	4.51	4.51	1.045	0.236	1.44	0.28	1.47	0.26
AS	356	1	<0.1	<0.1	293.2	8.4	5.0	3.1	20.77	2.46	1.65	0.77	1.62	0.66
B	295	62	<10	<10	75	25	20	15	11.9	0.5	3.15	0.44	2.99	0.56
BA	357			176	4854	748	535	386	528.1	0.7	6.48	0.49	6.46	0.50
BE	354	3	<1	<1	17	2	2	1	1.4	0.7	0.62	0.47		
CA	357			0.13	16.34	2.34	1.20	0.59	2.095	1.028	0.33	0.84	0.31	0.78
CE	350	7	<10	<10	136	43	42	45	14.9	0.3	3.72	0.35	3.72	0.40
CO	356	1	<4	<4	47	15	15	14	5.9	0.4	2.63	0.42	2.64	0.43
CR	357			1	89	42	43	45	15.1	0.4	3.68	0.44	3.70	0.39
CU	357			3	122	23	22	17	11.9	0.5	3.05	0.46	3.05	0.50
FE	357			0.05	6.82	2.55	2.69	2.96	0.937	0.352	0.90	0.44	0.93	0.38
K	357			0.54	2.74	1.54	1.53	1.64	0.317	0.205	0.41	0.22	0.42	0.21
LI	357			7	195	31	30	22	14.0	0.4	3.37	0.38	3.38	0.34
MG	357			0.09	2.79	0.85	0.81	0.78	0.371	0.430	-0.23	0.39	-0.23	0.39
MN	357			74	9264	593	478	380	587.3	1.0	6.20	0.57	6.19	0.58
MO	105	252	<4	<4	30	6	<4	<4	4.3	0.6	1.80	0.43		
NA	356	1	<0.05	<0.05	2.50	0.52	0.49	0.37	0.279	0.535	-0.80	0.60	-0.78	0.60
NB	352	5	<4	<4	33	14	15	14	5.1	0.3	2.64	0.37	2.64	0.36
NI	357			3	77	21	20	24	10.5	0.5	2.94	0.53	2.96	0.52
P	357			11	1841	559	538	538	199.6	0.4	6.26	0.40	6.28	0.31
SC	357			1	14	7	8	8	2.3	0.3	1.99	0.36	2.01	0.34
SE	355	2	<0.1	<0.1	7.8	1.0	0.9	0.7	0.79	0.78	-0.15	0.53	-0.17	0.51
SR	357			29	1038	188	156	116	107.6	0.6	5.13	0.45	5.11	0.44
TI	357			18	4795	2306	2366	2544	558.6	0.2	7.70	0.39	7.73	0.26
V	356	1	<2	<2	479	88	78	73	52.1	0.6	4.35	0.52	4.35	0.51
Y	357			4	25	14	15	15	3.3	0.2	2.65	0.26	2.67	0.24
ZN	357			13	298	84	82	90	39.2	0.5	4.34	0.46	4.35	0.45
ZR	357			2	126	75	77	80	14.8	0.2	4.30	0.28	4.32	0.18

NOTE: Refer to Table 1, Page 24 and Table C-1, Page C-4 for concentration units and symbol definitions.

Table B-2

CORRELATION MATRIX FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

	L-U	LUNT	L-SE	L-FE	L-SC	L-CR	L-V	L-CO	L-NI	L-CU	L-ZN	L-AS	L-TH
L-U	1.00 (355)												
LUNT	0.80*** 0.83*** (354)	1.00 (357)											
L-SE	0.50*** 0.45*** (353)	0.54*** 0.53*** (354)	1.00 (355)										
L-FE	0.37*** 0.41*** (355)	0.37*** 0.40*** (356)	0.43*** 0.43*** (355)	1.00 (357)									
L-SC	0.39*** 0.43*** (355)	0.38*** 0.39*** (356)	0.43*** 0.43*** (355)	0.91*** 0.91*** (357)	1.00 (357)								
L-CR	0.45*** 0.49*** (355)	0.41*** 0.48*** (356)	0.47*** 0.51*** (355)	0.84*** 0.76*** (357)	0.88*** 0.85*** (357)	1.00 (357)							
L-V	0.50*** 0.51*** (354)	0.49*** 0.46*** (355)	0.50*** 0.53*** (354)	0.78*** 0.78*** (356)	0.79*** 0.79*** (356)	0.81*** 0.79*** (356)	1.00 (356)						
L-CO	0.32*** 0.40*** (354)	0.37*** 0.40*** (355)	0.42*** 0.48*** (354)	0.81*** 0.93*** (356)	0.84*** 0.87*** (356)	0.74*** 0.80*** (356)	0.74*** 0.76*** (355)	1.00 (356)					
L-NI	0.41*** 0.46*** (355)	0.42*** 0.46*** (356)	0.53*** 0.50*** (355)	0.68*** 0.81*** (357)	0.77*** 0.81*** (357)	0.78*** 0.87*** (357)	0.84*** 0.85*** (356)	0.86*** 0.87*** (356)	1.00 (357)				
L-CU	0.42*** 0.45*** (355)	0.43*** 0.44*** (356)	0.49*** 0.53*** (355)	0.70*** 0.76*** (357)	0.76*** 0.77*** (357)	0.78*** 0.84*** (357)	0.76*** 0.77*** (356)	0.82*** 0.83*** (356)	0.84*** 0.87*** (357)	1.00 (357)			
L-ZN	0.42*** 0.44*** (355)	0.47*** 0.45*** (356)	0.51*** 0.50*** (355)	0.69*** 0.75*** (357)	0.74*** 0.73*** (357)	0.71*** 0.77*** (357)	0.79*** 0.77*** (356)	0.84*** 0.82*** (356)	0.84*** 0.83*** (357)	0.87*** 0.85*** (357)	1.00 (357)		
L-AS	0.37*** 0.45*** (354)	0.44*** 0.51*** (355)	0.47*** 0.55*** (354)	0.63*** 0.70*** (356)	0.54*** 0.60*** (356)	0.58*** 0.63*** (356)	0.50*** 0.62*** (355)	0.60*** 0.68*** (355)	0.58*** 0.71*** (356)	0.58*** 0.67*** (356)	0.52*** 0.61*** (356)	1.00 (356)	
L-TH	0.19*** 0.23*** (350)	0.25*** 0.31*** (351)	0.12** 0.11** (350)	0.34*** 0.25*** (352)	0.30*** 0.22*** (352)	0.20*** 0.16*** (352)	0.26*** 0.21*** (352)	0.23*** 0.20*** (351)	0.15*** 0.15*** (352)	0.23*** 0.21*** (352)	0.27*** 0.26*** (352)	0.23*** 0.22*** (351)	1.00 (352)
L-CE	0.24*** 0.19*** (348)	0.35*** 0.31*** (349)	0.18*** 0.11** (348)	0.24*** 0.01 (350)	0.18*** 0.06 (350)	0.20*** 0.05 (350)	0.17*** -0.00 (349)	0.19*** 0.08 (349)	0.11** 0.03 (350)	0.29*** 0.18*** (350)	0.28*** 0.11** (350)	0.22*** 0.13** (349)	0.45*** 0.44*** (345)
L-NB	0.13** 0.19*** (350)	0.18*** 0.18*** (351)	0.10* 0.05 (350)	0.47*** 0.41*** (352)	0.35*** 0.32*** (352)	0.14*** 0.10** (352)	0.42*** 0.40*** (352)	0.31*** 0.28*** (352)	0.15*** 0.16*** (352)	0.21*** 0.19*** (352)	0.23*** 0.20*** (352)	0.23*** 0.23*** (351)	0.46*** 0.43*** (348)
L-Y	0.32*** 0.32*** (355)	0.35*** 0.27*** (356)	0.23*** 0.13*** (355)	0.59*** 0.45*** (357)	0.56*** 0.42*** (357)	0.39*** 0.21*** (357)	0.60*** 0.54*** (356)	0.29*** 0.35*** (356)	0.31*** 0.28*** (357)	0.37*** 0.27*** (357)	0.41*** 0.30*** (357)	0.25*** 0.22*** (356)	0.41*** 0.34*** (352)
L-BA	0.06 0.14*** (355)	0.13** 0.15*** (356)	0.07 0.07 (355)	0.32*** 0.40*** (357)	0.23*** 0.26*** (357)	0.06 0.11** (357)	0.30*** 0.42*** (356)	0.27*** 0.31*** (356)	0.13** 0.19*** (357)	0.18*** 0.20*** (357)	0.22*** 0.25*** (357)	0.21*** 0.27*** (356)	0.20*** 0.16*** (352)
L-AL	0.34*** 0.42*** (355)	0.42*** 0.38*** (356)	0.27*** 0.33*** (355)	0.77*** 0.74*** (357)	0.82*** 0.80*** (357)	0.71*** 0.73*** (357)	0.69*** 0.68*** (356)	0.76*** 0.76*** (356)	0.61*** 0.65*** (357)	0.71*** 0.71*** (357)	0.65*** 0.66*** (357)	0.48*** 0.51*** (356)	0.35*** 0.25*** (352)
L-LI	0.43*** 0.48*** (355)	0.46*** 0.45*** (356)	0.23*** 0.33*** (355)	0.55*** 0.60*** (357)	0.68*** 0.71*** (357)	0.67*** 0.77*** (357)	0.56*** 0.54*** (356)	0.64*** 0.63*** (356)	0.60*** 0.65*** (357)	0.66*** 0.64*** (357)	0.61*** 0.57*** (357)	0.55*** 0.51*** (356)	0.19*** 0.17*** (352)
L-K	0.06 0.10* (355)	0.14** 0.11** (356)	-0.04 0.03 (355)	0.32*** 0.24*** (357)	0.44*** 0.37*** (357)	0.45*** 0.49*** (357)	0.21*** 0.19*** (356)	0.42*** 0.30*** (356)	0.36*** 0.36*** (357)	0.42*** 0.40*** (357)	0.37*** 0.35*** (357)	0.24*** 0.18*** (356)	0.09* 0.03 (352)
L-TI	0.33*** 0.37*** (355)	0.32*** 0.40*** (356)	0.24*** 0.23*** (355)	0.80*** 0.77*** (357)	0.71*** 0.78*** (357)	0.66*** 0.60*** (357)	0.56*** 0.59*** (356)	0.45*** 0.67*** (356)	0.29*** 0.51*** (357)	0.41*** 0.52*** (357)	0.37*** 0.51*** (357)	0.39*** 0.43*** (356)	0.44*** 0.38*** (352)
L-ZR	0.31*** 0.33*** (355)	0.31*** 0.39*** (356)	0.16*** 0.11** (355)	0.72*** 0.55*** (357)	0.66*** 0.60*** (357)	0.63*** 0.44*** (357)	0.40*** 0.33*** (356)	0.40*** 0.53*** (356)	0.23*** 0.35*** (357)	0.25*** 0.40*** (357)	0.22*** 0.40*** (357)	0.35*** 0.30*** (356)	0.41*** 0.37*** (352)
L-P	0.42*** 0.40*** (355)	0.44*** 0.42*** (356)	0.42*** 0.45*** (355)	0.69*** 0.42*** (357)	0.62*** 0.43*** (357)	0.66*** 0.50*** (357)	0.55*** 0.48*** (356)	0.47*** 0.45*** (356)	0.45*** 0.52*** (357)	0.55*** 0.54*** (357)	0.35*** 0.57*** (357)	0.51*** 0.46*** (356)	0.20*** 0.11** (352)
L-MN	-0.02 0.03 (355)	0.13** 0.15*** (356)	0.01 0.08 (355)	0.43*** 0.39*** (357)	0.32*** 0.25*** (357)	0.21*** 0.17*** (357)	0.11** 0.08 (356)	0.48*** 0.41*** (356)	0.24*** 0.21*** (357)	0.30*** 0.23*** (357)	0.32*** 0.25*** (357)	0.43*** 0.38*** (356)	0.14** 0.15*** (352)
L-NA	0.08 0.10* (354)	0.23*** 0.21*** (355)	-0.09* -0.06 (354)	0.27*** 0.17*** (356)	0.23*** 0.12** (356)	0.16*** 0.12** (356)	0.15*** 0.04 (355)	0.24*** 0.19*** (355)	0.06 0.03 (356)	0.20*** 0.11** (356)	0.22*** 0.12** (356)	0.16*** 0.11** (355)	0.24*** 0.20*** (351)
L-CA	-0.12** -0.17*** (355)	-0.17*** -0.19*** (356)	-0.16*** -0.22*** (355)	-0.40*** -0.46*** (357)	-0.35*** -0.45*** (357)	-0.33*** -0.39*** (357)	-0.24*** -0.28*** (356)	-0.54*** -0.53*** (356)	-0.30*** -0.33*** (357)	-0.33*** -0.35*** (357)	-0.38*** -0.41*** (357)	-0.26*** -0.25*** (356)	-0.15*** -0.13*** (352)
L-SR	0.10* 0.17*** (355)	0.12** 0.16*** (356)	-0.01 -0.02 (355)	-0.04 -0.02 (357)	-0.05 -0.07 (357)	-0.14** -0.12** (357)	0.13** 0.15*** (356)	-0.19*** -0.12** (356)	-0.09* -0.03 (357)	-0.09* -0.09* (357)	-0.12** -0.12** (357)	-0.07 -0.01 (356)	0.09* 0.11** (352)
L-MG	-0.00 0.04 (355)	-0.06 -0.07 (356)	-0.01 0.09* (355)	0.29*** 0.34*** (357)	0.40*** 0.39*** (357)	0.35*** 0.35*** (357)	0.26*** 0.28*** (356)	0.32*** 0.37*** (356)	0.38*** 0.25*** (357)	0.36*** 0.26*** (357)	0.32*** 0.25*** (357)	0.06 0.04 (356)	-0.01 -0.04 (352)

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%.

	L-CE	L-NB	L-Y	L-BA	L-AL	L-LI	L-K	L-TI	L-ZR	L-F	L-MN	L-NA	L-CA	L-SR	L-MG
L-CE	1.00 (350)														
L-NB	0.19*** 0.15*** (346)	1.00 (332)													
L-Y	0.46*** 0.29*** (350)	0.62*** 0.63*** (332)	1.00 (357)												
L-BA	0.22*** 0.11** (350)	0.56*** 0.61*** (332)	0.54*** 0.57*** (357)	1.00 (357)											
L-AL	0.38*** 0.18*** (350)	0.53*** 0.45*** (332)	0.63*** 0.45*** (357)	0.45*** 0.42*** (357)	1.00 (357)										
L-LI	0.12** 0.01 (350)	0.17*** 0.11** (332)	0.26*** 0.17*** (357)	0.06 0.02 (357)	0.73*** 0.71*** (357)	1.00 (357)									
L-K	0.19*** 0.09* (350)	-0.06 -0.17*** (332)	0.06 -0.14*** (357)	0.01 -0.06 (357)	0.59*** 0.49*** (357)	0.59*** 0.57*** (357)	1.00 (357)								
L-TI	0.30*** 0.13** (350)	0.57*** 0.49*** (332)	0.62*** 0.48*** (357)	0.29*** 0.45*** (357)	0.67*** 0.71*** (357)	0.33*** 0.51*** (357)	0.33*** 0.30*** (357)	1.00 (357)							
L-ZR	0.36*** 0.30*** (350)	0.33*** 0.34*** (332)	0.56*** 0.44*** (357)	0.17*** 0.23*** (357)	0.62*** 0.62*** (357)	0.39*** 0.54*** (357)	0.38*** 0.36*** (357)	0.89*** 0.71*** (357)	1.00 (357)						
L-F	0.29*** 0.10* (350)	0.15*** 0.01 (332)	0.47*** 0.21*** (357)	0.11** 0.08 (357)	0.57*** 0.40*** (357)	0.41*** 0.38*** (357)	0.34*** 0.22*** (357)	0.62*** 0.24*** (357)	0.61*** 0.20*** (357)	1.00 (357)					
L-MN	0.21*** 0.22*** (350)	0.15*** 0.14*** (332)	0.19*** 0.16*** (357)	0.38*** 0.35*** (357)	0.40*** 0.29*** (357)	0.25*** 0.16*** (357)	0.32*** 0.20*** (357)	0.30*** 0.30*** (357)	0.22*** 0.38*** (357)	0.34*** 0.25*** (357)	1.00 (357)				
L-NA	0.22*** 0.16*** (349)	0.22*** 0.17*** (332)	0.18*** -0.00 (356)	0.44*** 0.42*** (356)	0.48*** 0.31*** (356)	0.29*** 0.20*** (356)	0.45*** 0.36*** (356)	0.37*** 0.41*** (356)	0.31*** 0.21*** (356)	0.20*** 0.00 (356)	0.44*** 0.41*** (356)	1.00 (356)			
L-CA	-0.13** -0.09* (350)	-0.14** -0.09* (332)	-0.12** -0.09 (357)	-0.04 -0.06 (357)	-0.43*** -0.47*** (357)	-0.25*** -0.27*** (357)	-0.31*** -0.33*** (357)	-0.30*** -0.43*** (357)	-0.29*** -0.39*** (357)	-0.23*** -0.29*** (357)	-0.21*** -0.20*** (357)	-0.21*** -0.21*** (356)	1.00 (357)		
L-SR	0.03 -0.00 (350)	0.26*** 0.30*** (332)	0.29*** 0.36*** (357)	0.36*** 0.43*** (357)	0.04 0.04 (357)	0.02 0.01 (357)	-0.19*** -0.27*** (357)	0.04 0.06 (357)	0.01 0.01 (357)	-0.06 -0.12** (357)	-0.02 -0.01 (357)	0.15*** 0.13** (356)	0.62*** 0.57*** (357)	1.00 (357)	
L-MG	-0.02 -0.13** (350)	-0.03 0.01 (332)	0.08 0.01 (357)	-0.04 -0.01 (357)	0.31*** 0.33*** (357)	0.46*** 0.44*** (357)	0.42*** 0.24*** (357)	0.14*** 0.25*** (357)	0.17*** 0.18*** (357)	0.14*** 0.04 (357)	0.14*** 0.03 (357)	0.18*** 0.05 (356)	0.24*** 0.13** (357)	0.21*** 0.10* (357)	1.00 (357)

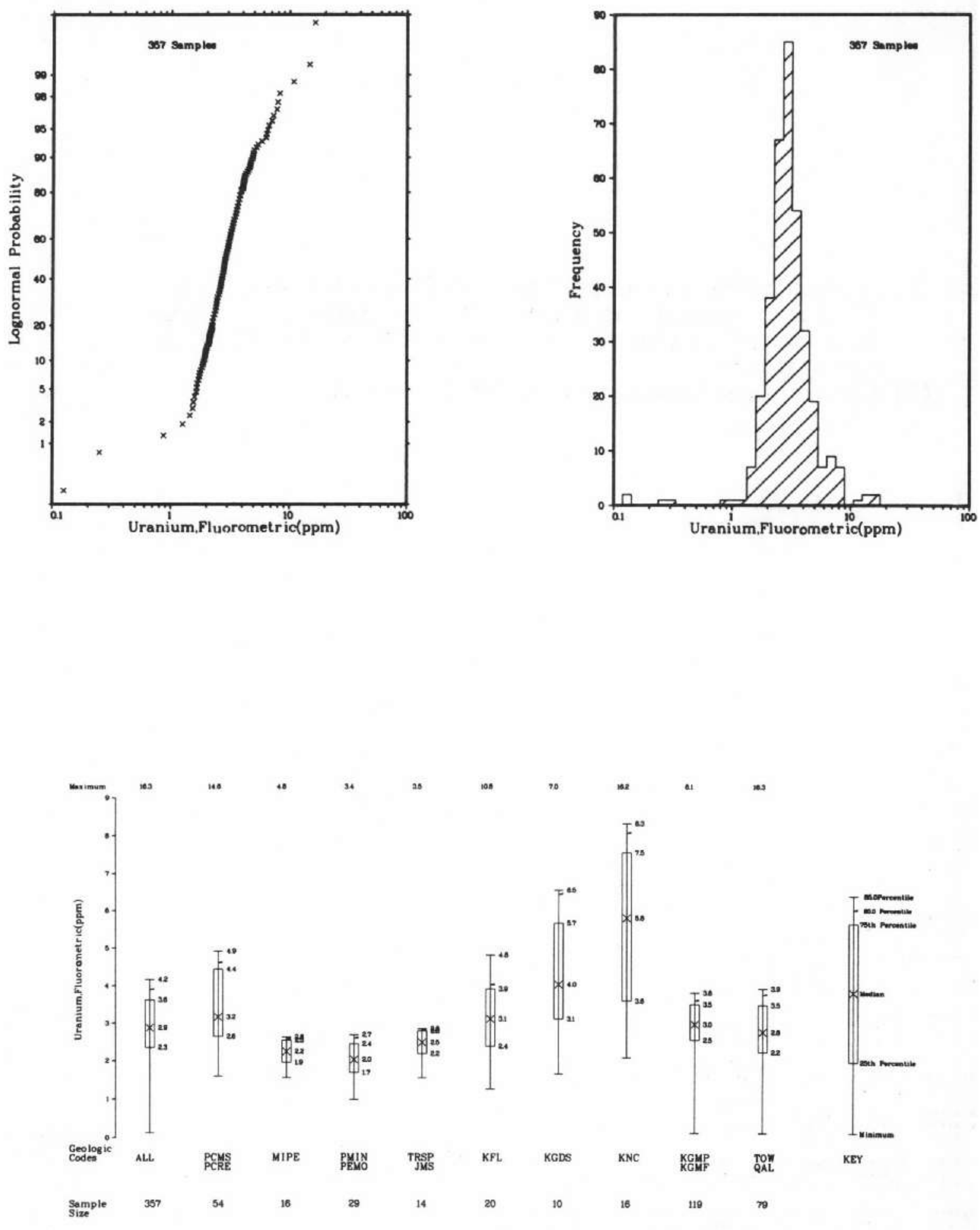


Figure B-1a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SOLUBLE URANIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

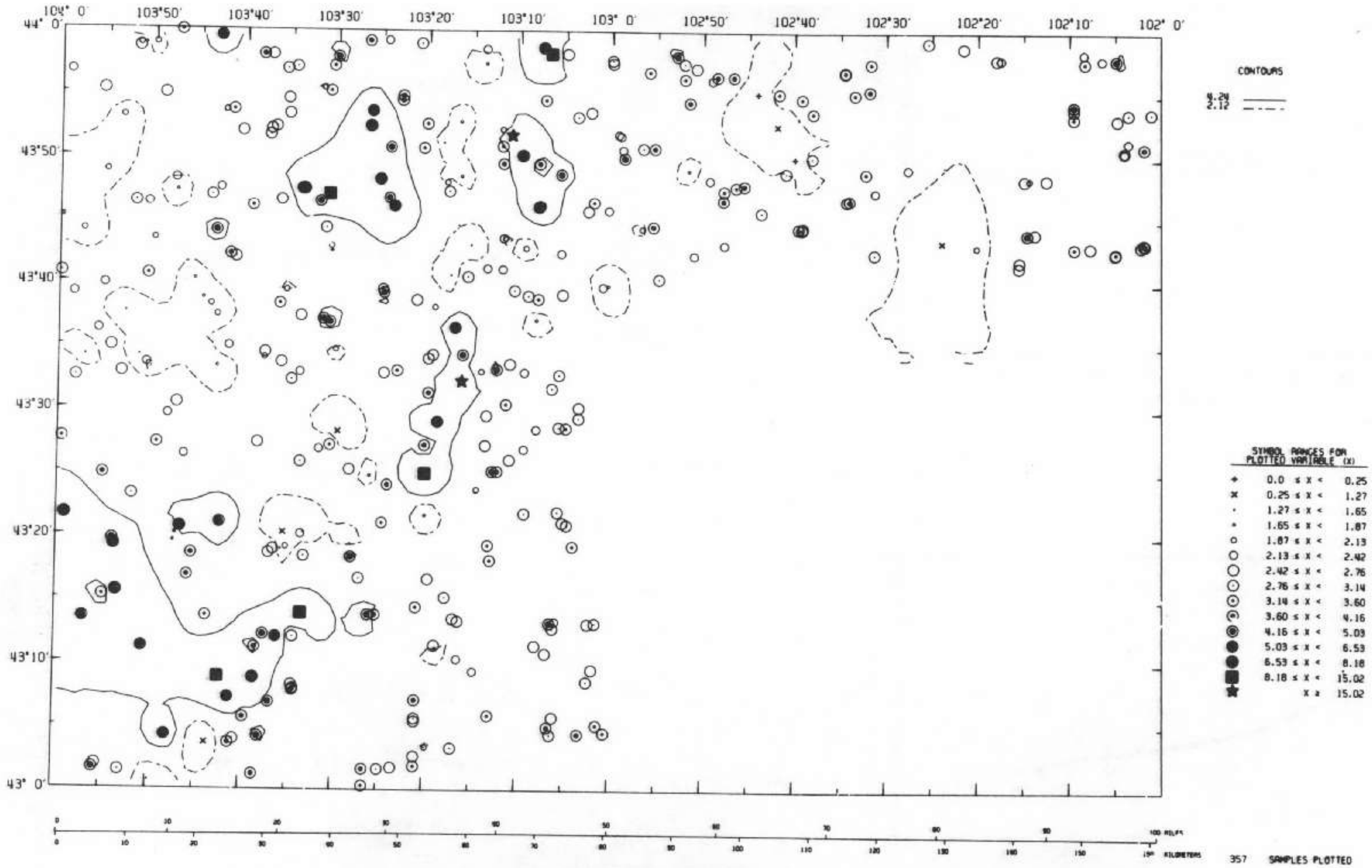


Figure B-1b

GEOCHEMICAL DISTRIBUTION OF SOLUBLE URANIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

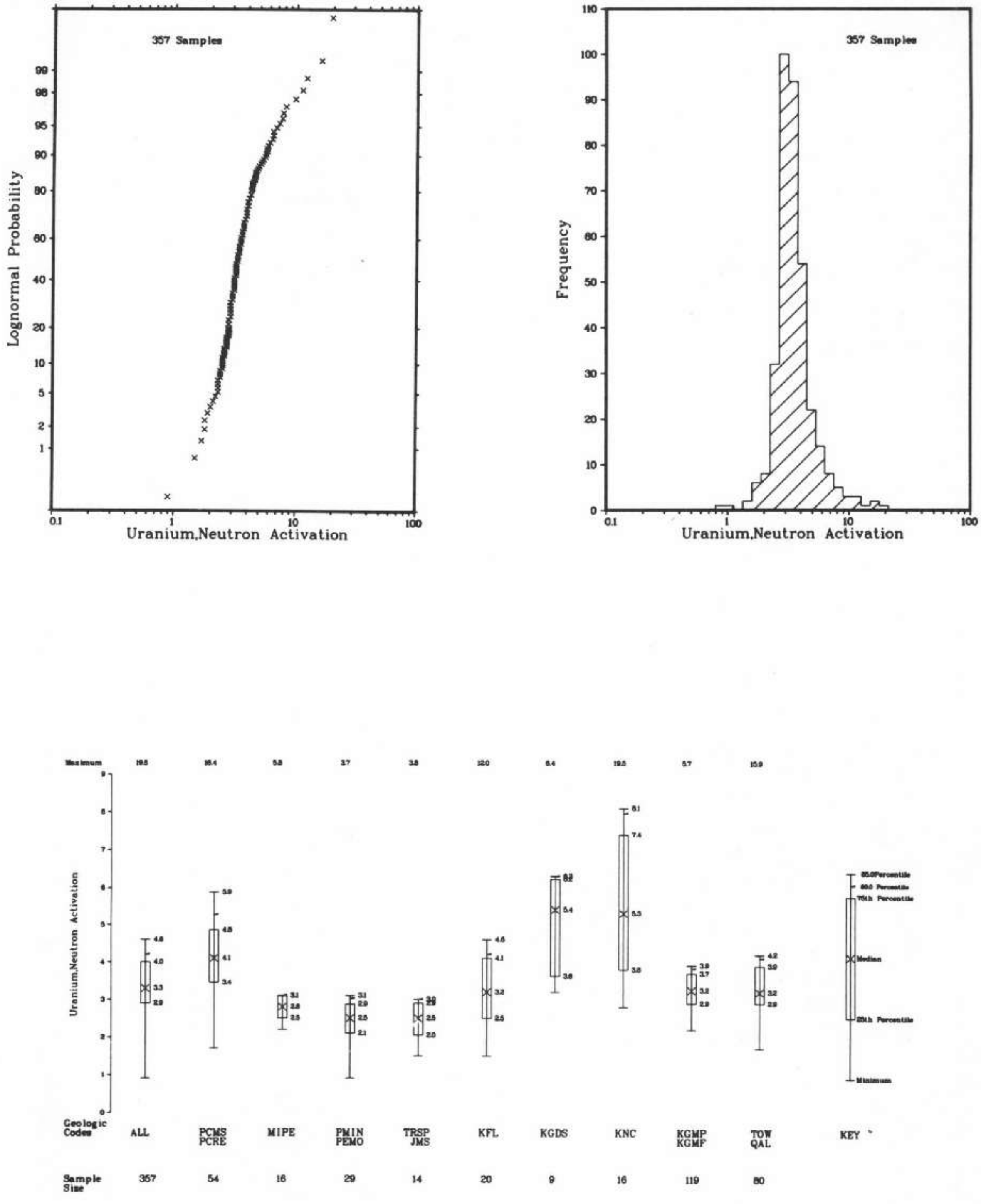


Figure B-2a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM BY NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

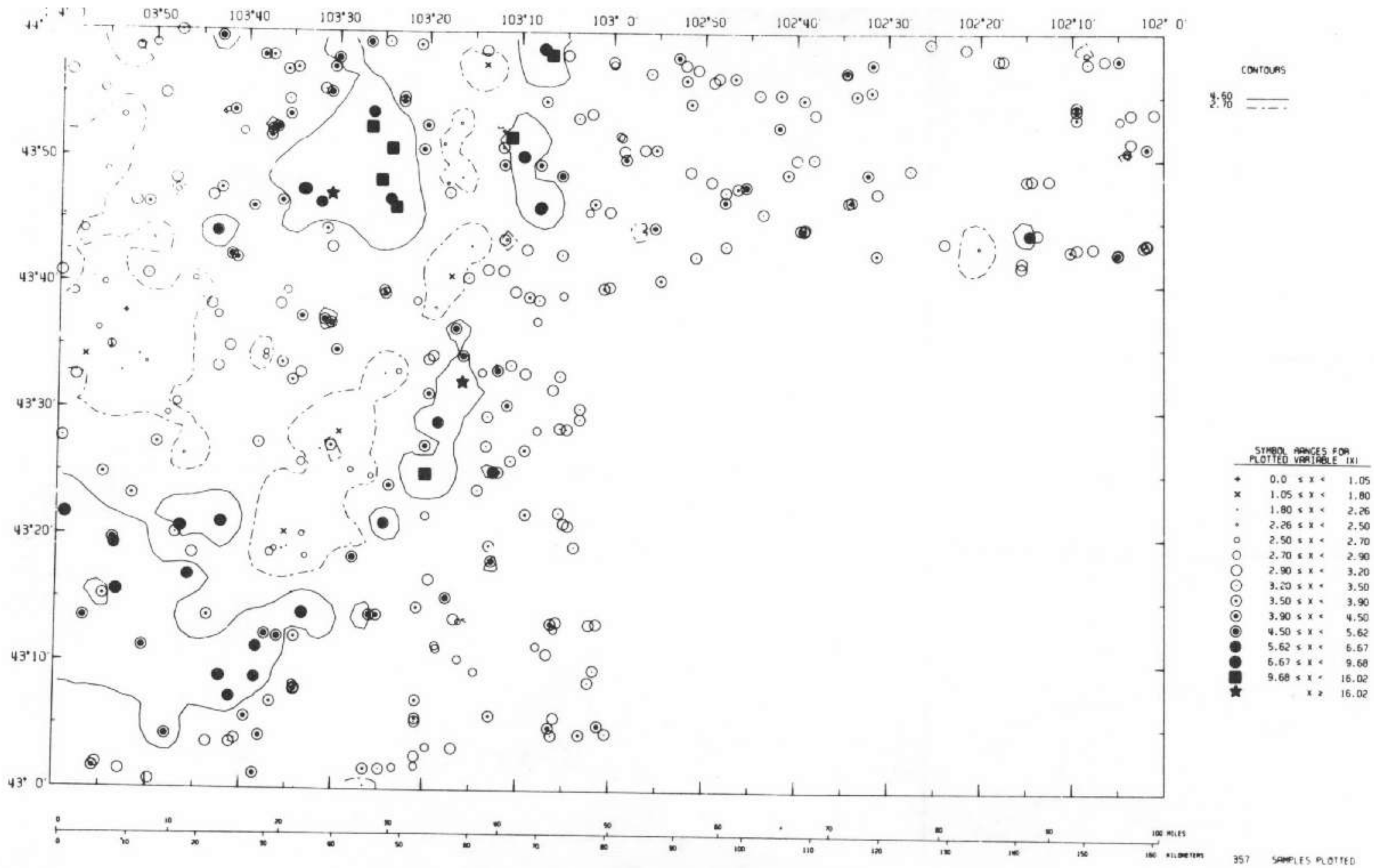


Figure B-2b

GEOCHEMICAL DISTRIBUTION OF URANIUM BY NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

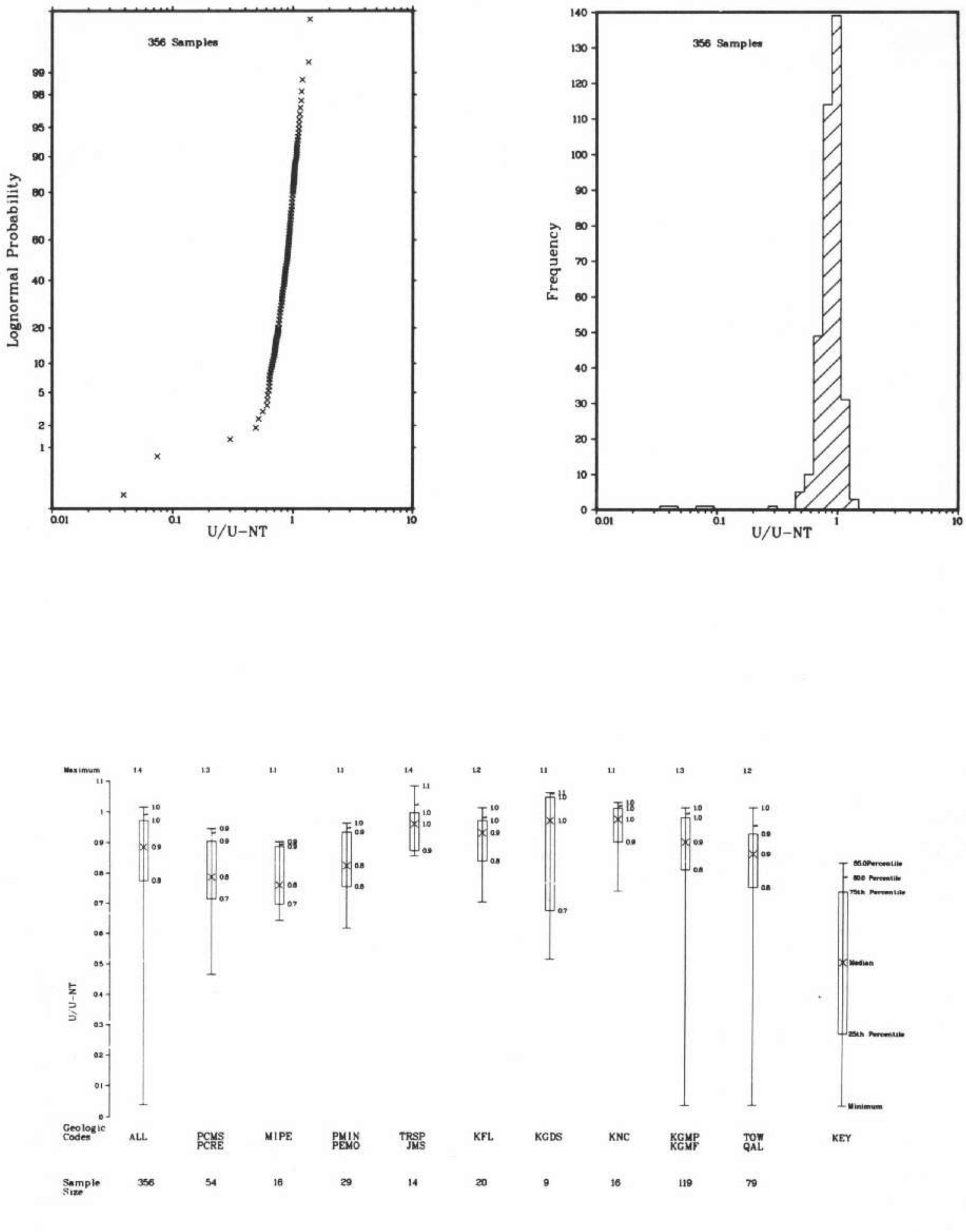


Figure B-3a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR URANIUM FLUOROMETRIC/
URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

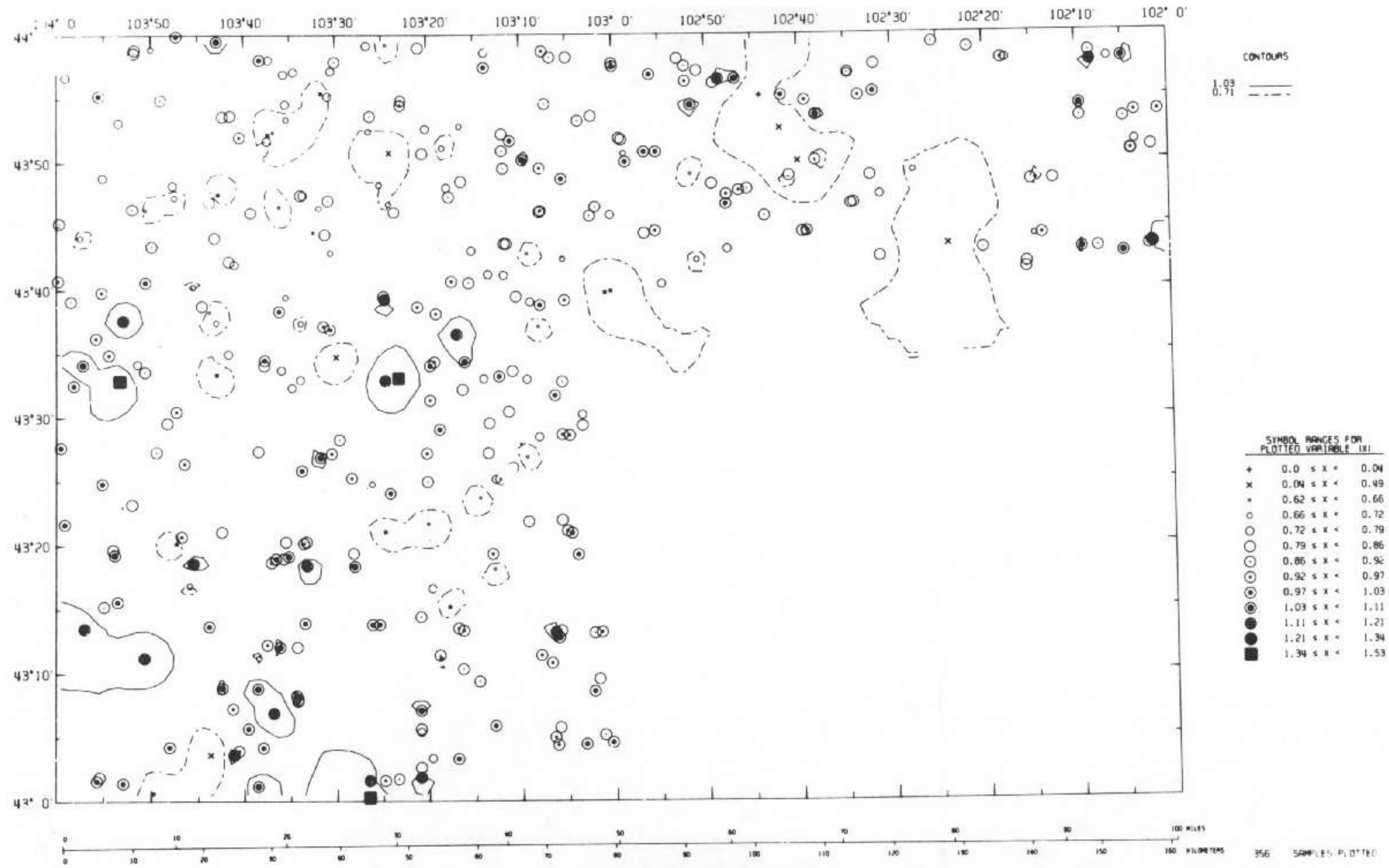


Figure B-3b

GEOCHEMICAL DISTRIBUTION OF URANIUM FLUOROMETRIC/URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

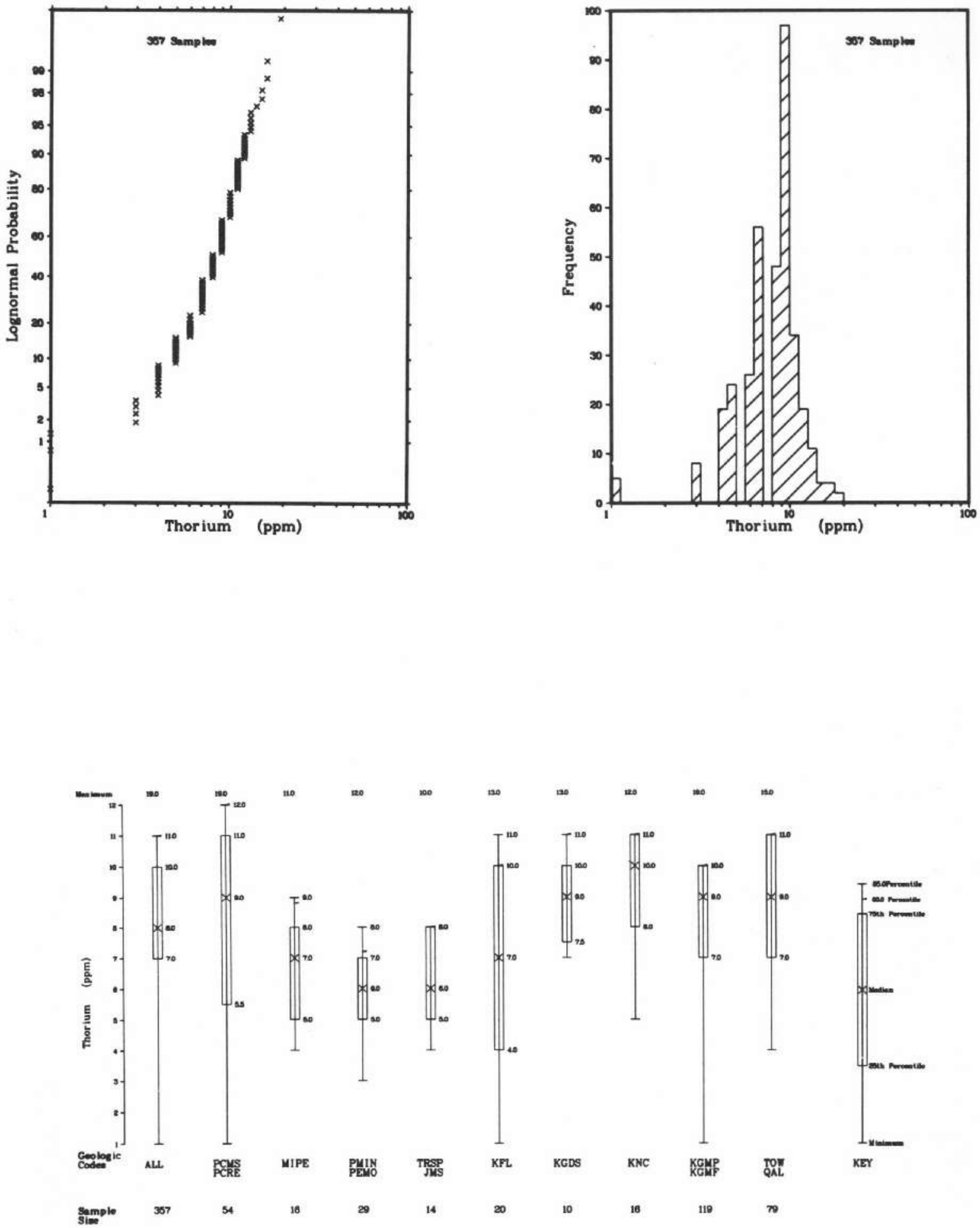


Figure B-4a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR THORIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

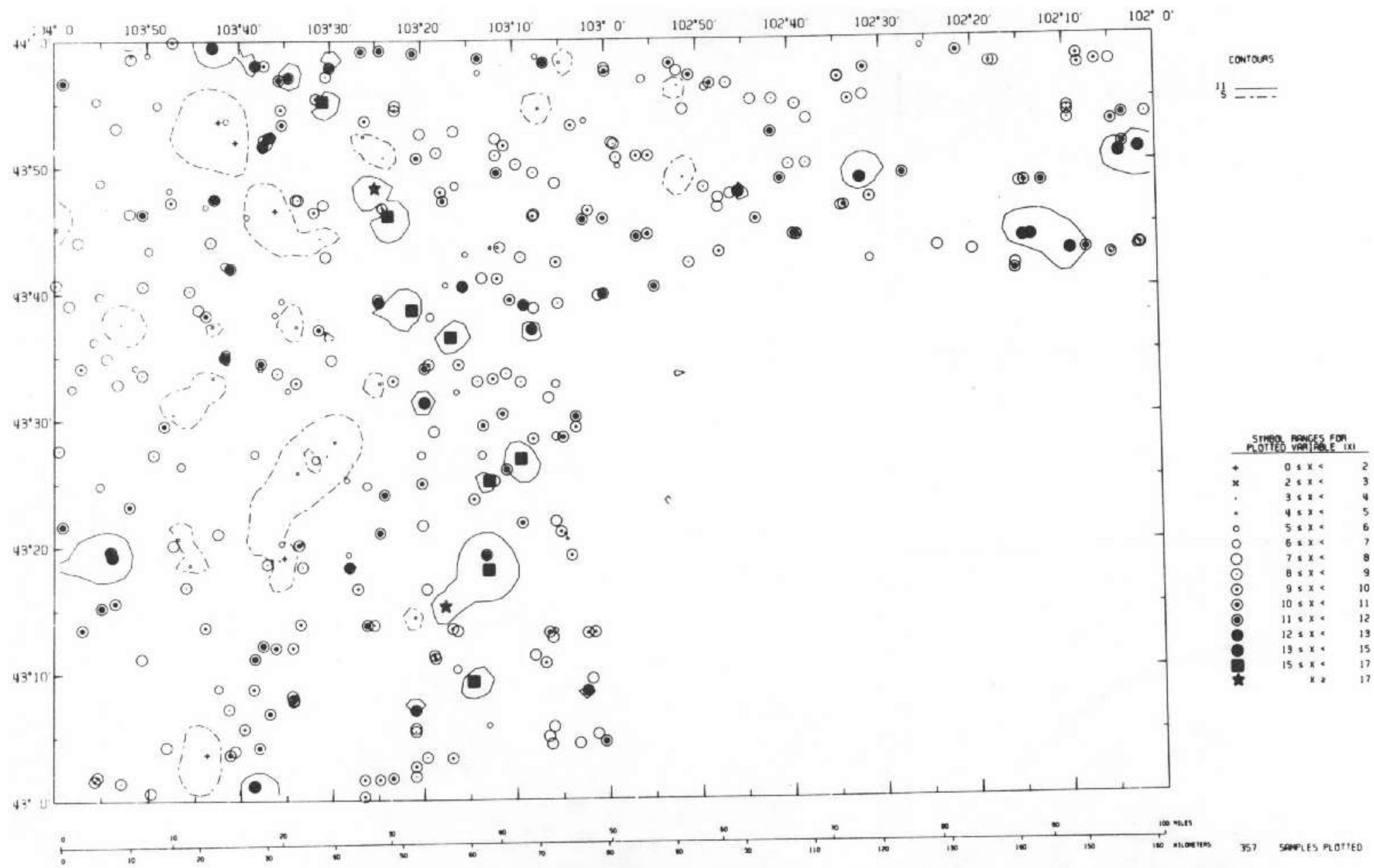


Figure B-4b

GEOCHEMICAL DISTRIBUTION OF THORIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

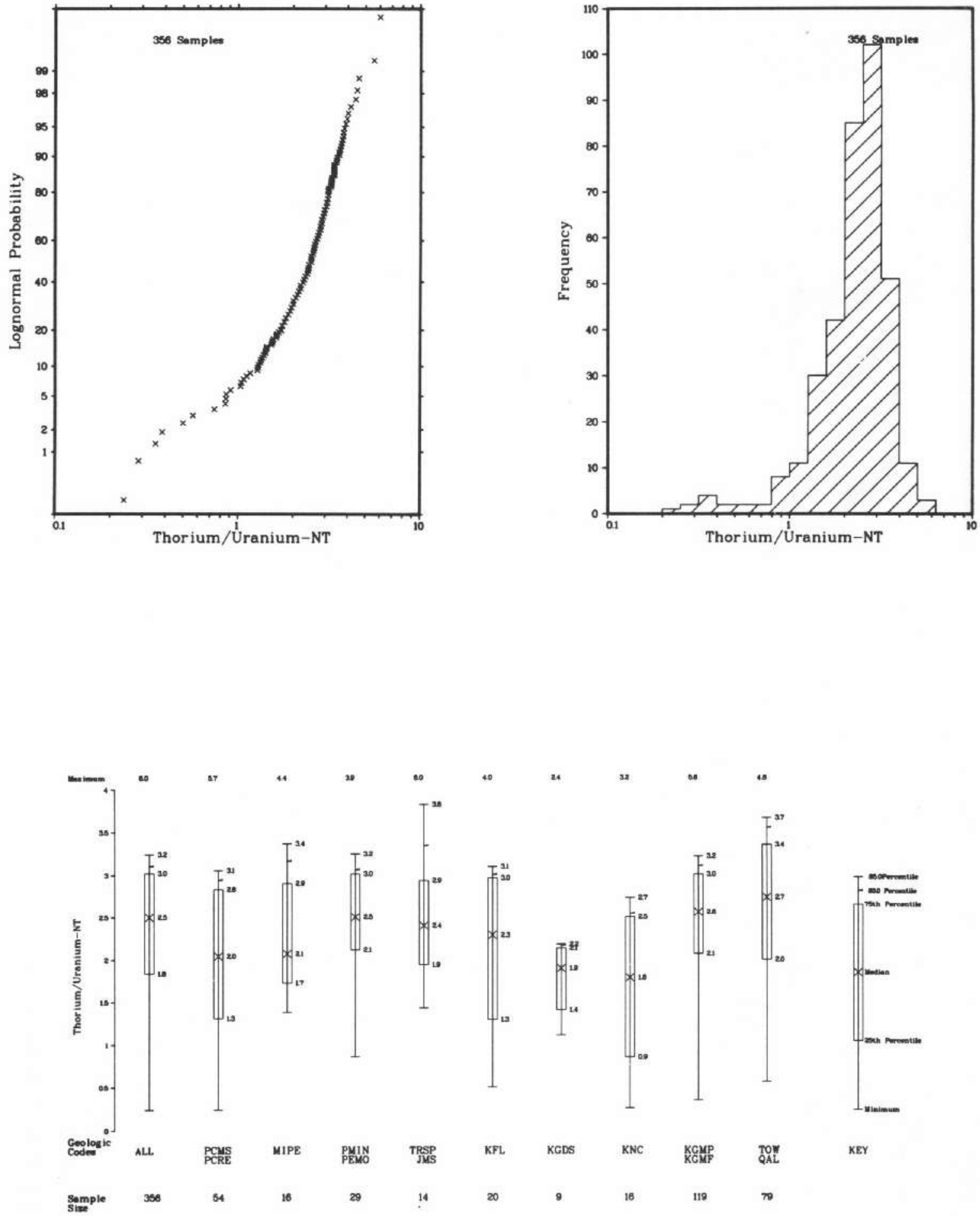


Figure B-5a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR THORIUM/URANIUM NEUTRON ACTIVATION IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

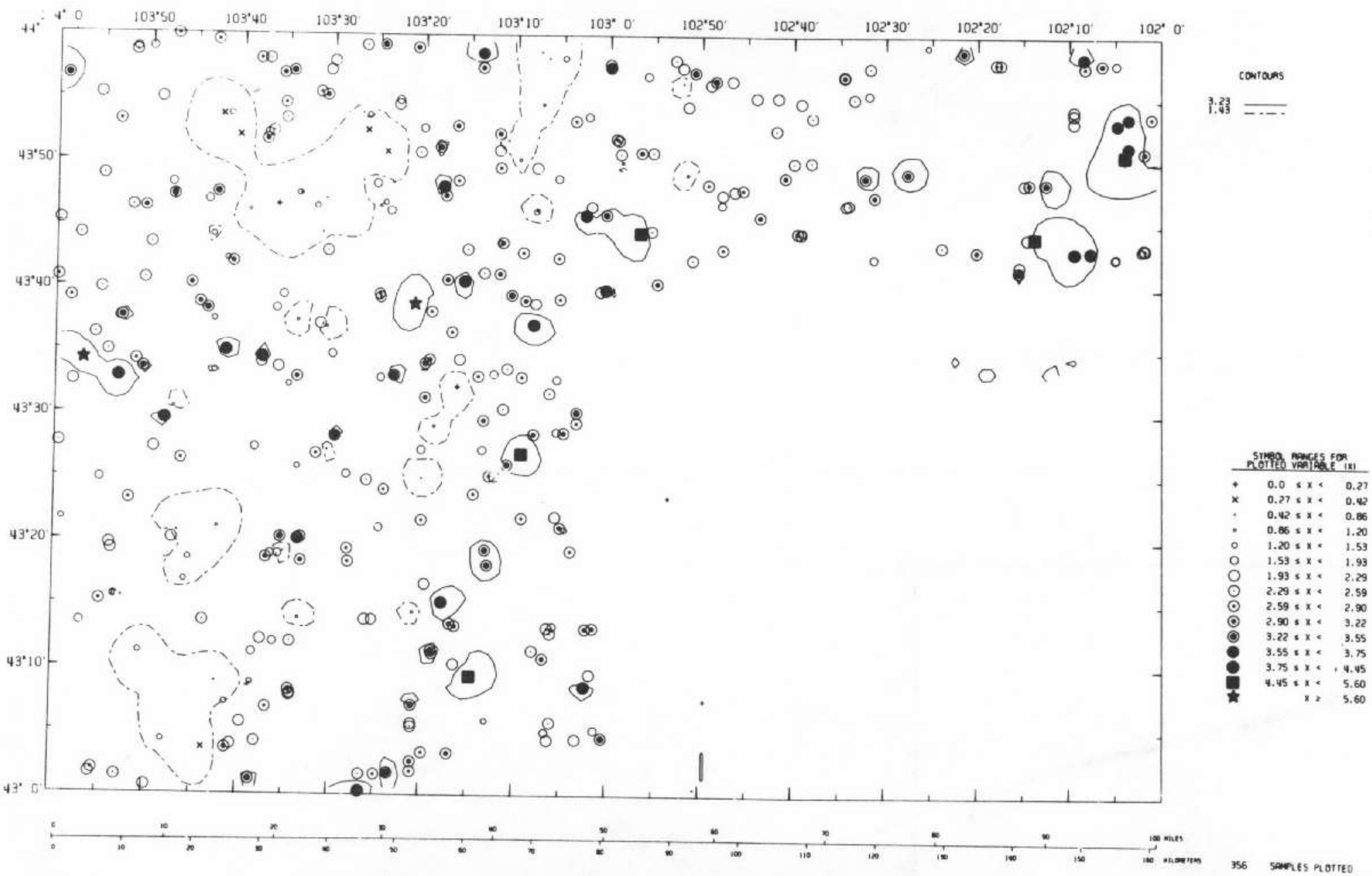
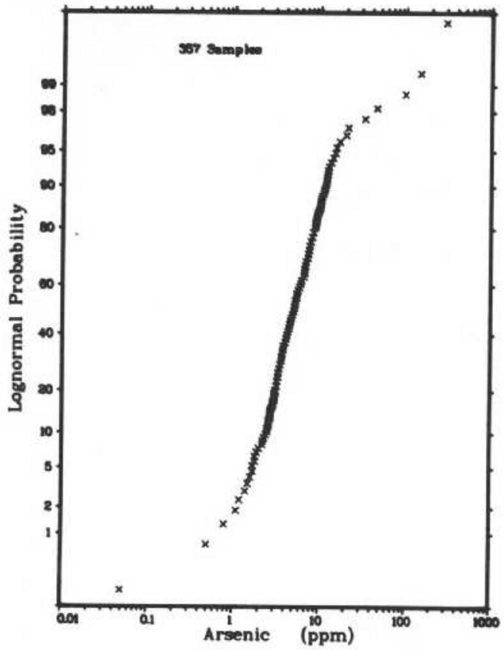
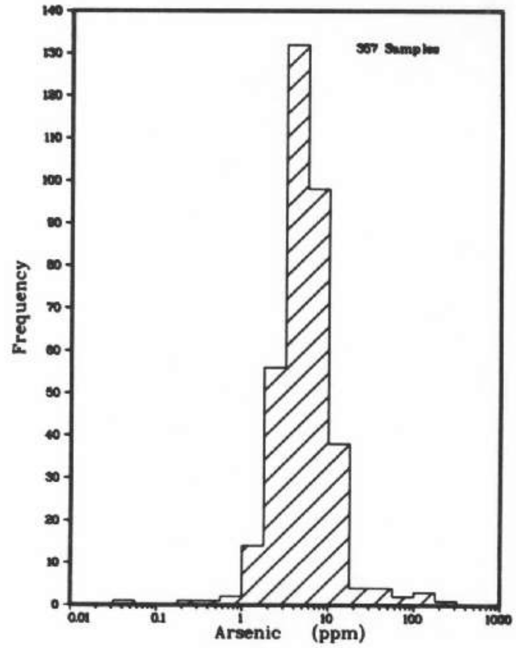


Figure B-5b

GEOCHEMICAL DISTRIBUTION OF THORIUM/URANIUM NEUTRON ACTIVATION
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





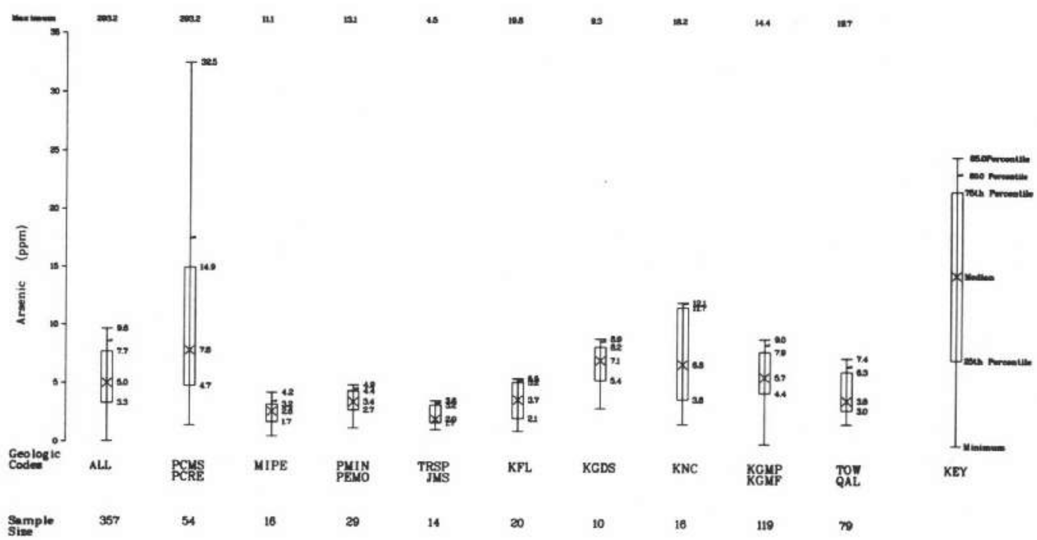


Figure B-6a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR ARSENIC (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUARDRANGLE

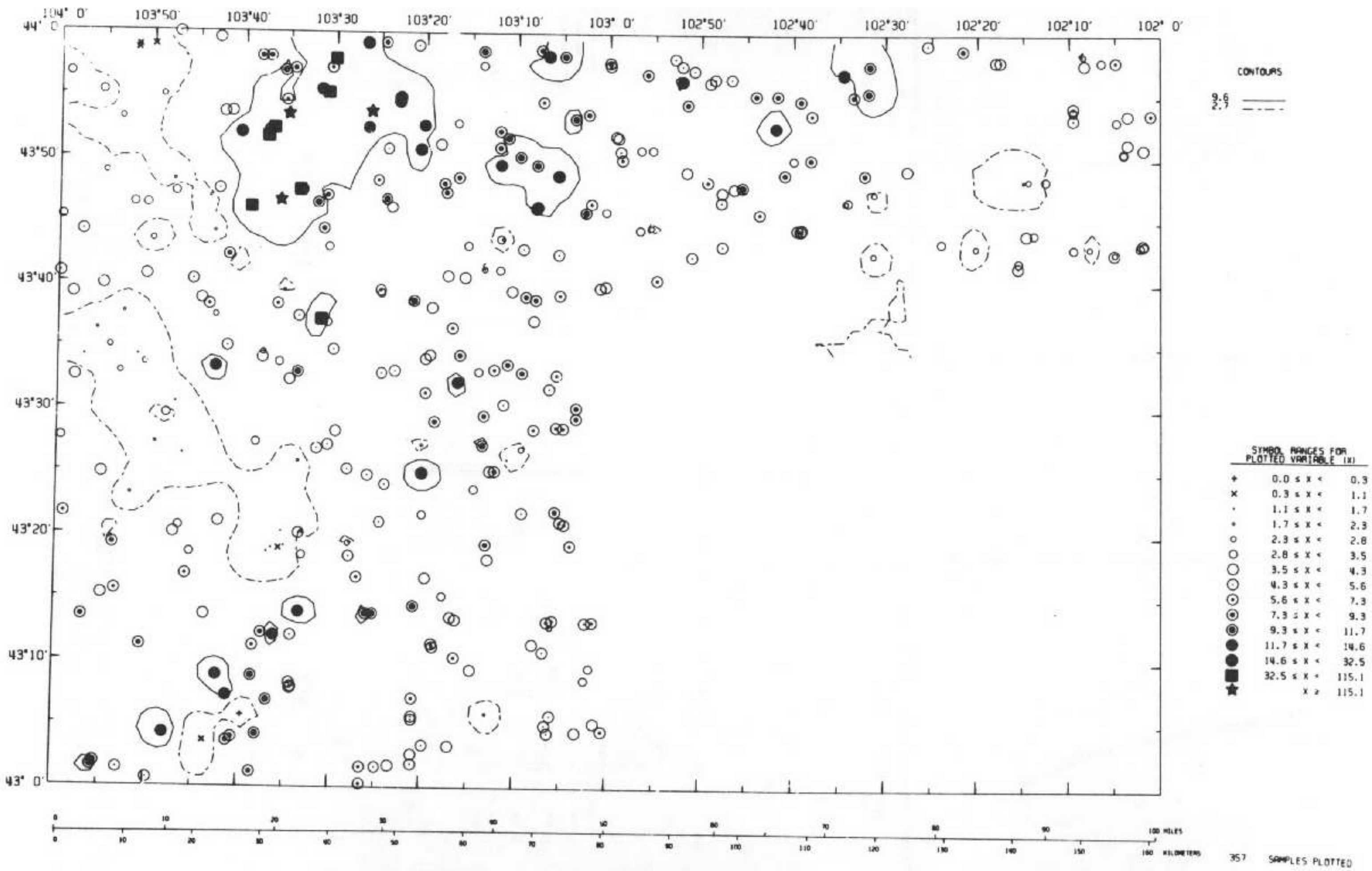


Figure B-6b

GEOCHEMICAL DISTRIBUTION OF ARSENIC (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

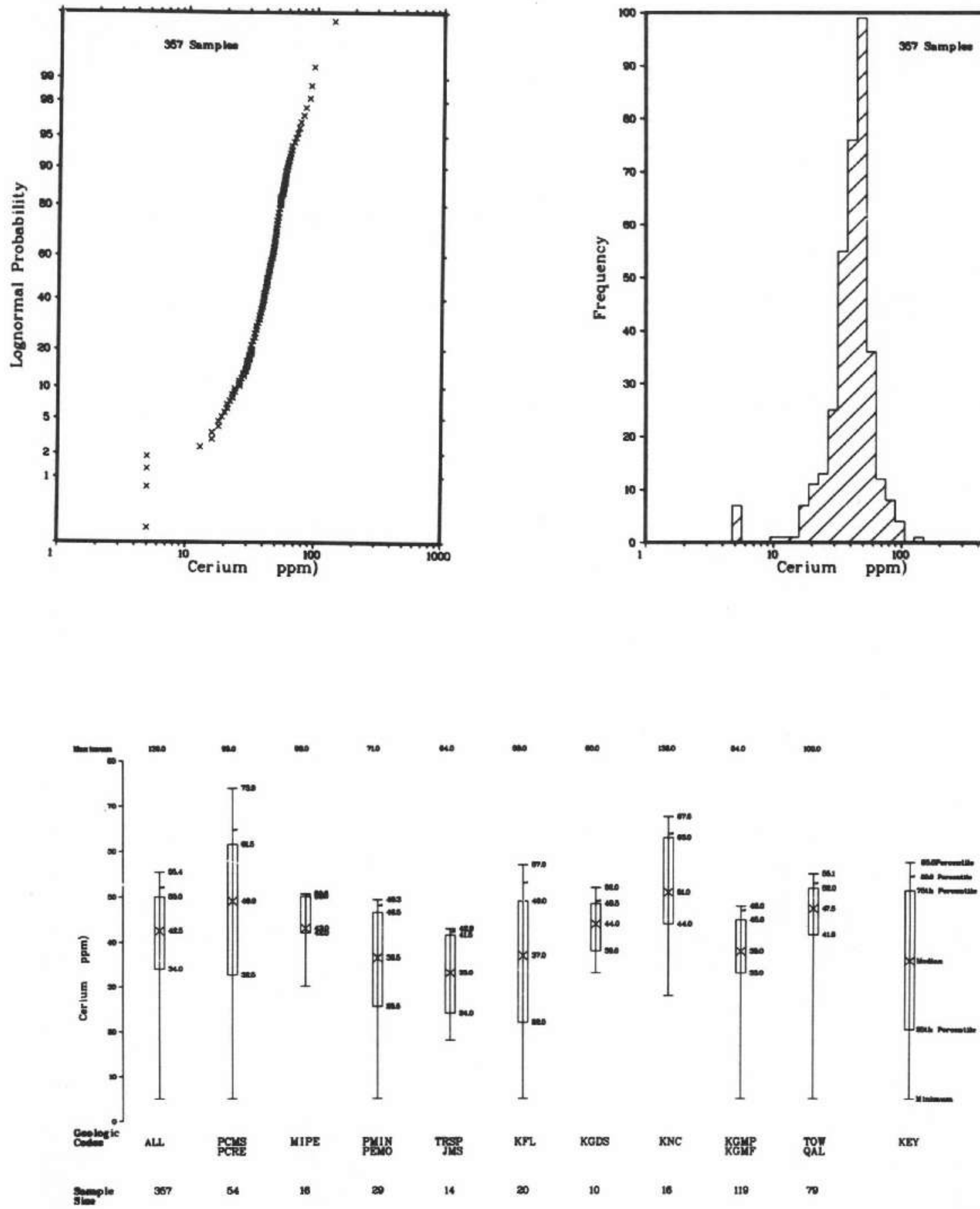


Figure B-7a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CERIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

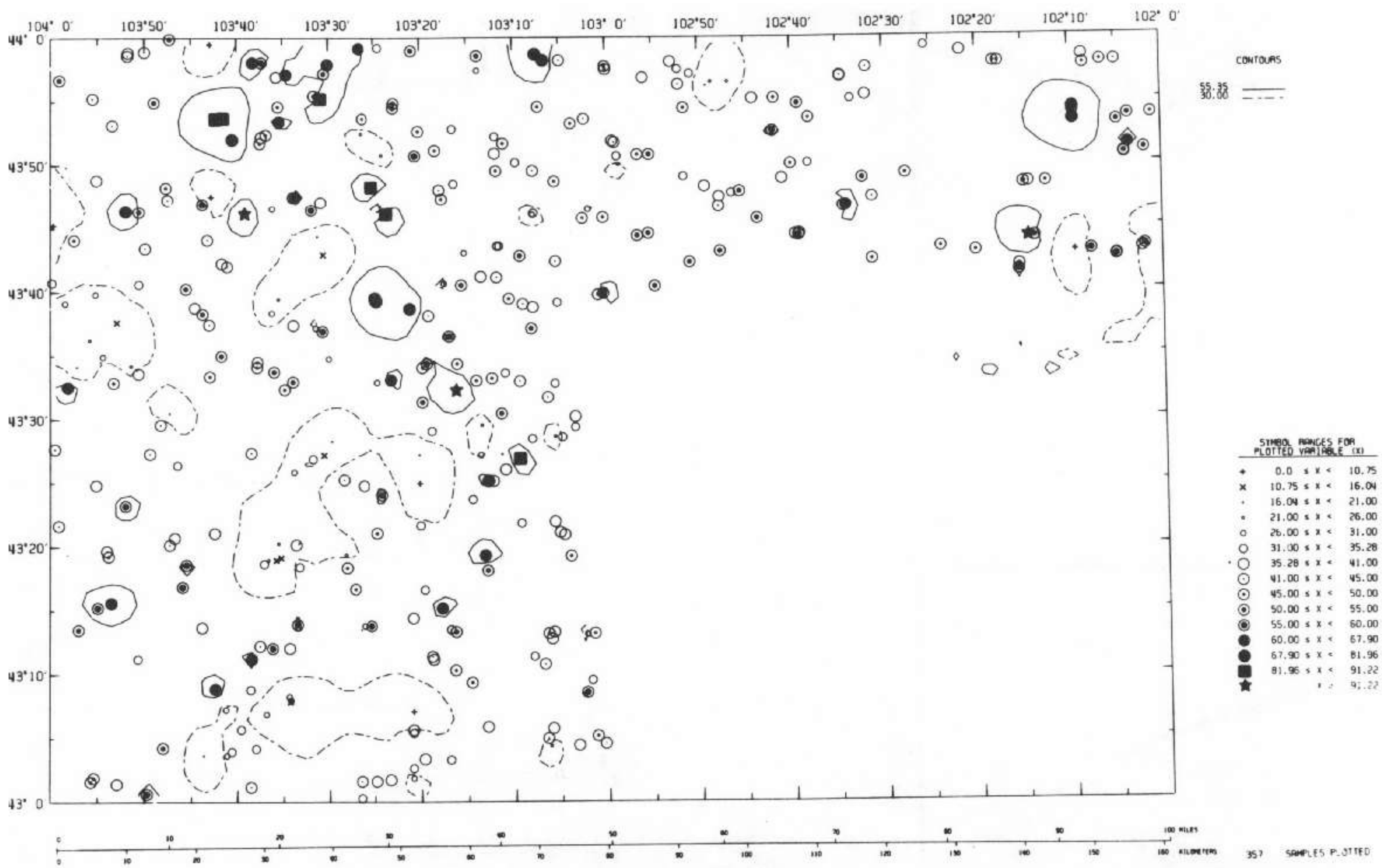


Figure B-7b

GEOCHEMICAL DISTRIBUTION OF CERIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

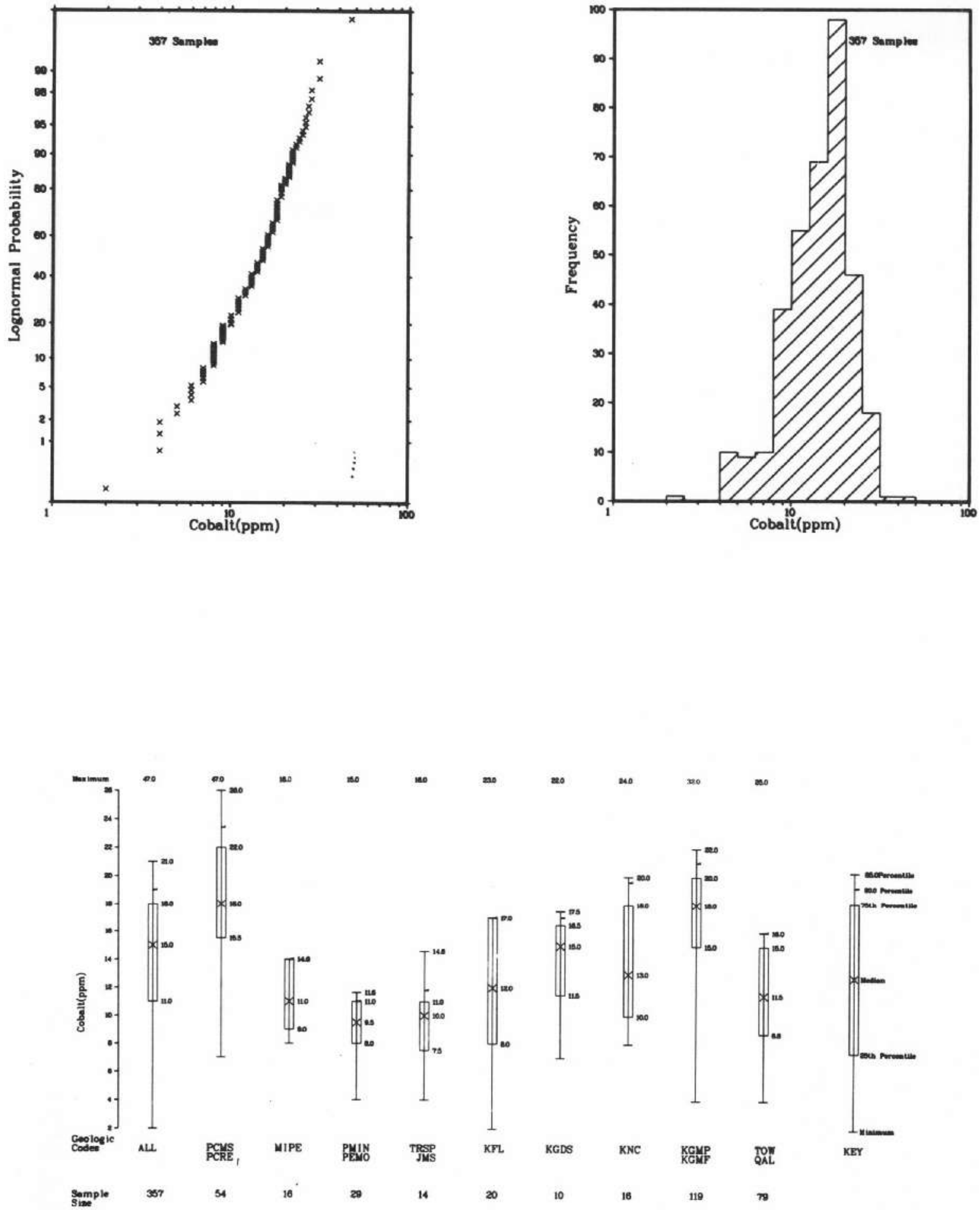


Figure B-8a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR COBALT (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

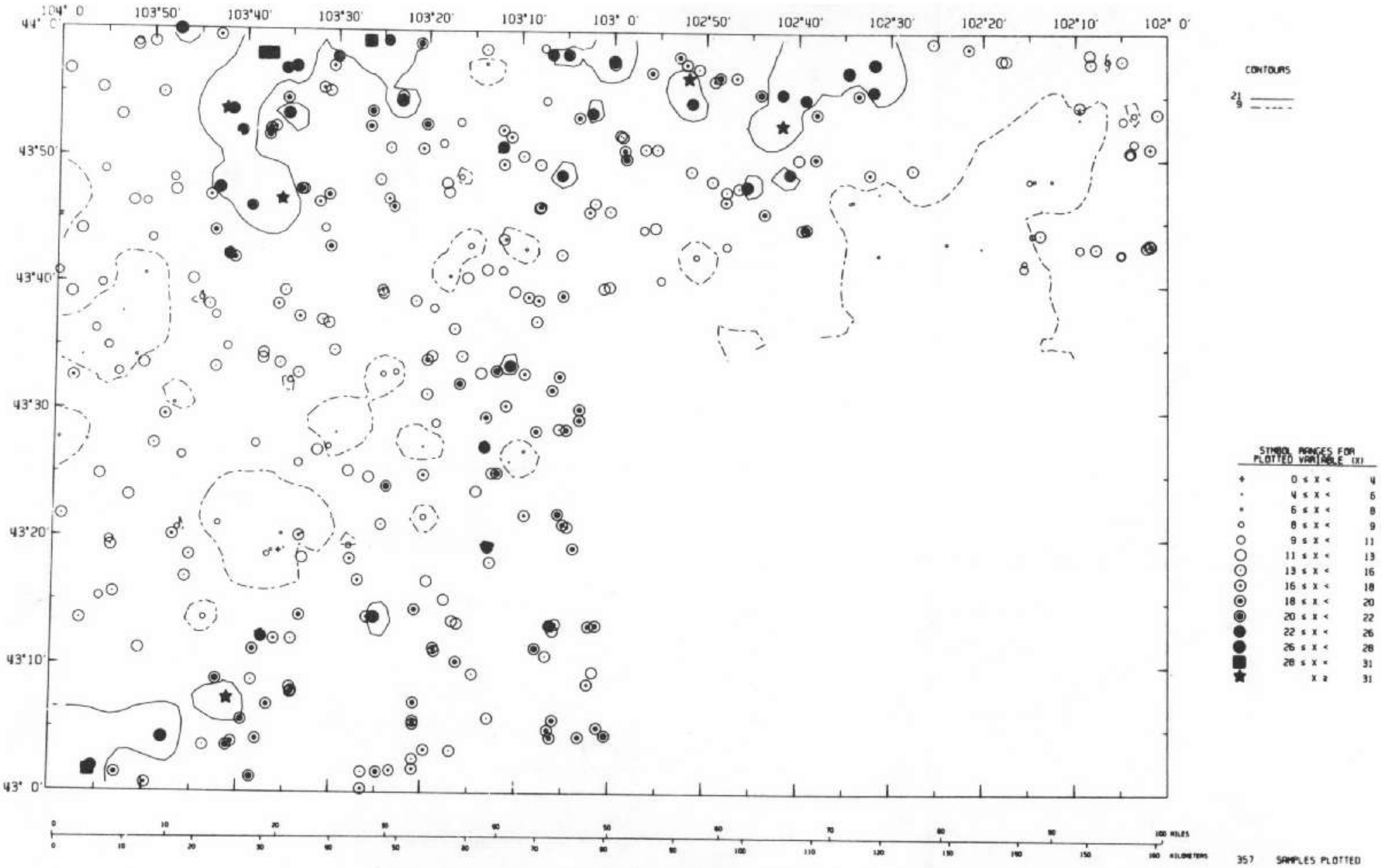


Figure B-8b

GEOCHEMICAL DISTRIBUTION OF COBALT (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

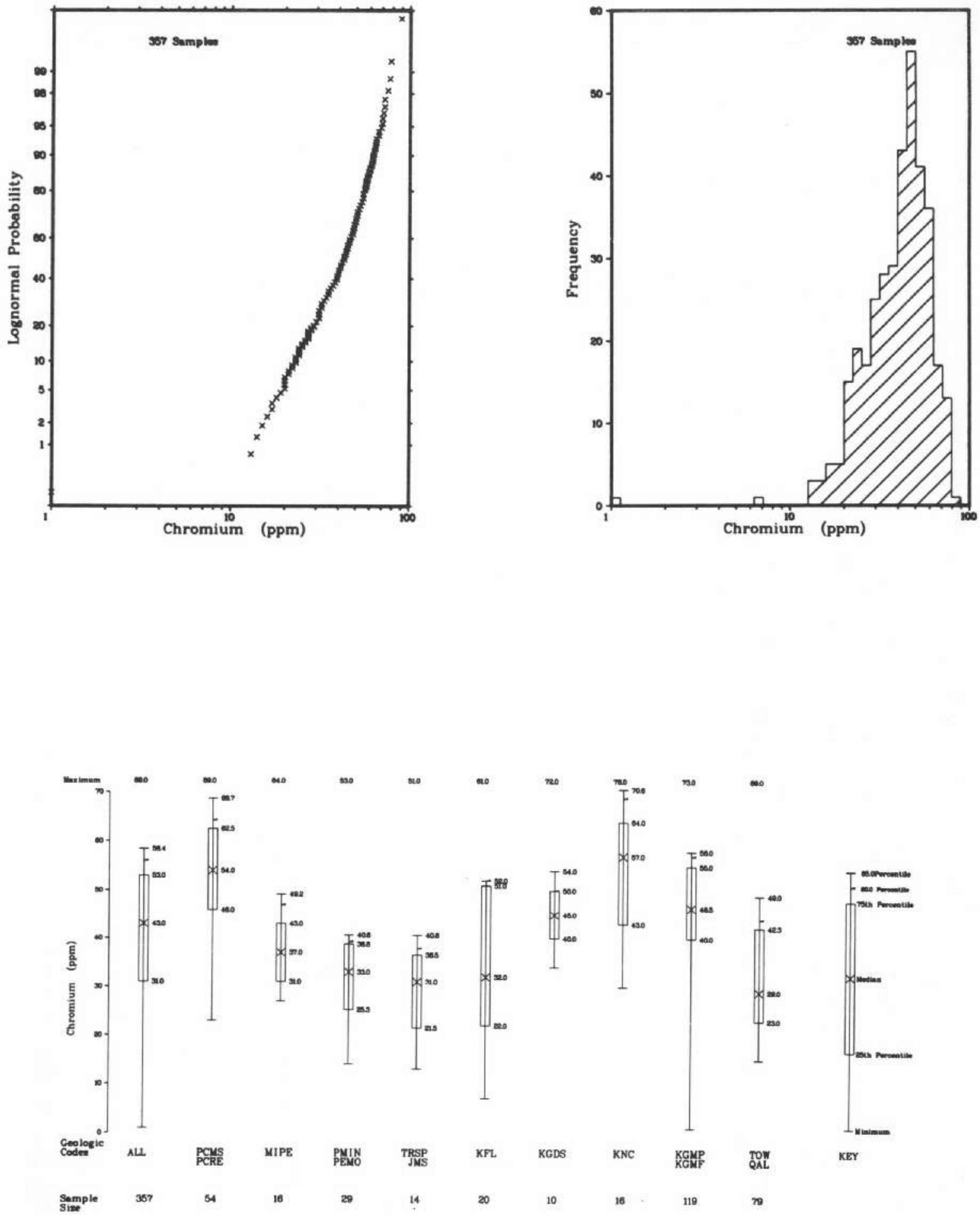


Figure B-9a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR CHROMIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

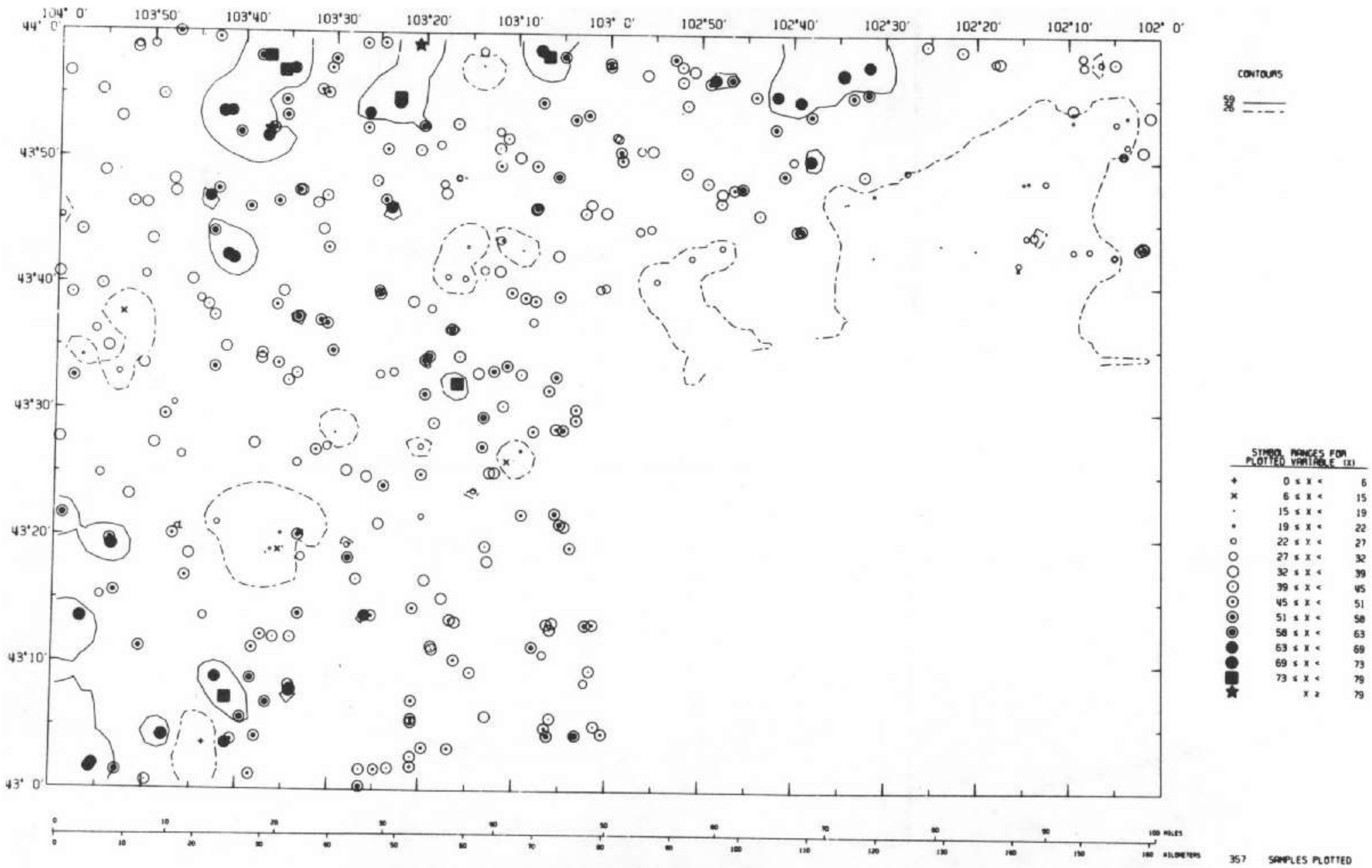


Figure B-9b

GEOCHEMICAL DISTRIBUTION OF CHROMIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

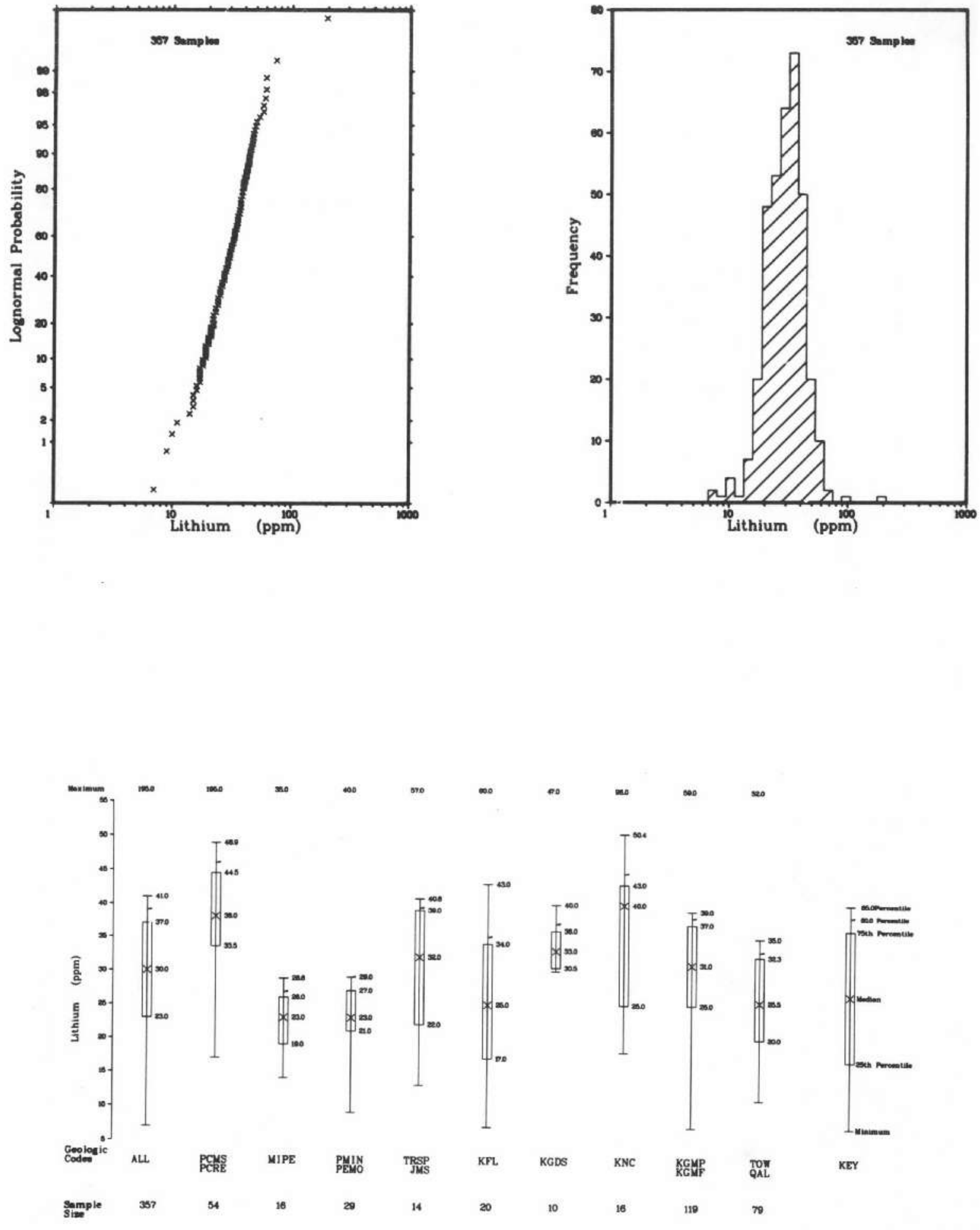


Figure B-10a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR LITHIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

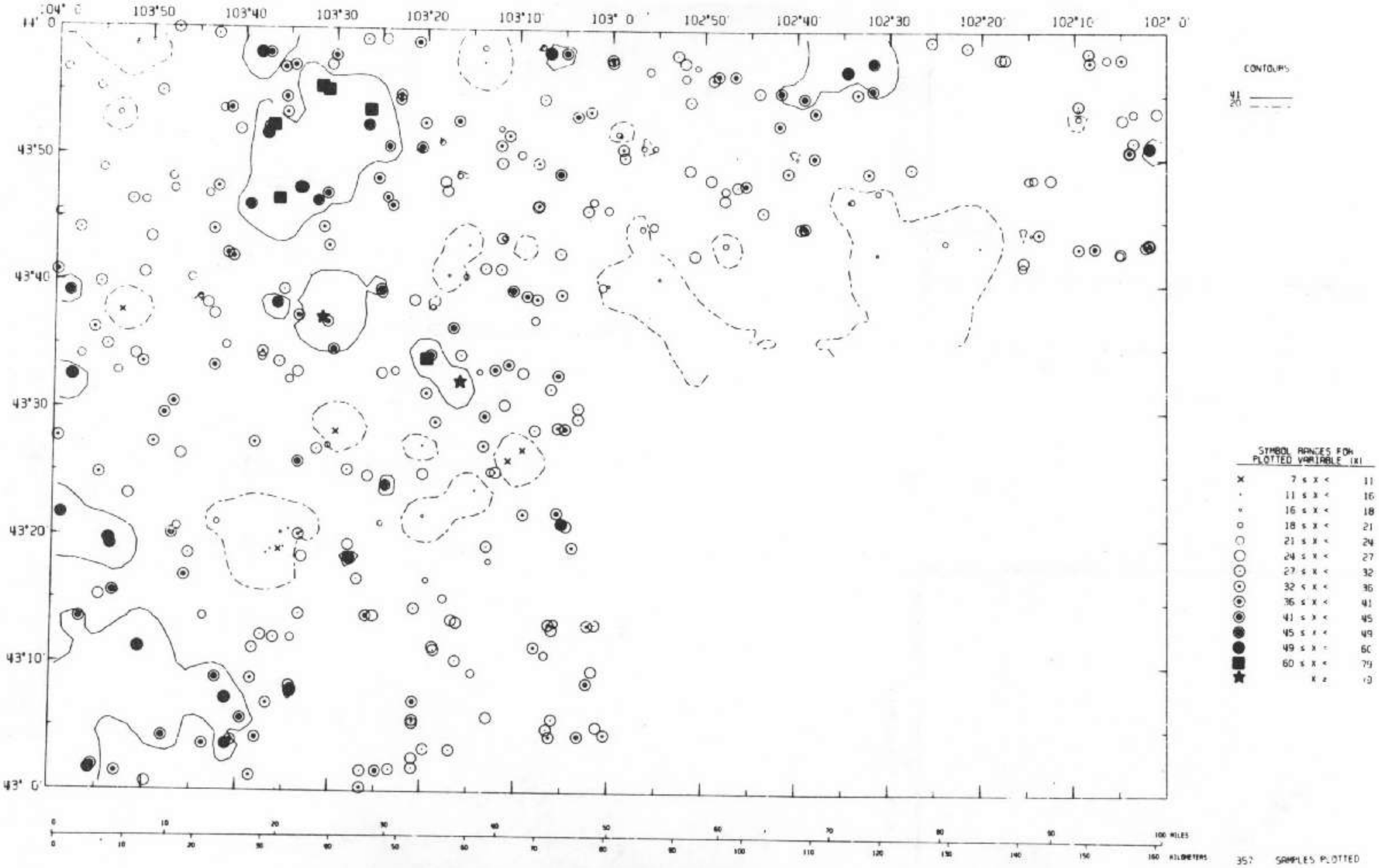


Figure B-10b

GEOCHEMICAL DISTRIBUTION OF LITHIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

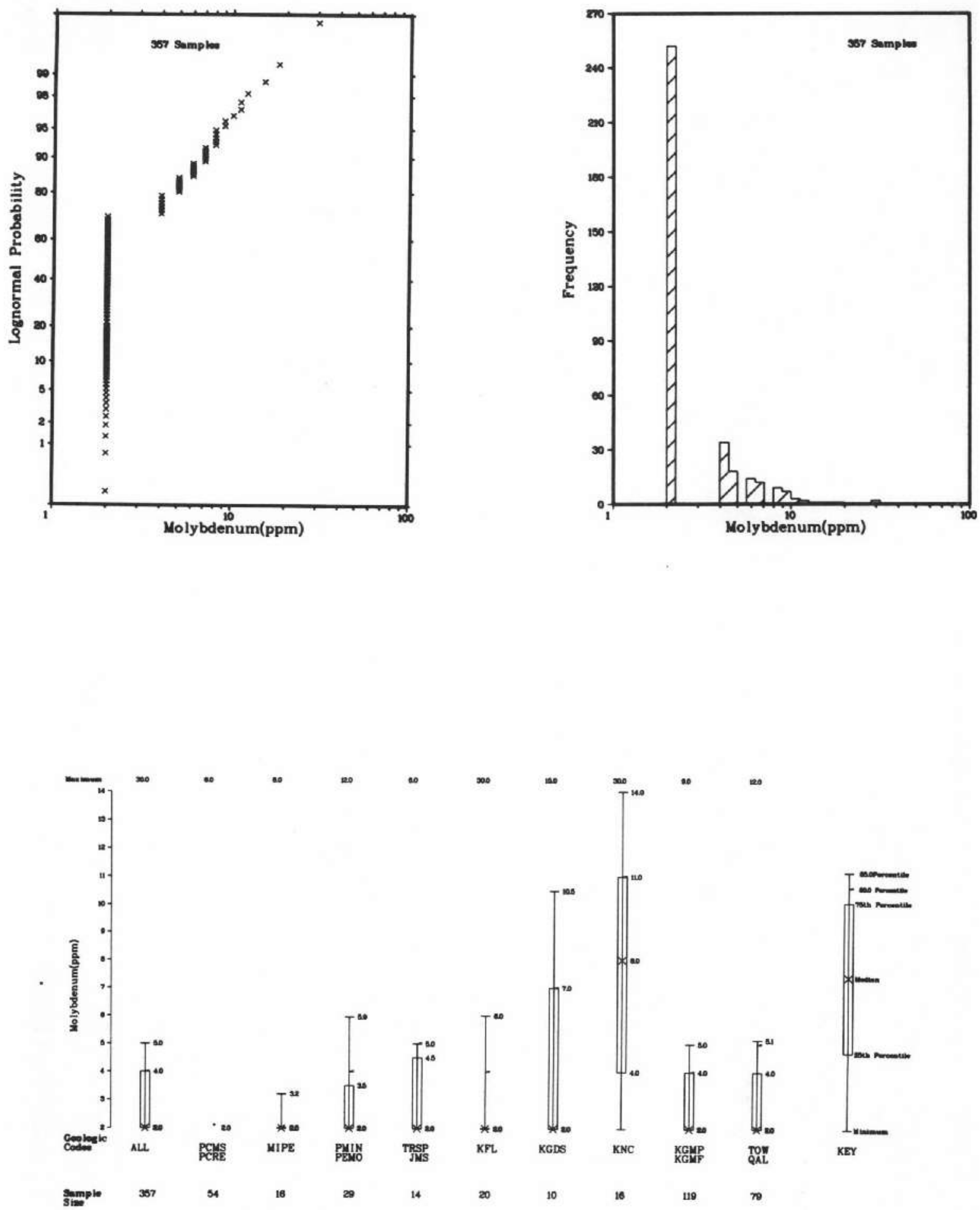


Figure B-11a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR MOLYBDENUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

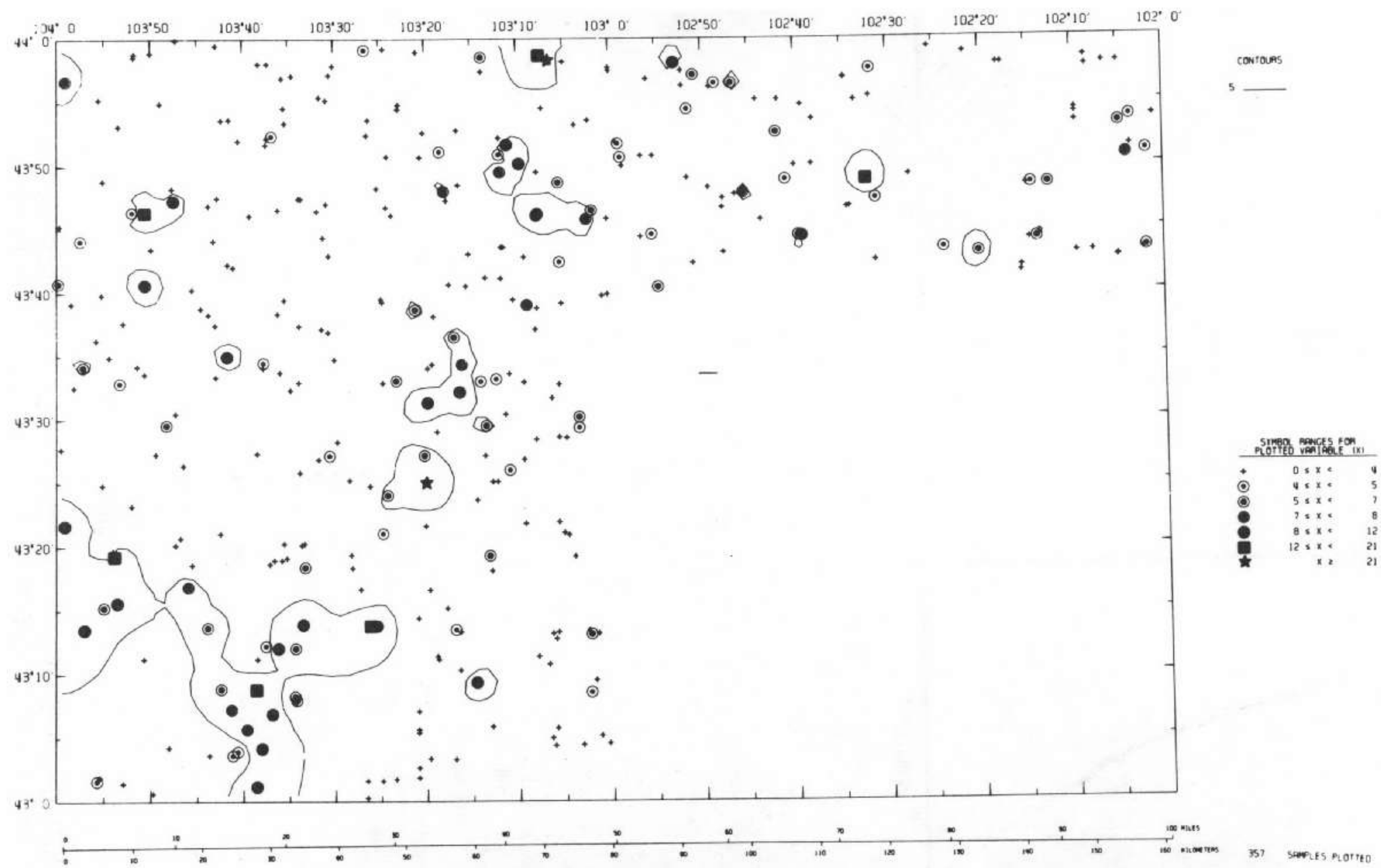
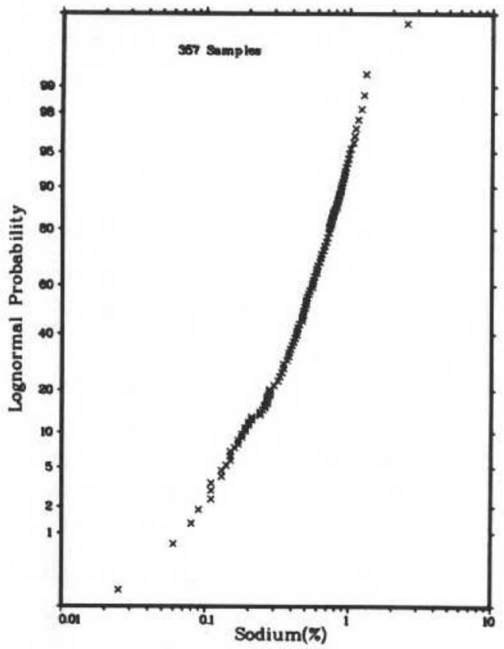
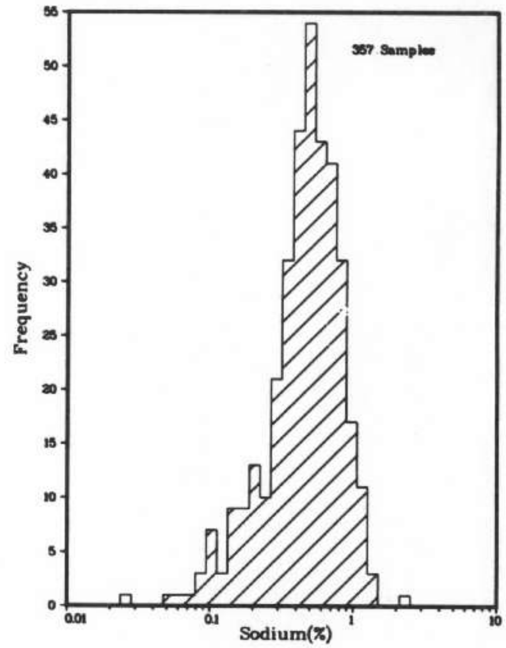


Figure B-11b

GEOCHEMICAL DISTRIBUTION OF MOLYBDENUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





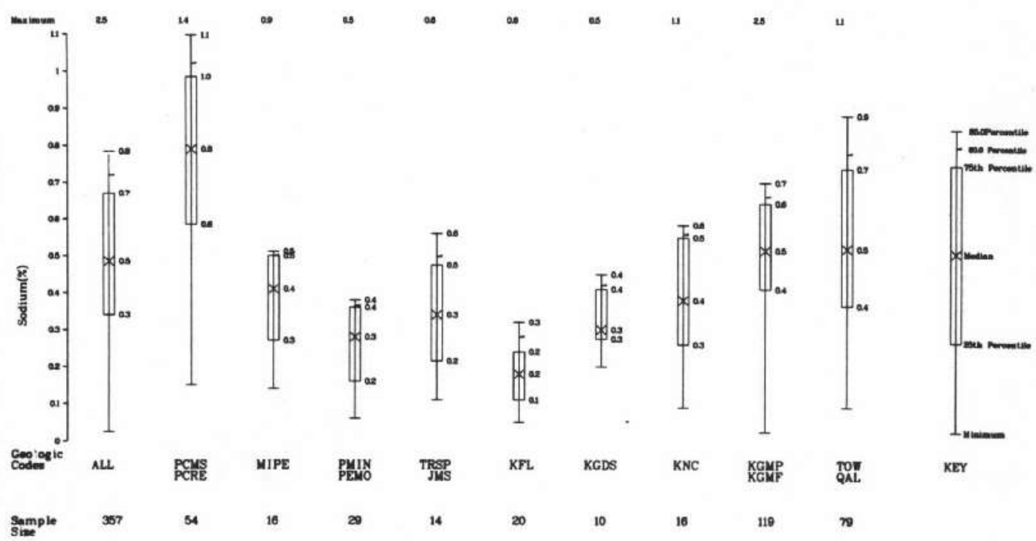


Figure B-12a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SODIUM (%)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

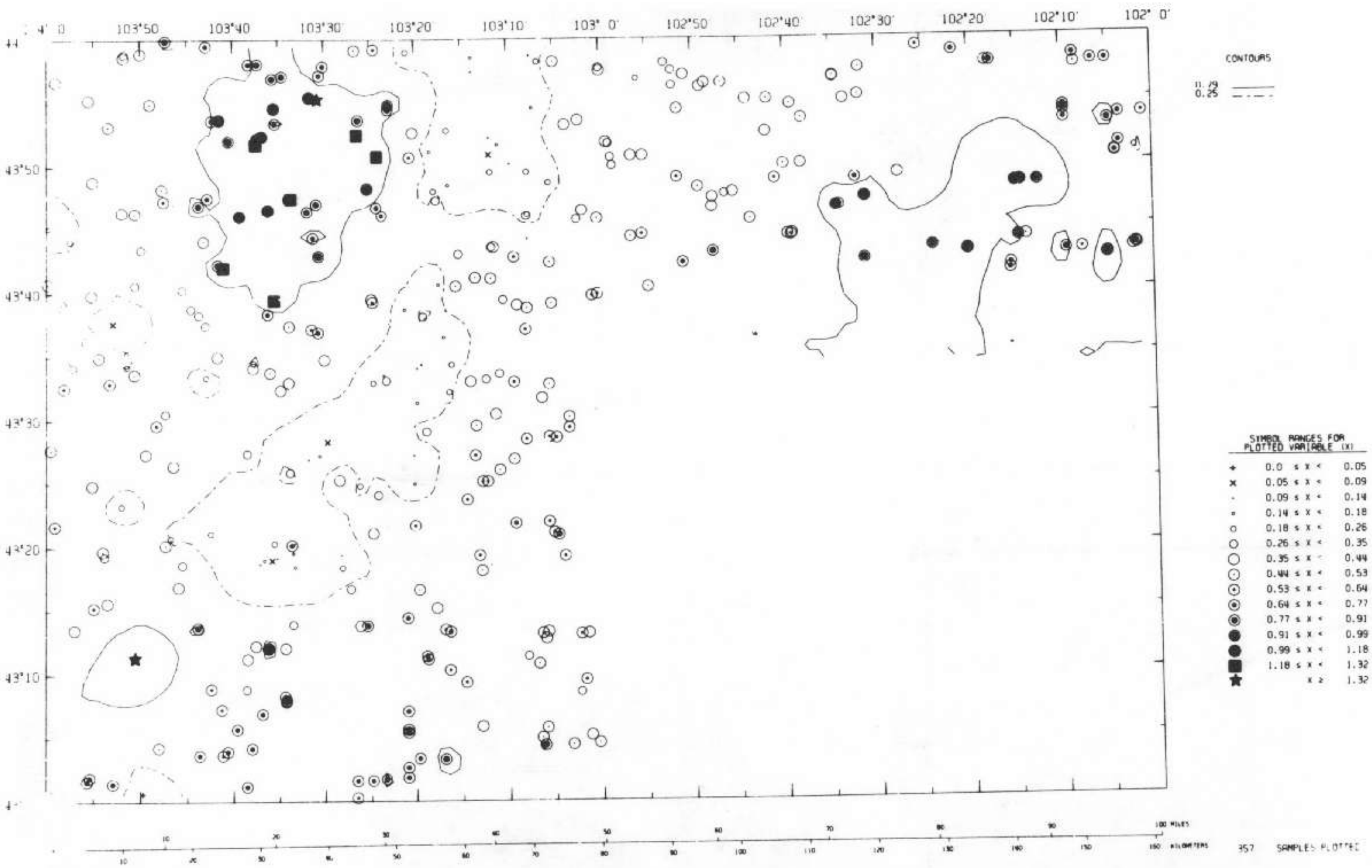
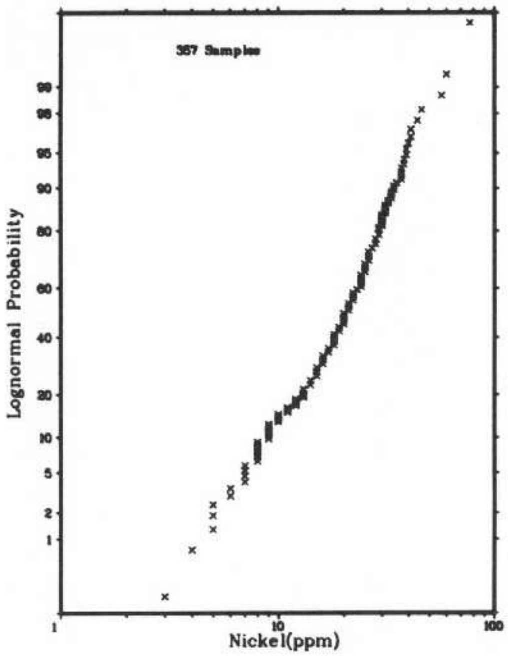
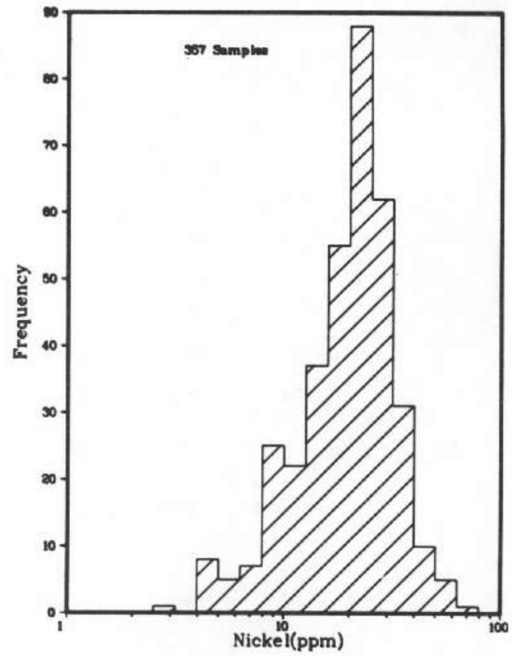


Figure B-12b

GEOCHEMICAL DISTRIBUTION OF SODIUM (%) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





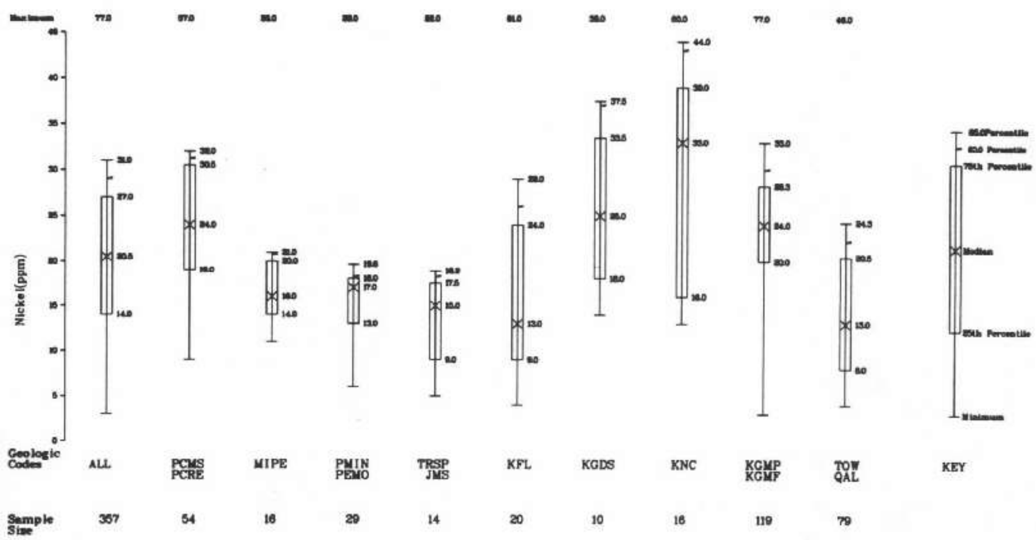


Figure B-13a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR NICKEL (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

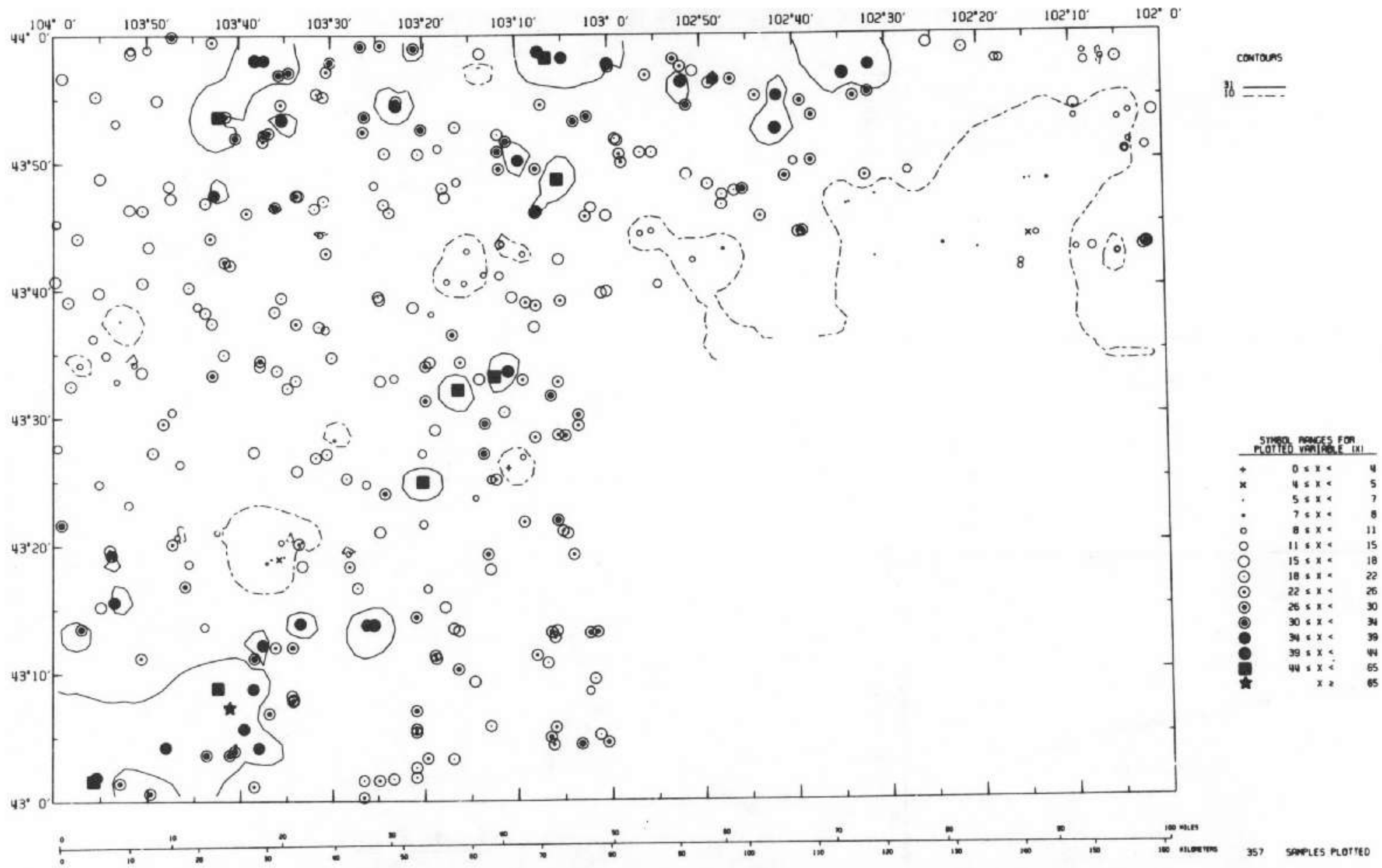


Figure B-13b

GEOCHEMICAL DISTRIBUTION OF NICKEL (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

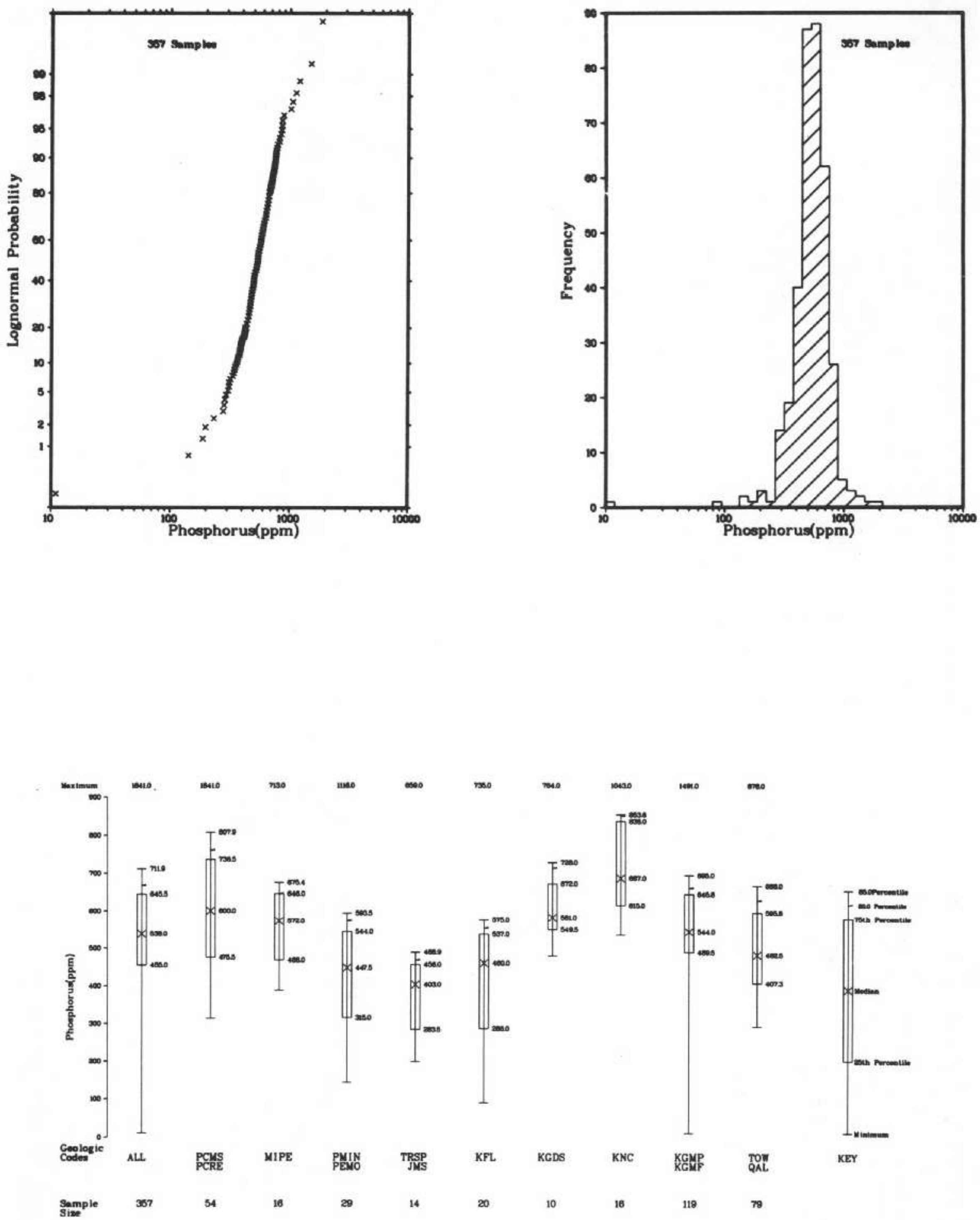


Figure B-14a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR PHOSPHORUS (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

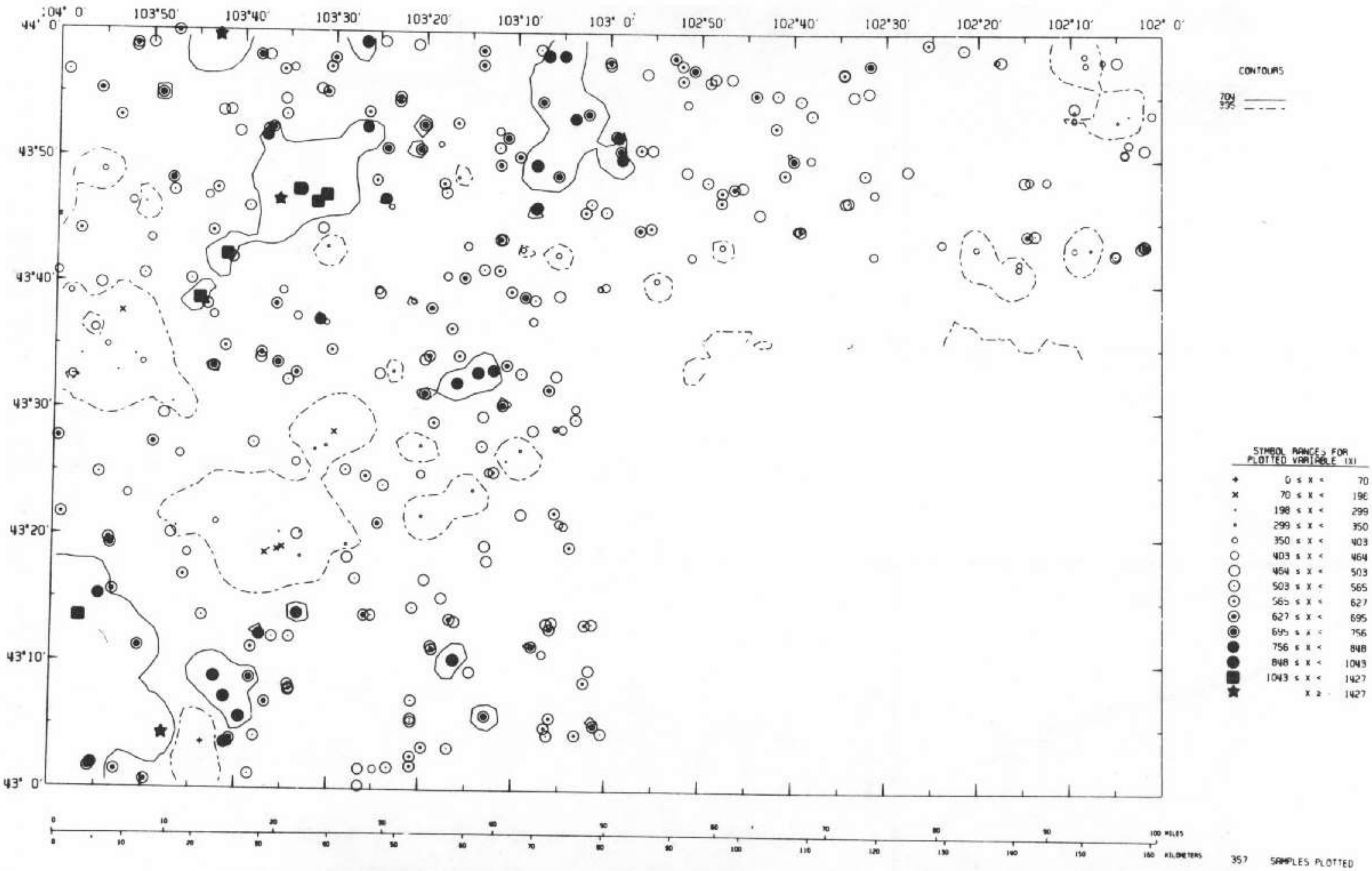


Figure B-14b

GEOCHEMICAL DISTRIBUTION OF PHOSPHORUS (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

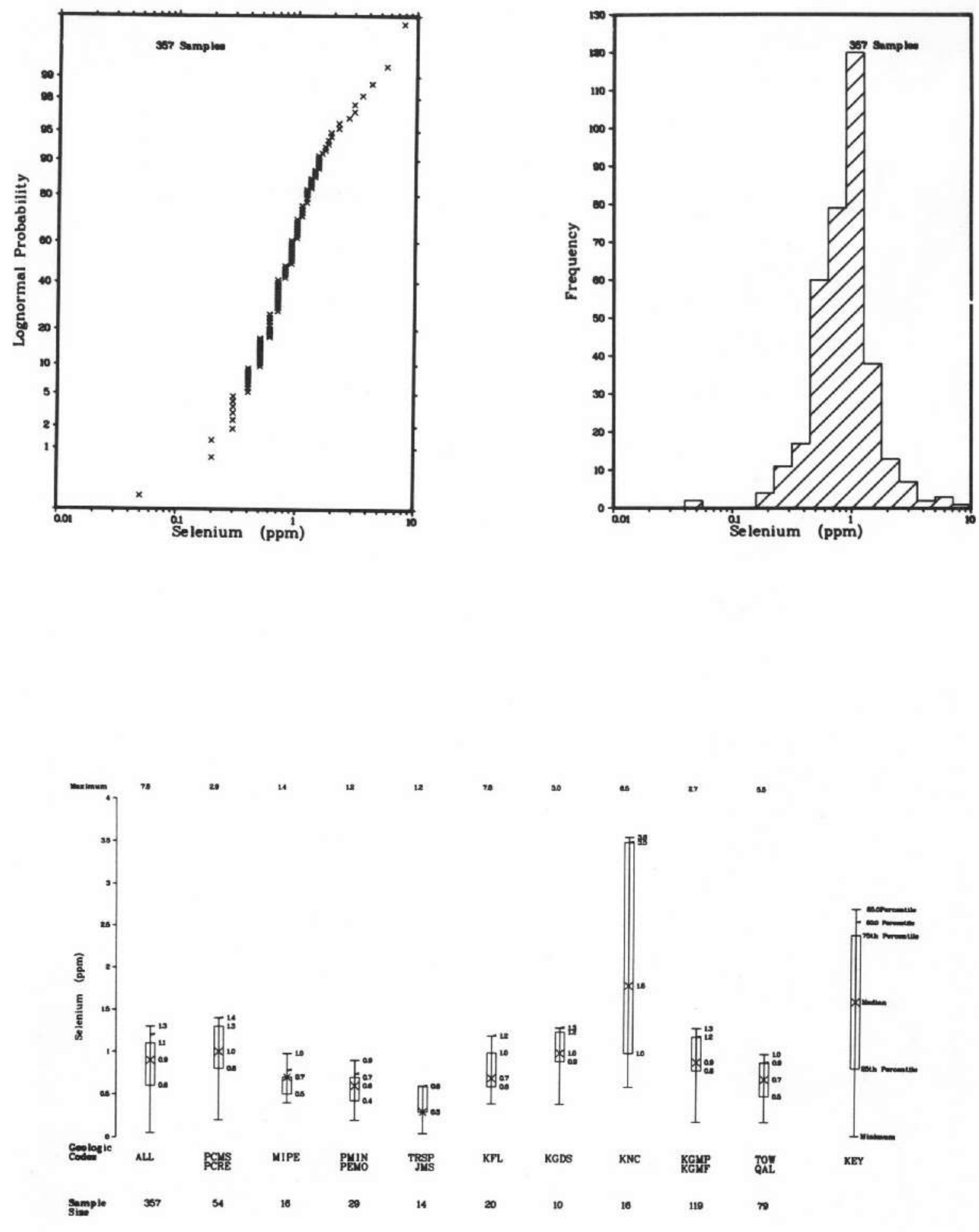


Figure B-15a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR SELENIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

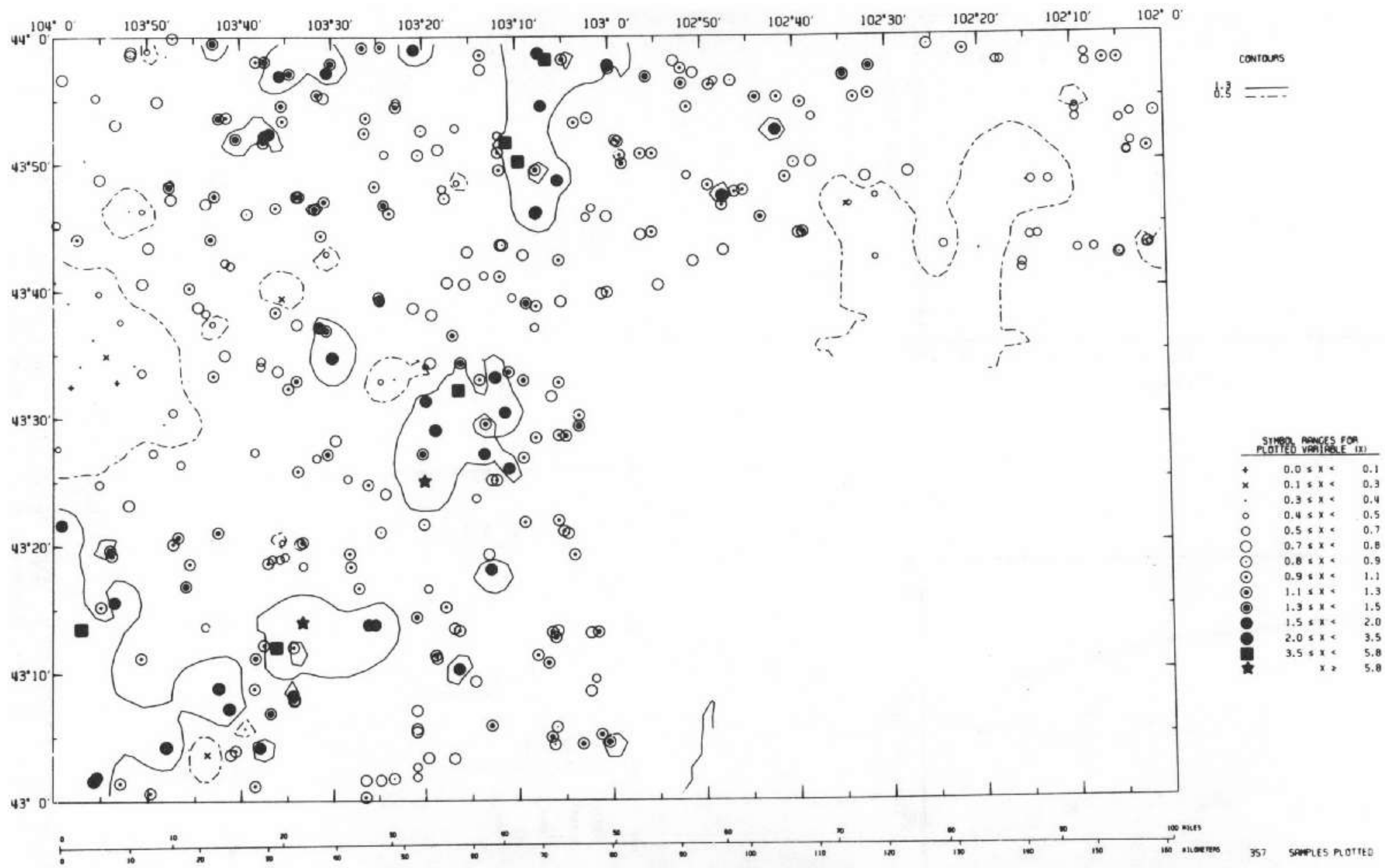
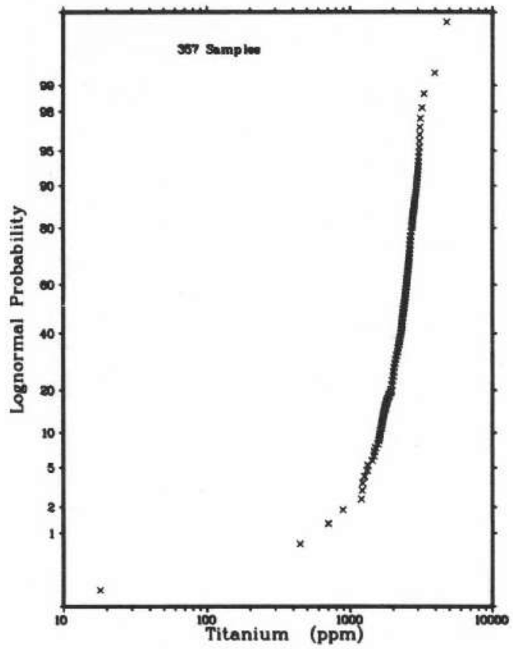
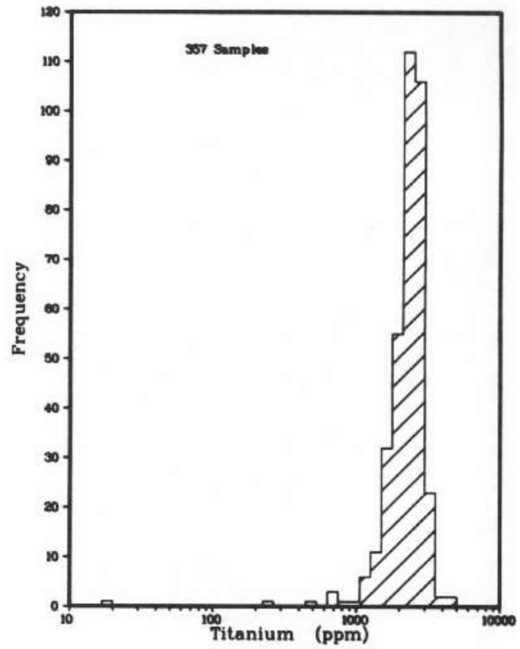


Figure B-15b

GEOCHEMICAL DISTRIBUTION OF SELENIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





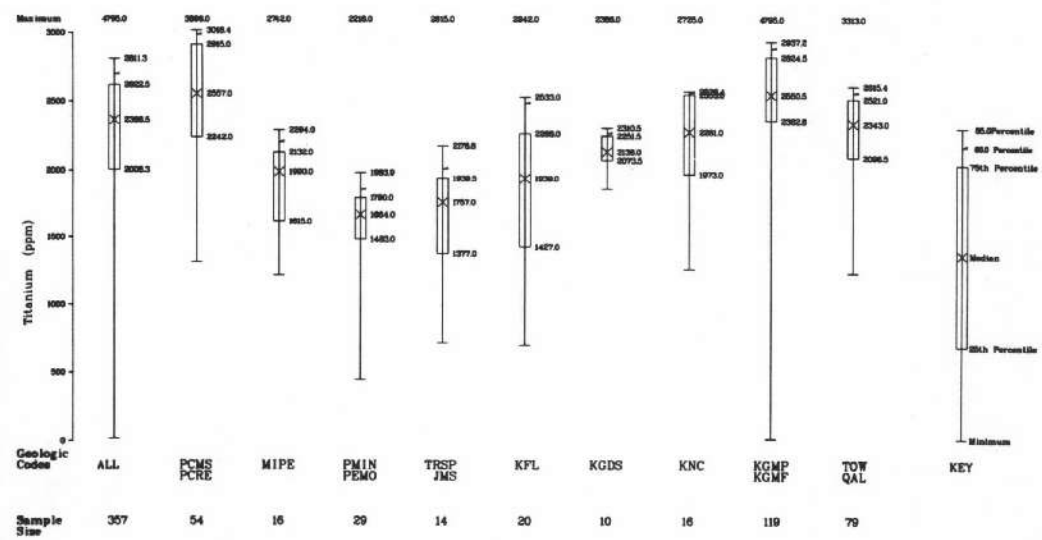


Figure B-16a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR TITANIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

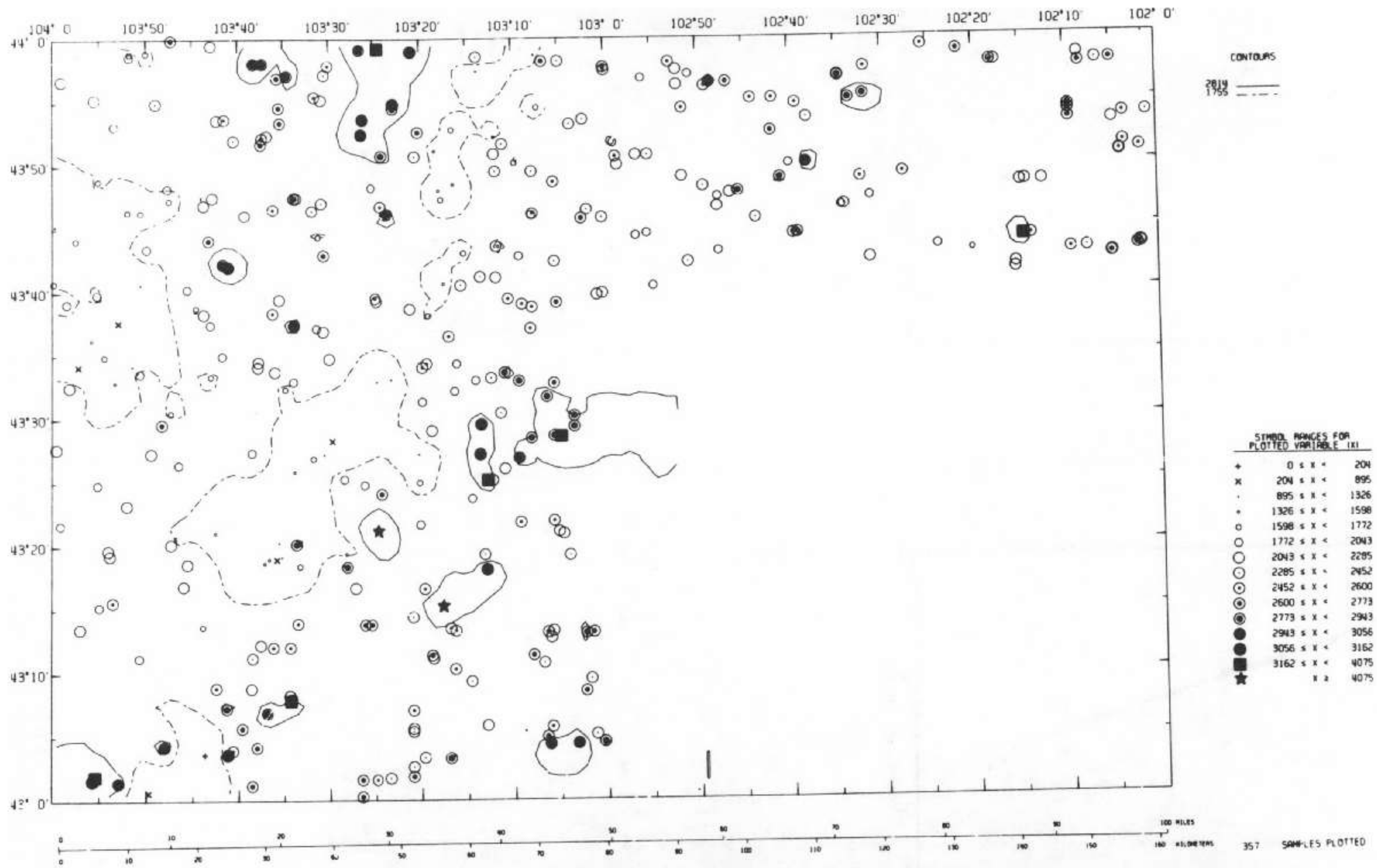
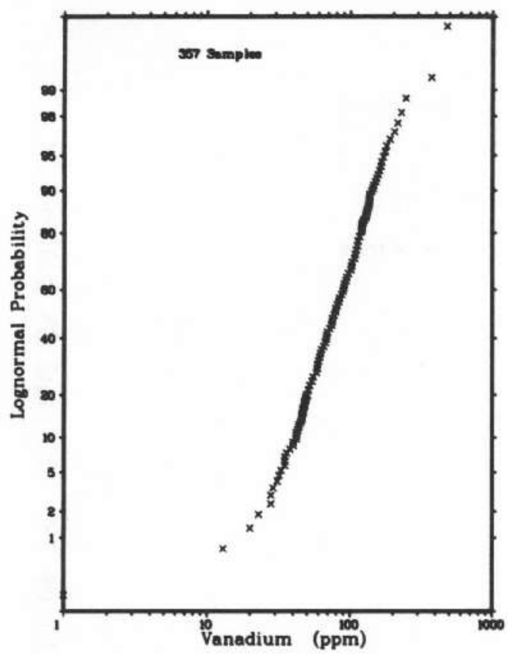
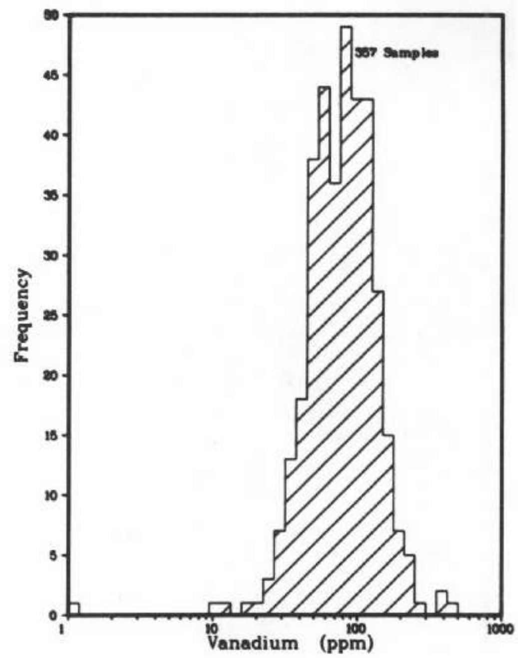


Figure B-16b

GEOCHEMICAL DISTRIBUTION OF TITANIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





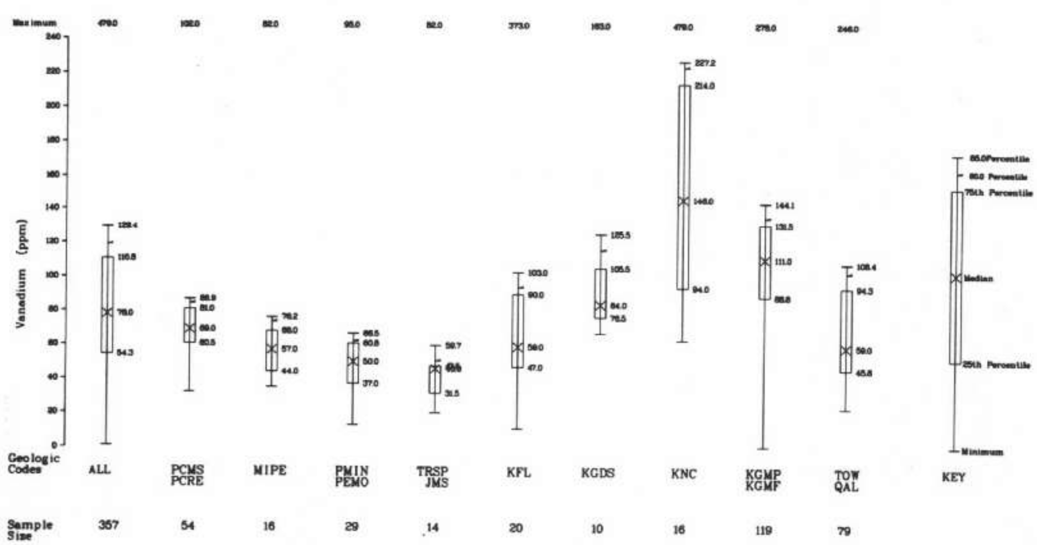


Figure B-17a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR VANADIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

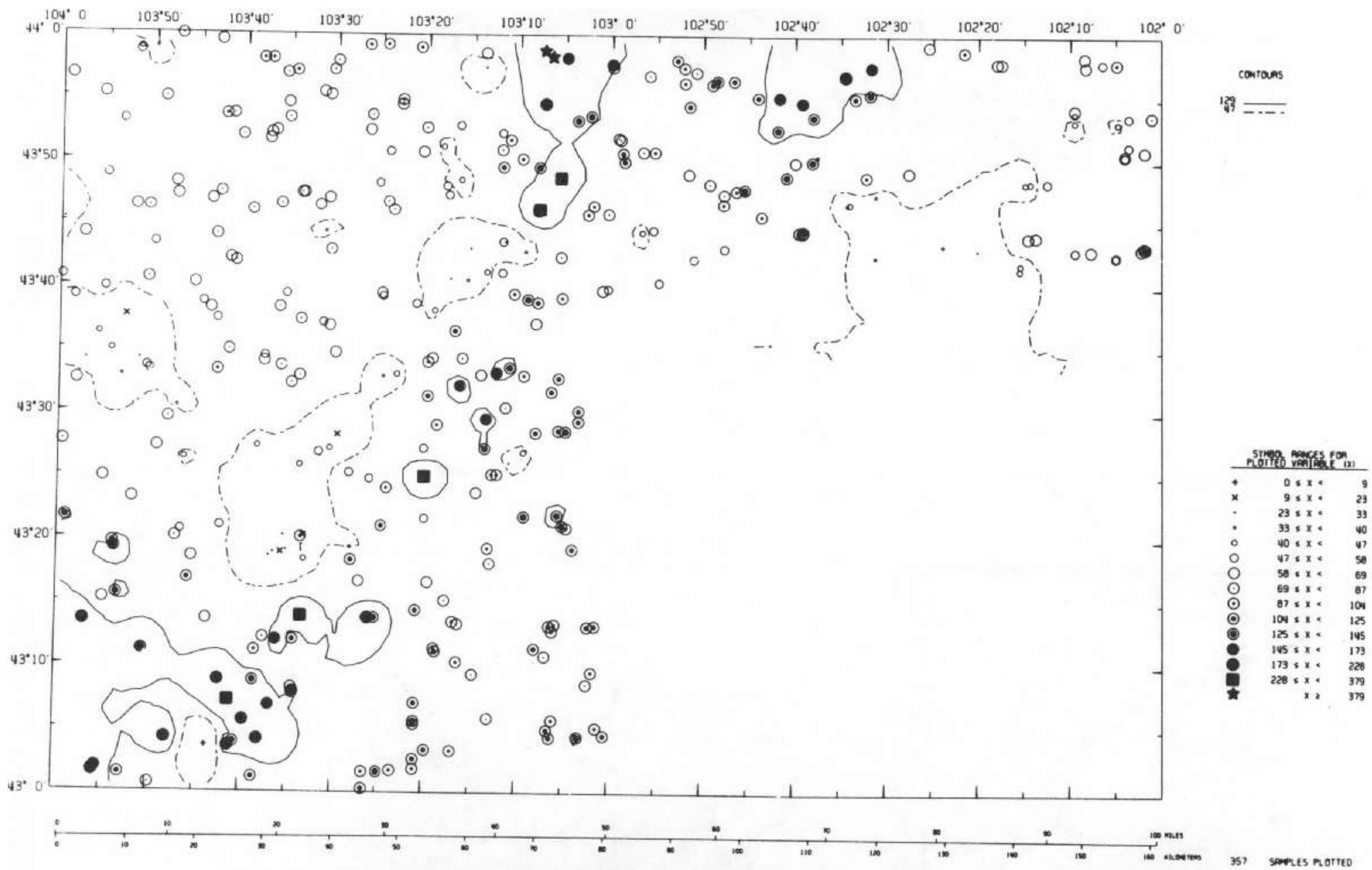
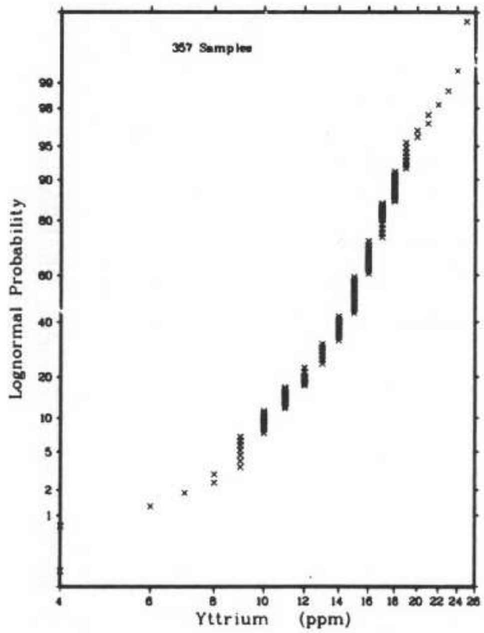
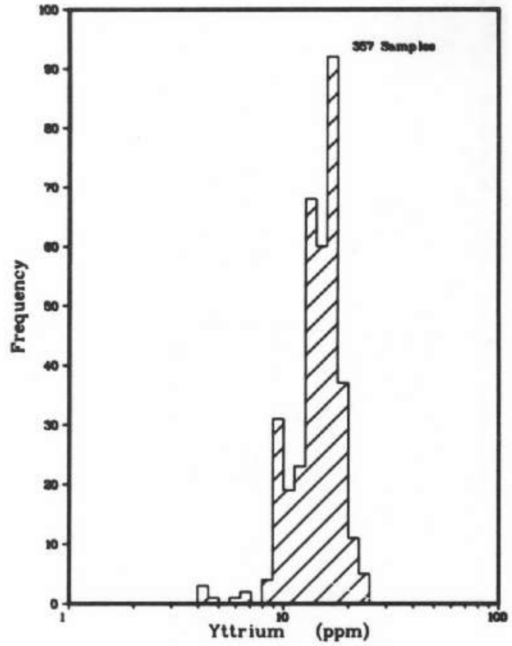


Figure B-17b

GEOCHEMICAL DISTRIBUTION OF VANADIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





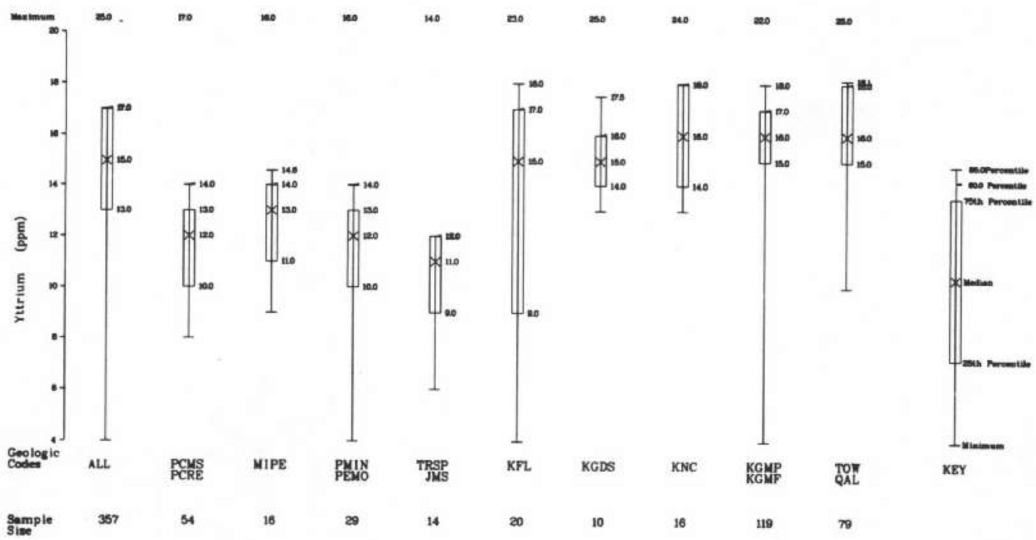


Figure B-18a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR YTTRIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

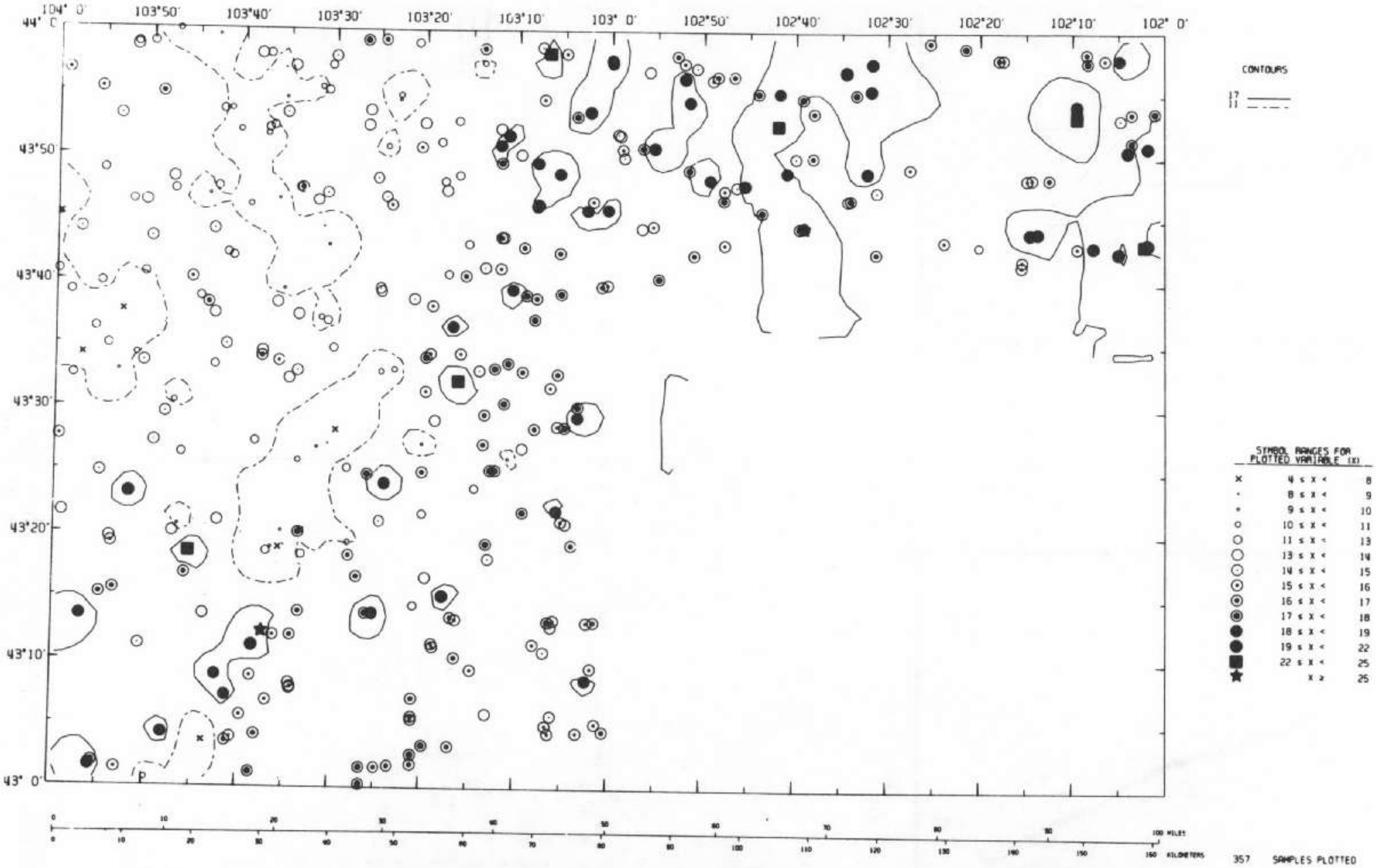


Figure B-18b

GEOCHEMICAL DISTRIBUTION OF YTTRIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

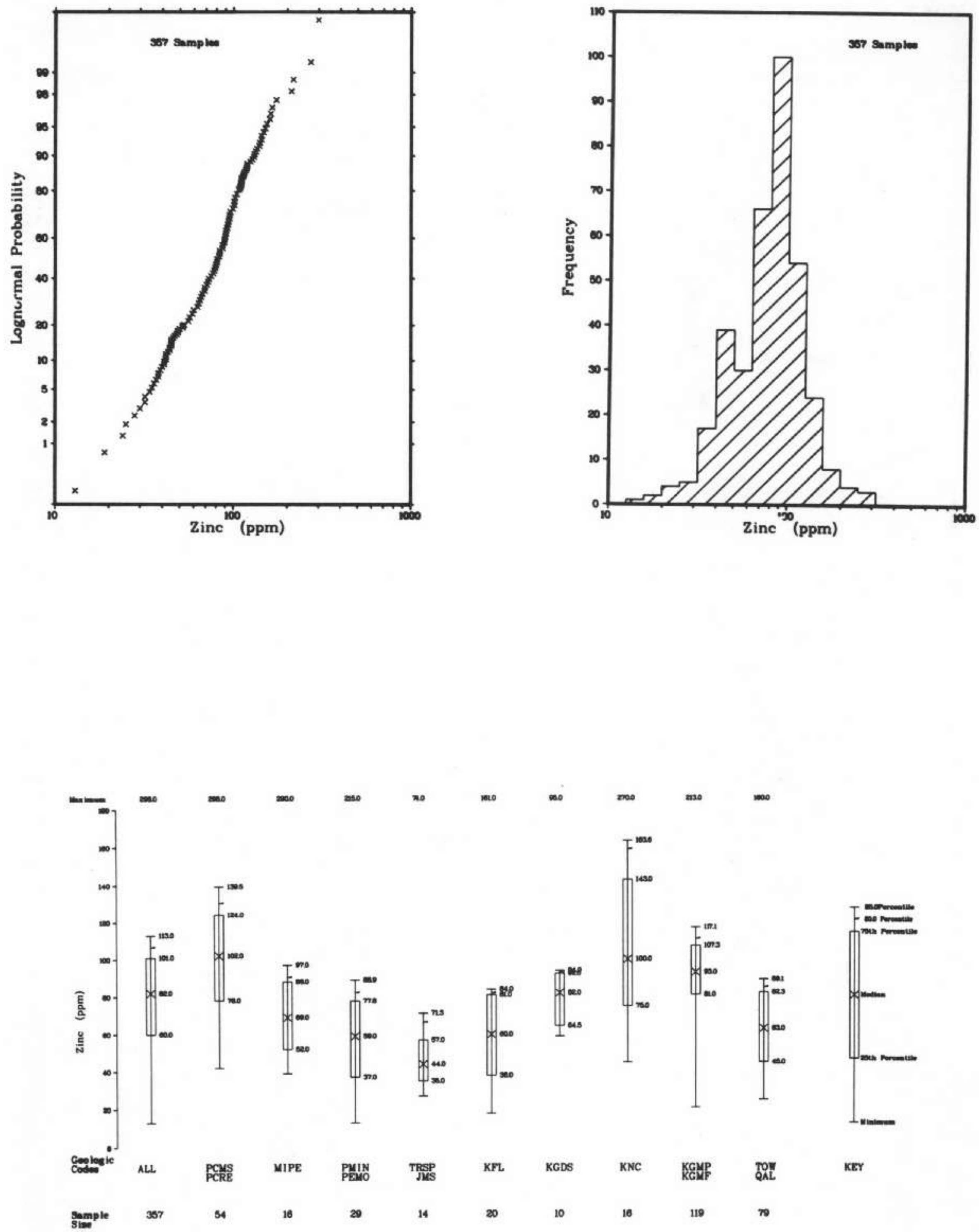


Figure B-19a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR ZINC (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

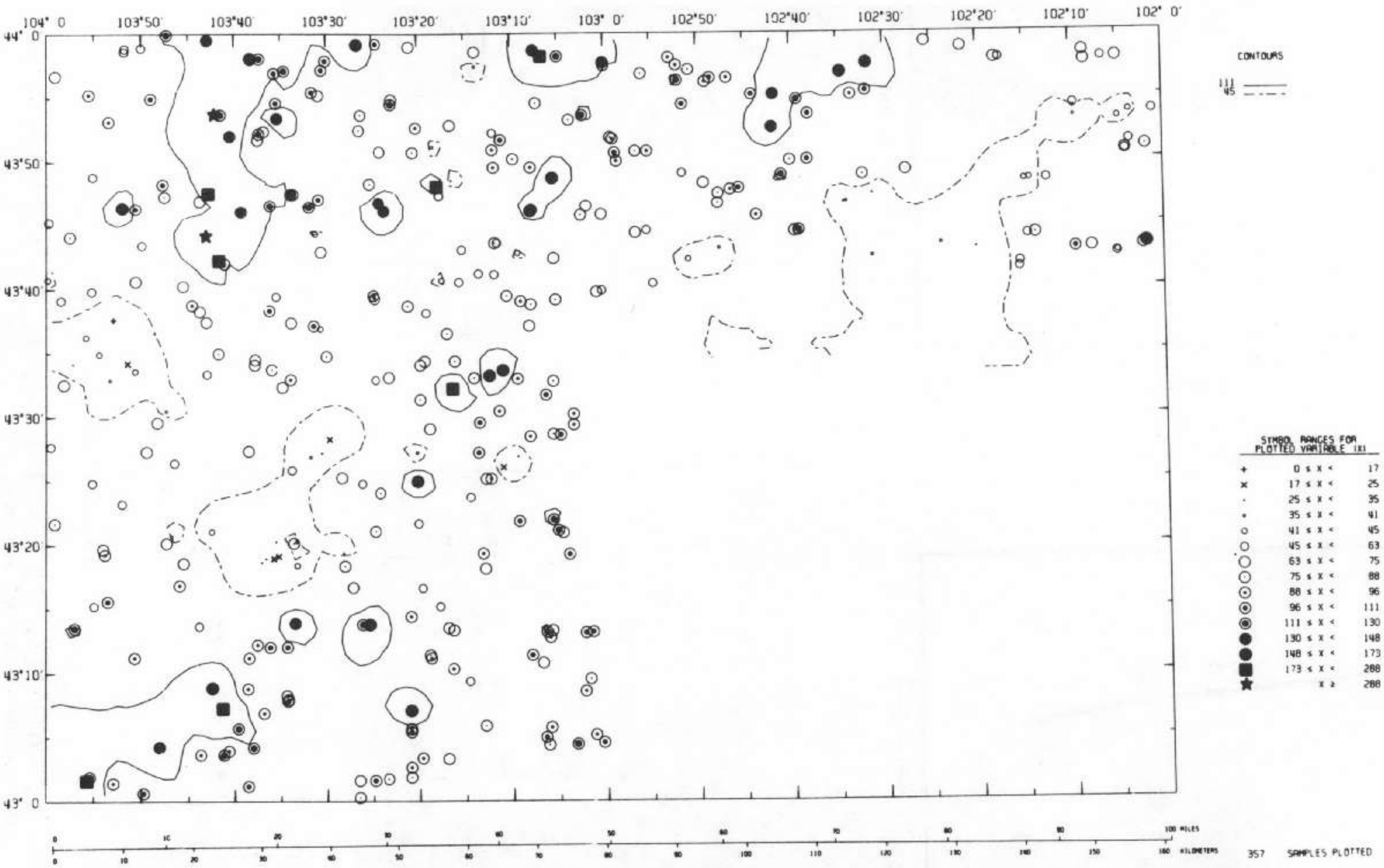
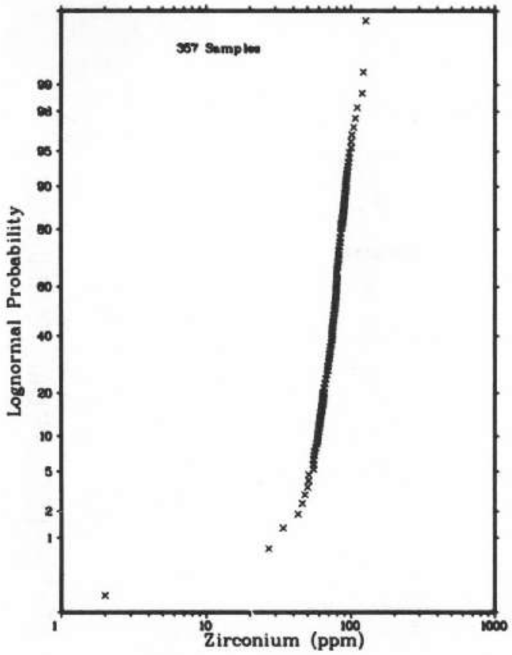
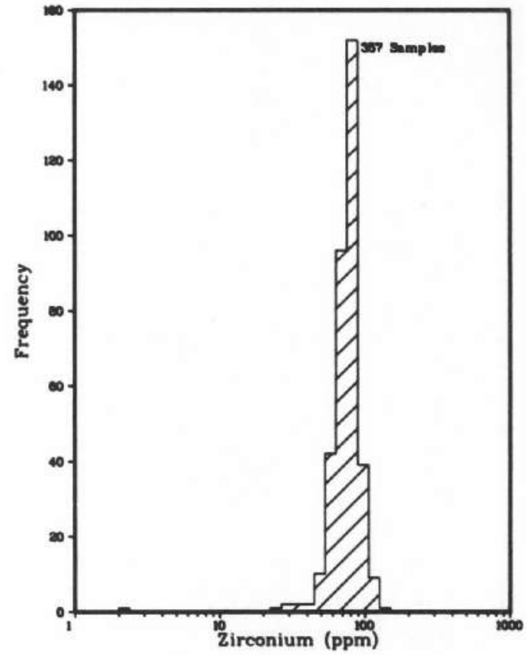


Figure B-19b

GEOCHEMICAL DISTRIBUTION OF ZINC (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE





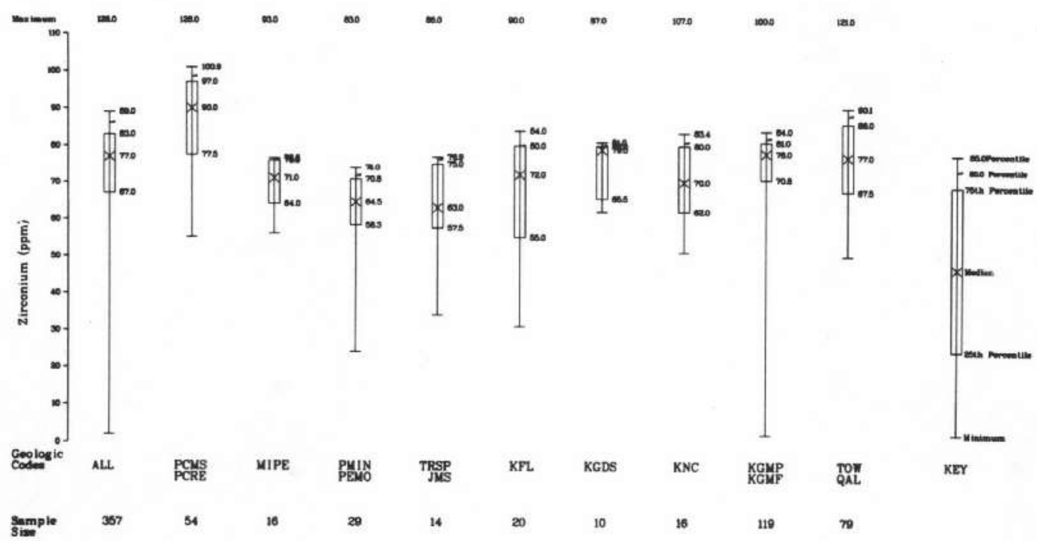


Figure B-20a

PROBABILITY, FREQUENCY, AND PERCENTILE PLOTS FOR ZIRCONIUM (PPM)
IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

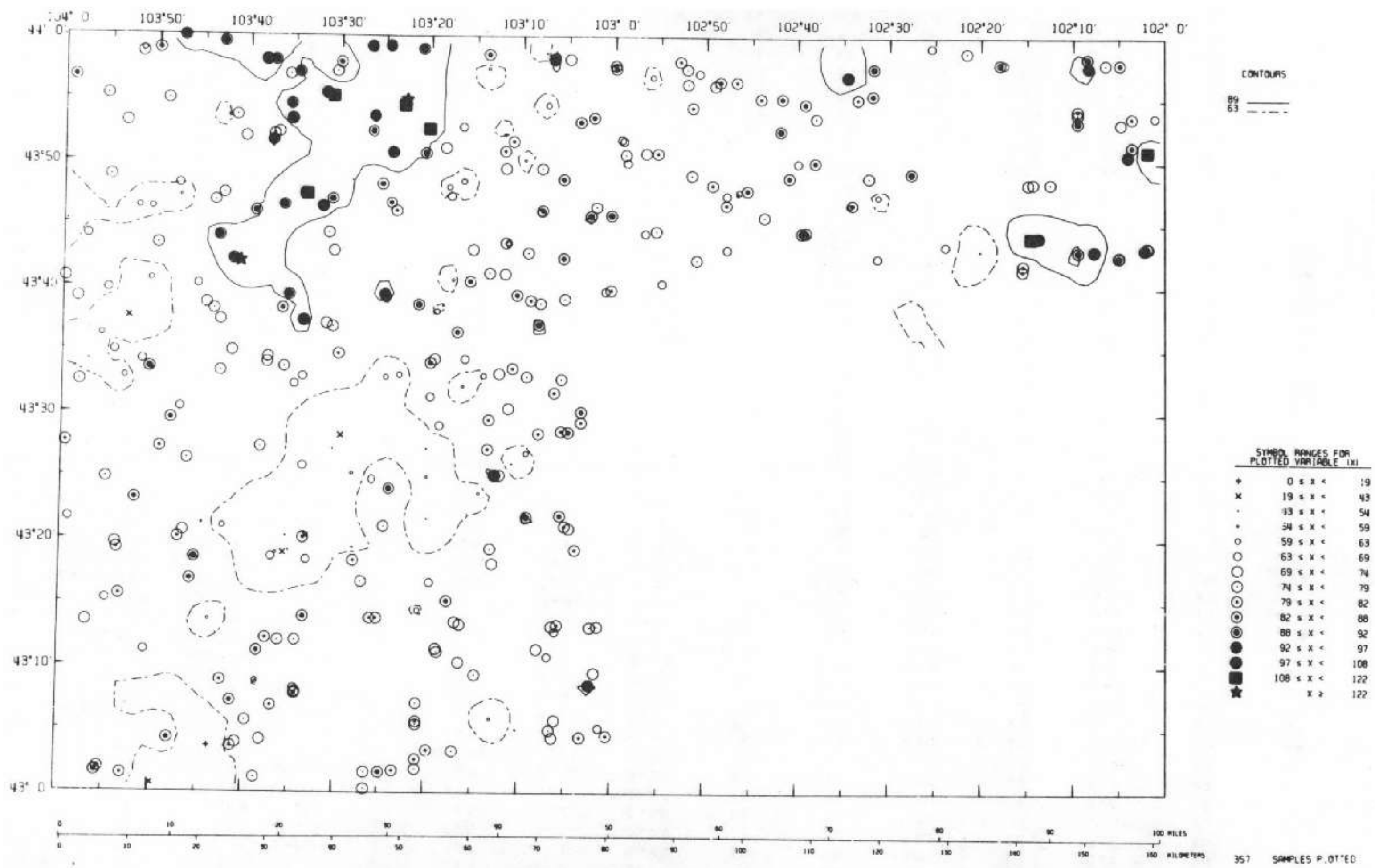


Figure B-20b

GEOCHEMICAL DISTRIBUTION OF ZIRCONIUM (PPM) IN STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

Table B-3

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
401909	46-43.820	-102.461	-3-12-	2.3	3.3	0.71	11	58	480	18	0.7	28	12	3.6
401910	46-43.789	-102.521	-3-12-	2.2	2.9	0.77	9	35	410	9	0.4	18	5	2.3
401911	46-43.778	-102.568	-3-12-	3.7	4.3	0.86	10	40	530	11	0.4	18	6	3.3
401912	46-43.777	-102.573	-3-12-	2.5	3.2	0.79	7	35	480	10	0.2	16	5	2.7
401913	46-43.814	-102.683	-3-15-	3.1	3.6	0.85	11	130	570	30	0.9	33	28	9.0
401914	46-43.778	-102.693	-3-12-	4.1	4.7	0.88	10	60	570	21	0.6	40	15	7.6
401915	46-43.761	-102.728	-3-15-	3.0	3.4	0.88	10	100	470	22	1.1	27	23	6.5
401916	46-43.833	-102.667	-3-15-	<0.25	3.1	0.04	8	64	750	17	0.8	17	13	3.1
401917	46-43.834	-102.636	-3-15-	2.9	3.3	0.89	8	140	450	25	0.7	38	26	7.3
401918	46-43.814	-102.538	-3-12-	3.5	4.1	0.84	14	100	520	23	0.7	33	24	7.6
401919	46-43.876	-102.699	-3-12-	0.32	4.3	0.07	11	140	590	34	1.5	36	43	13.
401920	46-43.855	-102.709	-3-12-	3.3	3.3	0.99	13	140	500	25	0.8	37	29	7.0
401921	46-43.919	-102.735	-3-15-	<0.25	3.2	0.04	7	120	640	25	1.2	30	25	7.3
401922	46-43.723	-102.399	-3-12-	0.25	2.9	0.09	7	37	440	11	0.6	19	7	3.0
401924	46-43.701	-102.406	-3-12-	4.1	5.5	0.75	11	37	480	8	0.4	17	4	2.4
401925	46-43.707	-102.522	-3-15-	2.8	3.5	0.81	6	33	460	10	0.4	17	5	2.6
401927	46-43.941	-102.779	-3-15-	3.9	3.5	1.1	8	120	500	24	0.8	40	27	5.5
401928	46-43.941	-102.809	-3-12-	3.6	3.1	1.2	10	130	500	31	0.6	39	34	5.1
401930	46-43.936	-102.818	-3-12-	2.4	2.9	0.81	6	110	590	23	1.0	33	25	4.5
401931	46-43.952	-102.847	-3-15-	2.6	3.1	0.85	10	75	700	19	0.7	20	17	5.0
401932	46-43.958	-102.869	-3-15-	2.8	3.1	0.91	7	98	590	22	1.0	24	25	4.7
401937	46-43.907	-102.859	-3-12-	3.8	3.5	1.1	7	110	460	26	0.9	28	31	7.8
401938	46-43.817	-102.860	-3-15-	1.8	2.9	0.63	3	68	470	17	0.5	26	17	4.1
401939	46-43.834	-102.822	-3-15-	2.4	2.9	0.83	8	82	540	18	0.9	24	19	5.7
401942	46-43.790	-102.796	-3-12-	3.1	3.3	0.95	7	84	590	18	2.2	23	18	3.6
401943	46-43.777	-102.797	-3-15-	4.1	4.0	1.0	7	91	580	20	0.9	25	19	4.4
401945	46-43.810	-102.905	-3-12-	3.0	3.0	1.0	5	91	560	21	1.2	24	23	6.1
401946	46-43.846	-102.922	-3-15-	3.7	3.8	0.98	9	91	470	20	1.0	20	20	3.3
401948	46-43.846	-102.943	-3-15-	3.0	3.1	0.97	9	73	580	19	1.0	19	19	3.1
401949	46-43.862	-102.984	-3-15-	2.3	2.8	0.82	8	70	760	19	1.0	17	16	3.8
401950	46-43.864	-102.988	-3-15-	2.3	2.7	0.84	7	72	650	19	0.9	18	18	4.1
401951	46-43.739	-102.654	-3-12-	3.2	4.4	0.73	11	61	590	13	0.5	22	12	6.0
401952	46-43.741	-102.652	-3-15-	3.0	3.3	0.92	6	130	370	28	1.2	36	29	4.1
401953	46-43.740	-102.660	-3-12-	3.2	3.9	0.82	11	110	440	23	0.7	33	24	7.4
401954	46-43.938	-102.868	-3-15-	3.2	3.5	0.93	3	100	570	31	1.2	23	40	12.
401956	46-43.968	-102.882	-3-15-	4.7	3.9	1.2	10	110	630	25	0.7	31	27	5.2
401958	46-43.962	-103.000	-3-12-	2.9	3.1	0.95	7	150	640	33	2.4	37	40	8.7
401959	46-43.958	-102.999	-3-15-	2.7	2.7	1.0	10	120	560	25	0.9	34	27	6.8
401962	46-43.947	-102.932	-3-15-	3.3	3.4	0.98	6	79	470	25	1.3	22	24	8.9
401964	46-43.718	-102.795	-3-15-	2.4	3.2	0.74	9	47	380	11	0.7	18	7	5.4
401966	46-43.797	-102.759	-3-15-	3.9	4.5	0.86	13	140	490	27	1.0	37	31	11.
401967	46-43.795	-102.774	-3-12-	3.4	3.6	0.94	7	100	650	24	1.0	29	20	3.9
401968	46-43.833	-102.977	-3-15-	4.2	4.2	0.99	5	100	840	24	1.1	29	24	6.5
401969	46-43.844	-102.980	-3-15-	2.2	3.1	0.72	8	120	700	25	0.9	32	23	5.1
401971	46-43.739	-102.944	-3-15-	1.9	2.4	0.80	11	42	650	19	0.7	18	9	2.9
401973	46-43.704	-102.850	-3-15-	2.3	3.3	0.70	8	47	420	13	0.7	24	8	4.6
401976	46-43.742	-102.924	-3-15-	3.8	4.0	0.94	10	52	580	17	1.0	22	9	2.6
401983	46-43.706	-103.091	-3-15-	2.3	3.2	0.71	9	77	350	19	0.9	29	15	5.4
401984	46-43.686	-103.225	-3-15-	2.3	3.0	0.75	7	43	520	16	0.6	29	9	2.6
401985	46-43.685	-103.197	-3-15-	2.3	2.9	0.78	9	53	600	17	1.0	27	13	3.3
401986	46-43.657	-103.175	-3-15-	2.8	3.1	0.90	10	94	620	19	0.6	43	15	3.7
401989	46-43.646	-103.132	-3-15-	3.3	3.4	0.98	7	100	540	27	0.9	35	22	8.6
401990	46-43.650	-103.150	-3-15-	2.8	3.8	0.73	12	140	700	31	1.4	36	24	7.7
401991	46-43.645	-103.104	-3-15-	2.4	3.3	0.74	6	71	460	18	0.9	27	17	6.4
401992	46-43.726	-103.196	-3-15-	2.4	3.0	0.80	4	47	640	19	0.7	29	12	2.9

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
401993	46-43.726	-103.192	-3-15-	2.0	2.4	0.85	7	31	550	13	0.8	19	8	1.8
401998	46-43.652	-103.088	-3-15-	2.6	2.8	0.93	8	100	490	25	0.7	32	22	6.8
401999	46-43.654	-103.036	-3-15-	2.7	3.0	0.90	10	59	210	16	0.8	23	10	4.2
402000	46-43.652	-103.015	-3-15-	2.1	3.5	0.61	7	62	350	18	0.7	21	16	4.3
402002	46-43.664	-103.005	-3-15-	1.8	3.2	0.56	12	55	460	16	0.9	17	15	4.3
402004	46-43.618	-103.135	-3-15-	1.7	2.7	0.64	12	61	460	19	0.6	21	15	4.0
402007	46-43.957	-103.230	-3-15-	1.7	1.7	0.98	5	23	630	10	0.7	11	7	2.8
402008	46-43.976	-103.230	-3-15-	2.2	3.0	0.74	11	59	660	20	1.0	20	17	9.4
402011	46-43.549	-103.156	-3-15-	2.1	2.9	0.74	8	94	540	26	1.1	26	24	8.1
402015	46-43.507	-103.189	-3-15-	3.3	4.1	0.80	10	78	740	25	1.7	24	21	4.4
402016	46-43.507	-103.205	-3-15-	3.1	3.5	0.88	10	100	590	28	1.2	33	29	6.2
402017	46-43.713	-103.155	-3-15-	1.9	2.9	0.65	8	35	360	13	0.7	16	9	4.7
402019	46-43.550	-103.234	-3-15-	2.1	2.8	0.74	8	63	850	20	0.9	19	16	3.3
402022	46-43.673	-102.913	-3-15-	2.8	3.7	0.75	11	48	380	15	0.7	17	13	6.7
402025	46-43.717	-103.255	-3-15-	1.6	2.1	0.76	5	29	430	14	0.7	15	8	3.3
402028	46-43.710	-103.343	-3-15-	3.0	3.8	0.79	8	42	610	21	0.8	25	21	14.
402030	46-43.675	-103.260	-3-15-	2.9	3.2	0.91	12	38	630	17	0.7	20	9	3.7
402033	46-43.644	-103.352	-3-15-	2.6	2.8	0.95	16	47	380	18	0.7	24	16	10.
402036	46-43.528	-103.106	-3-15-	2.9	2.9	1.0	7	110	690	33	0.7	31	31	4.4
402038	46-43.546	-103.093	-3-15-	2.9	3.2	0.90	6	120	500	29	0.9	39	24	7.0
402039	46-43.677	-103.291	-3-15-	1.6	1.7	0.94	5	32	430	12	0.7	17	9	3.7
402040	46-43.635	-103.319	-3-15-	2.1	2.3	0.92	6	44	630	18	0.7	19	10	3.8
402042	46-43.572	-103.322	-3-15-	2.8	3.0	0.94	9	80	630	23	0.7	43	18	4.0
402044	46-43.567	-103.330	-3-15-	3.1	3.2	0.37	11	94	530	26	0.4	60	26	5.3
402048	46-43.608	-103.282	-3-12-	6.3	5.3	1.2	15	110	590	30	1.2	41	26	6.5
402049	46-43.572	-103.268	-3-12-	4.9	4.6	1.1	9	79	620	25	1.3	31	25	7.3
402051	46-43.536	-103.272	-3-15-	16.	20.	0.83	5	170	840	46	3.5	96	60	12.
402052	46-43.522	-103.330	-3-12-	3.9	4.2	0.93	13	110	740	27	1.5	35	29	6.4
402053	46-43.401	-103.403	-3-12-	4.0	4.1	0.98	11	90	550	22	0.7	48	29	5.2
402054	46-43.413	-103.436	-3-15-	1.8	2.5	0.70	6	57	580	18	0.9	24	13	5.5
402055	46-43.471	-103.495	-3-15-	0.98	1.1	0.89	4	18	140	7	0.7	10	7	3.5
402057	46-43.553	-103.206	-3-15-	4.9	4.9	0.99	9	150	780	31	2.2	37	44	6.1
402058	46-43.560	-103.182	-3-15-	2.7	3.2	0.86	8	140	650	32	1.2	37	41	8.1
402059	46-43.191	-103.225	-3-15-	2.4	2.8	0.86	4	79	590	19	0.8	24	20	4.4
402060	46-43.190	-103.133	-3-15-	2.7	2.8	0.95	7	110	740	28	1.0	35	24	3.5
402061	46-43.159	-103.030	-3-15-	2.7	3.2	0.85	7	91	500	21	0.5	26	18	3.3
402062	46-43.143	-103.039	-3-12-	3.1	3.2	0.98	12	74	610	24	0.7	36	14	3.3
402063	46-43.086	-103.021	-3-15-	3.5	3.9	0.90	7	89	760	27	1.2	25	20	3.6
402065	46-43.074	-103.054	-3-12-	3.6	3.5	1.0	7	130	600	27	1.1	37	30	3.8
402070	46-43.213	-103.101	-3-15-	2.9	2.8	1.0	7	88	670	23	1.2	25	22	2.7
402071	46-43.220	-103.107	-3-15-	4.5	3.9	1.1	10	120	520	35	1.2	32	29	7.0
402072	46-43.222	-103.097	-3-15-	2.4	2.9	0.82	5	87	500	22	0.8	22	21	6.0
402074	46-43.220	-103.025	-3-15-	2.8	3.0	0.93	9	110	550	27	1.1	29	27	5.8
402075	46-43.219	-103.038	-3-15-	2.6	3.0	0.88	9	120	600	27	0.7	35	28	5.2
402077	46-43.180	-103.114	-3-15-	2.7	2.9	0.92	9	75	420	20	1.1	23	18	5.0
402079	46-43.073	-103.104	-3-12-	3.0	3.2	0.95	7	110	540	23	0.8	34	25	4.7
402081	46-43.083	-103.109	-3-12-	4.1	4.2	0.97	7	110	580	25	1.1	31	27	4.4
402082	46-43.096	-103.100	-3-12-	2.4	2.9	0.84	7	97	620	23	0.8	28	24	5.1
402084	46-43.076	-103.007	-3-12-	3.3	3.3	0.99	11	120	540	28	1.4	32	28	6.8
402091	46-43.098	-103.216	-3-12-	3.6	3.5	1.0	5	79	740	22	1.1	24	20	2.2
402093	46-43.232	-103.558	-3-15-	8.2	8.1	1.0	9	230	780	50	6.5	31	37	14.
402097	46-43.201	-103.572	-3-15-	3.1	3.7	0.85	9	120	540	22	1.0	22	27	5.3
402099	46-43.147	-103.643	-3-15-	7.0	6.4	1.1	9	140	740	27	0.9	35	38	9.3
402101	46-43.187	-103.641	-3-12-	4.0	6.0	0.67	11	91	580	26	1.2	31	30	7.1
402102	46-43.204	-103.626	-3-12-	4.7	5.1	0.93	11	84	760	24	1.0	30	38	8.7

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. D. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
402105	46-43.245	-103.655	-3-12-	3.7	4.1	0.90	9	74	620	22	1.0	33	19	4.6
402107	46-43.228	-103.731	-3-12-	3.6	3.6	1.00	9	67	540	12	0.6	22	13	3.8
402108	46-43.148	-103.707	-3-12-	8.4	8.1	1.0	6	230	850	47	3.0	43	44	12.
402110	46-43.228	-103.595	-3-12-	5.2	4.9	1.1	12	100	540	22	0.9	37	22	5.8
402111	46-43.201	-103.603	-3-12-	5.8	5.3	1.1	10	160	550	33	3.6	27	25	12.
402112	46-43.421	-103.473	-3-15-	2.4	2.6	0.94	5	53	500	18	0.6	27	18	4.3
402115	46-43.138	-103.573	-3-15-	2.9	2.8	1.0	9	93	620	21	1.7	30	20	5.8
402116	46-43.131	-103.571	-3-15-	4.0	4.0	0.99	10	160	500	26	0.9	49	29	4.5
402117	46-43.133	-103.570	-3-12-	4.0	4.0	1.0	11	110	590	26	0.9	34	24	5.7
402118	46-43.166	-103.605	-3-12-	4.1	3.9	1.0	6	72	610	23	1.2	30	19	4.9
402122	46-43.156	-103.244	-3-15-	2.3	2.7	0.87	15	81	470	16	0.7	21	16	4.2
402124	46-43.754	-103.995	-3-15-	1.7	1.9	0.88	4	32	340	8	0.5	23	11	2.9
402126	46-43.763	-103.952	-3-15-	2.6	3.1	0.85	4	70	440	14	0.4	25	18	3.5
402128	46-43.619	-103.323	-3-15-	4.5	4.9	0.92	10	54	780	30	1.5	200	21	62.
402129	46-43.615	-103.511	-3-15-	4.7	4.6	1.0	4	61	400	18	1.3	38	14	3.2
402130	46-43.623	-103.564	-3-15-	2.6	3.9	0.67	4	69	440	19	0.7	38	22	4.8
402132	46-43.539	-103.580	-3-15-	2.8	3.7	0.75	5	78	540	18	1.0	22	18	4.0
402133	46-43.549	-103.565	-3-15-	2.3	3.1	0.74	9	82	630	25	1.1	25	21	11.
402134	46-43.562	-103.599	-3-15-	2.7	3.5	0.76	8	78	700	20	0.7	30	19	3.2
402136	46-43.579	-103.500	-3-12-	2.0	4.0	0.49	7	60	610	21	2.9	41	18	4.7
402141	46-43.071	-103.801	-3-12-	5.2	5.3	0.98	7	200	1500	46	2.2	44	38	14.
402142	46-43.011	-103.829	-3-15-	1.6	3.1	0.51	7	75	660	26	0.9	26	28	4.8
402143	46-43.024	-103.882	-3-15-	3.1	3.1	1.0	8	120	670	26	0.9	38	28	5.2
402144	46-43.027	-103.928	-3-15-	4.2	4.2	0.99	9	180	750	42	2.1	45	56	10.
402145	46-43.032	-103.923	-3-15-	2.7	3.4	0.80	9	150	850	37	1.8	41	37	9.3
402149	46-43.945	-103.984	-3-15-	2.3	3.1	0.76	11	62	540	15	0.7	21	17	3.0
402151	46-43.921	-103.925	-3-15-	2.7	2.8	0.97	6	59	660	18	0.6	23	18	3.0
402153	46-43.814	-103.918	-3-15-	1.9	2.5	0.76	6	48	360	12	0.7	23	15	2.7
402155	46-43.886	-103.890	-3-15-	2.0	2.6	0.76	7	55	570	17	0.7	19	14	2.6
402158	46-43.916	-103.816	-3-15-	2.6	2.9	0.89	6	75	710	21	0.7	27	17	2.7
402161	46-43.982	-103.833	-3-12-	1.9	2.8	0.70	5	35	540	9	0.4	16	11	0.8
402163	46-43.999	-103.788	-3-12-	3.3	3.4	0.98	9	72	640	34	0.8	30	31	4.6
402165	46-43.977	-103.863	-3-12-	2.5	2.8	0.91	7	54	550	17	0.8	17	16	0.5
402166	46-43.981	-103.862	-3-12-	1.9	2.3	0.82	4	44	650	15	0.7	14	11	0.8
402169	46-43.894	-103.437	-3-12-	5.3	5.9	0.91	9	84	580	32	0.9	73	30	160.
402170	46-43.908	-103.381	-3-15-	4.1	4.4	0.93	9	96	640	33	1.1	39	41	13.
402171	46-43.914	-103.380	-3-15-	3.7	4.2	0.38	8	89	640	33	0.6	37	29	15.
402175	46-43.986	-103.443	-3-15-	3.6	4.6	0.79	11	99	880	57	1.1	31	30	17.
402176	46-43.987	-103.408	-3-15-	2.2	3.4	0.64	11	91	490	52	1.1	24	28	7.6
402182	46-43.992	-103.715	-3-12-	5.2	4.9	1.1	14	61	1800	21	1.4	30	22	3.8
402184	46-43.958	-103.637	-3-15-	4.1	4.2	0.98	12	94	720	49	0.9	49	39	8.8
402296	46-43.302	-103.215	-3-12-	3.1	4.8	0.65	16	75	490	15	1.9	20	16	3.6
402308	46-43.222	-103.272	-3-15-	2.4	2.6	0.93	8	84	500	23	1.0	25	20	5.1
402309	46-43.225	-103.281	-3-15-	2.7	2.9	0.94	9	99	670	21	0.8	26	21	5.5
402310	46-43.172	-103.273	-3-15-	2.3	2.7	0.87	6	93	1000	33	1.9	27	26	6.5
402312	46-43.240	-103.348	-3-15-	3.1	3.6	0.87	4	120	530	30	1.2	28	28	9.6
402313	46-43.230	-103.423	-3-15-	4.0	4.0	1.0	8	140	530	37	1.7	26	39	9.5
402314	46-43.230	-103.436	-3-15-	5.0	5.1	0.98	11	200	690	35	1.8	40	37	10.
402317	46-43.190	-103.314	-3-15-	2.4	2.7	0.90	9	88	540	23	1.2	24	22	6.8
402319	46-43.055	-103.282	-3-15-	2.8	2.9	0.97	9	93	510	19	0.7	27	21	3.9
402320	46-43.027	-103.442	-3-15-	3.9	3.5	1.1	9	87	490	18	0.7	28	21	5.7
402321	46-43.121	-103.688	-3-12-	5.4	5.7	0.94	8	280	860	54	2.7	53	77	12.
402323	46-43.095	-103.660	-3-15-	4.1	4.0	1.0	9	190	850	43	0.3	44	34	<0.1
402324	46-43.061	-103.686	-3-15-	3.7	3.2	1.2	10	180	800	40	0.7	47	33	8.5
402325	46-43.047	-103.661	-3-12-	4.4	4.3	1.0	10	120	520	23	1.0	32	20	6.2

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
402326	46-43.061	-103.728	-3-15-	0.87	2.9	0.30	<2	<2	11	11	0.2	36	33	0.3
402327	46-43.048	-103.718	-3-12-	3.3	3.4	0.96	11	140	890	36	0.9	42	32	6.2
402328	46-43.020	-103.642	-3-15-	4.1	3.9	1.1	13	120	530	27	0.9	32	25	7.7
402329	46-43.070	-103.633	-3-12-	4.3	4.3	1.0	10	180	540	34	1.6	39	34	10.
402330	46-43.115	-103.614	-3-15-	4.2	3.7	1.1	10	150	660	31	1.3	35	27	10.
402331	46-43.056	-103.677	-3-12-	3.1	3.3	0.93	7	130	700	31	0.9	39	30	8.2
402332	46-43.306	-103.468	-3-15-	4.8	4.6	1.0	12	110	490	26	0.9	50	24	4.8
402333	46-43.338	-103.555	-3-12-	1.5	1.8	0.86	4	20	200	8	1.2	13	5	2.0
402334	46-43.336	-103.560	-3-15-	2.4	2.5	0.95	10	100	480	23	0.7	34	23	5.0
402335	46-43.307	-103.554	-3-12-	2.8	2.5	1.1	8	46	340	11	0.5	26	15	3.0
402336	46-43.338	-103.592	-3-15-	1.3	1.5	0.84	5	30	280	8	0.4	17	9	1.4
402337	46-43.453	-103.509	-3-15-	3.4	3.5	0.96	3	40	310	12	1.2	19	18	4.5
402338	46-43.448	-103.529	-3-15-	2.2	2.1	1.1	6	48	330	13	0.5	30	21	4.7
402339	46-43.431	-103.563	-3-12-	2.8	2.3	0.99	4	42	460	13	0.9	41	15	2.0
402340	46-43.456	-103.641	-3-15-	2.7	3.2	0.86	6	46	520	35	0.6	32	17	3.1
402341	46-43.583	-103.695	-3-15-	2.4	3.1	0.78	12	75	570	18	0.7	22	20	5.1
402342	46-43.575	-103.629	-3-15-	2.5	2.5	0.99	11	57	650	44	0.5	35	26	2.6
402348	46-43.316	-103.610	-3-15-	2.6	2.6	1.0	4	28	280	8	0.6	15	5	1.2
402349	46-43.311	-103.618	-3-15-	2.5	2.7	0.94	8	32	190	9	0.9	15	7	1.6
402357	46-43.316	-103.596	-3-15-	1.5	1.9	0.81	3	11	89	5	0.5	7	4	1.0
402358	46-43.319	-103.587	-3-15-	2.1	2.0	1.1	<2	23	190	7	0.6	11	6	1.3
402364	46-43.285	-103.827	-3-12-	7.0	7.2	0.97	12	150	760	33	2.5	40	37	6.2
402365	46-43.281	-103.766	-3-15-	3.9	5.7	0.69	8	120	570	25	1.3	37	29	6.8
402366	46-43.310	-103.759	-3-15-	3.6	3.1	1.2	4	68	460	17	1.0	28	13	3.3
402367	46-43.336	-103.789	-3-15-	1.6	3.2	0.52	7	79	480	21	0.9	43	24	4.2
402368	46-43.345	-103.780	-3-15-	7.1	7.6	0.93	4	48	290	13	1.2	21	8	3.4
402369	46-43.260	-103.892	-3-12-	7.5	7.4	1.0	10	140	680	30	1.5	42	38	6.6
402370	46-43.254	-103.916	-3-12-	3.4	3.8	0.91	11	68	810	14	1.0	25	15	3.8
402383	46-43.735	-103.958	-3-15-	1.9	2.8	0.69	7	61	620	21	1.0	27	20	4.4
402387	46-43.627	-103.882	-3-15-	1.4	0.90	1.6	3	13	150	5	0.4	9	6	1.8
402429	46-43.277	-103.327	-3-15-	2.4	3.1	0.78	7	60	480	13	0.6	20	11	3.7
402430	46-43.253	-103.296	-3-15-	2.8	4.6	0.60	19	83	490	15	0.9	22	15	3.2
402431	46-43.278	-103.453	-3-15-	2.9			9	67	530	17	0.9	30	20	6.6
402432	46-43.323	-103.470	-3-15-	1.5	1.8	0.85	5	36	310	10	0.9	24	9	2.5
402433	46-43.186	-103.312	-3-15-	1.7	2.7	0.61	9	110	660	31	0.8	28	23	6.0
402434	46-43.118	-103.348	-3-15-	3.8	3.5	1.1	12	120	540	23	0.7	38	26	6.6
402435	46-43.094	-103.348	-3-15-	2.8	3.5	0.81	7	130	550	27	0.7	34	23	5.4
402436	46-43.090	-103.348	-3-15-	2.5	3.2	0.77	8	120	540	30	0.7	31	24	5.4
402437	46-43.056	-103.328	-3-15-	2.0	2.8	0.73	8	110	610	27	0.7	27	24	5.4
402438	46-43.031	-103.348	-3-15-	3.3	2.8	1.2	8	98	570	20	0.6	28	21	5.0
402439	46-43.044	-103.348	-3-15-	2.4	2.9	0.84	9	110	570	23	0.6	26	20	4.1
402440	46-43.029	-103.389	-3-15-	2.4	2.7	0.90	10	100	500	22	0.8	29	20	4.1
402441	46-43.005	-103.442	-3-12-	3.1	2.2	1.4	9	110	500	24	0.9	33	22	6.6
402442	46-43.027	-103.414	-3-12-	3.0	3.3	0.92	9	130	450	27	0.7	38	23	5.3
402443	46-43.322	-103.219	-3-15-	3.3	3.6	0.93	12	100	480	26	0.7	28	26	7.6
402446	46-43.364	-103.154	-3-12-	3.0	3.8	0.80	10	130	480	25	0.9	33	24	5.3
402447	46-43.356	-103.094	-3-15-	2.8	3.4	0.83	7	140	570	34	1.0	37	30	7.8
402448	46-43.352	-103.085	-3-15-	2.9	3.1	0.94	9	140	450	31	0.9	47	25	6.5
402449	46-43.349	-103.077	-3-15-	3.0	3.1	0.98	4	95	420	29	0.8	29	21	6.2
402450	46-43.321	-103.066	-3-12-	3.2	3.2	0.99	9	120	580	27	0.9	33	25	6.0
402452	46-43.947	-102.444	-3-12-	3.0	5.3	0.57	8	57	620	12	0.9	20	9	6.9
402454	46-43.987	-102.424	-3-12-	2.9	3.3	0.88	5	79	600	14	0.8	29	17	4.7
402458	46-43.691	-102.259	-3-15-	2.8	3.1	0.91	11	44	380	13	0.5	22	8	4.3
402459	46-43.698	-102.258	-3-12-	2.6	3.2	0.80	7	42	370	14	0.6	26	8	3.1
402460	46-43.717	-102.336	-3-15-	2.0	2.3	0.88	7	28	370	8	0.3	15	5	2.5

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
402463	46-43.923	-102.531	-3-15-	3.7	3.7	0.99	7	130	480	28	1.0	42	31	12.
402464	46-43.918	-102.558	-3-15-	3.4	3.7	0.93	9	120	470	23	0.9	34	26	9.2
402468	46-43.919	-102.696	-3-15-	3.6	3.5	1.0	8	160	510	33	1.0	42	34	9.0
402469	46-43.912	-102.654	-3-15-	3.5	3.7	0.95	8	150	520	31	0.9	44	27	7.6
402473	46-43.826	-102.343	-3-12-	3.9	5.0	0.69	11	56	680	12	0.7	18	6	4.3
402474	46-43.893	-102.634	-3-15-	3.3	3.0	1.1	7	140	530	26	0.6	36	26	6.1
402478	46-43.959	-102.529	-3-15-	3.3	3.9	0.84	10	170	700	39	1.3	45	36	11.
402479	46-43.948	-102.576	-3-15-	3.6	4.0	0.89	8	170	560	35	1.3	47	41	12.
402480	46-43.947	-102.576	-3-15-	3.5	2.3	1.3	9	180	620	31	1.0	45	34	7.8
402483	46-43.970	-103.082	-3-15-	2.5	3.1	0.82	4	160	810	51	1.1	42	35	10.
402485	46-43.970	-103.111	-3-15-	13.	14.	0.90	12	400	950	73	5.6	57	60	18.
402486	46-43.978	-103.125	-3-15-	6.6	7.1	0.93	3	480	540	43	3.0	18	39	7.5
402488	46-43.909	-103.121	-3-15-	3.3	3.8	0.86	4	190	720	23	1.5	28	22	5.6
402489	46-43.893	-103.038	-3-15-	2.5	3.1	0.81	5	130	750	31	0.8	33	30	7.5
402490	46-43.811	-103.092	-3-15-	4.6	4.5	1.0	7	230	750	48	1.5	41	46	15.
402491	46-43.870	-103.199	-3-15-	1.9	2.3	0.83	7	50	430	13	0.6	20	18	8.1
402492	46-43.861	-103.184	-3-15-	16.	16.	1.0	9	100	710	28	5.5	34	33	10.
402493	46-43.836	-103.162	-3-12-	8.2	7.7	1.1	8	100	680	30	4.2	23	37	11.
402494	46-43.825	-103.131	-3-15-	3.9	4.1	0.95	8	130	880	24	1.1	33	26	9.7
402495	46-43.763	-103.005	-3-15-	2.2	2.9	0.76	10	74	510	19	0.7	22	15	3.2
402499	46-43.774	-103.032	-3-12-	3.4	3.7	0.91	9	90	540	18	0.6	21	17	6.7
402500	46-43.752	-103.042	-3-15-	2.4	2.8	0.87	11	100	580	23	0.6	29	22	9.9
402501	46-43.825	-103.197	-3-15-	3.8	4.2	0.91	11	110	670	27	0.9	30	29	12.
402502	46-43.848	-103.199	-3-15-	3.1	3.5	0.90	8	84	540	22	0.9	32	30	8.8
402504	46-43.757	-103.132	-3-15-	5.5	6.1	0.90	9	170	640	25	1.7	28	22	5.5
402505	46-43.769	-103.130	-3-15-	6.3	6.3	0.93	7	250	590	34	1.9	35	41	20.
402512	46-43.887	-103.062	-3-15-	2.9	3.3	0.89	9	130	760	30	0.9	37	30	11.
402513	46-43.912	-103.117	-3-12-	2.6	3.4	0.78	7	64	430	15	1.8	22	18	6.6
402518	46-43.831	-103.200	-3-12-	2.4	3.3	0.72	6	51	520	19	1.2	34	17	55.
402519	46-43.808	-103.273	-3-15-	1.7	2.1	0.80	6	40	320	10	0.4	19	13	7.6
402520	46-43.800	-103.299	-3-15-	1.9	2.4	0.78	9	47	590	17	0.6	25	19	8.8
402521	46-43.788	-103.295	-3-15-	3.1	3.4	0.90	10	49	550	16	0.8	25	16	8.1
402522	46-43.781	-103.307	-3-15-	3.0	3.0	0.99	11	47	400	12	0.4	21	15	9.2
402523	46-43.484	-103.313	-3-12-	6.4	6.3	1.0	7	95	570	13	3.0	32	16	9.2
402524	46-43.453	-103.336	-3-15-	3.8	3.9	0.97	6	49	300	11	1.3	15	12	2.2
402525	46-43.416	-103.335	-3-15-	11.	4.5	2.4	10	370	460	37	7.8	28	61	20.
402527	46-43.463	-103.305	-3-12-	4.0	4.9	0.81	8	150	530	33	5.7	65	53	11.
402528	46-43.474	-103.134	-3-15-	2.1	2.8	0.77	9	110	490	24	1.0	31	24	6.9
402530	46-43.492	-103.224	-3-15-	2.6	3.3	0.80	10	160	500	30	1.2	39	30	8.5
402531	46-43.489	-103.057	-3-15-	2.9	3.4	0.86	9	110	510	24	1.3	31	24	9.2
402534	46-43.503	-103.057	-3-15-	2.6	3.4	0.78	11	110	460	24	0.9	30	26	8.5
402535	46-43.476	-103.080	-3-15-	3.2	3.4	0.93	10	130	450	26	1.2	37	26	6.0
402536	46-43.477	-103.093	-3-15-	2.9	3.2	0.92	6	120	390	22	1.0	34	23	6.6
402539	46-43.453	-103.226	-3-15-	2.7	3.2	0.86	6	130	320	30	1.5	35	31	11.
402547	46-43.448	-103.156	-3-12-	2.2	3.5	0.63	16	42	310	5	0.9	10	8	2.4
402548	46-43.434	-103.182	-3-12-	2.5	3.2	0.79	11	28	280	3	1.8	7	3	1.5
402549	46-43.419	-103.204	-3-15-	3.6	3.9	0.93	8	100	600	21	1.0	27	22	8.0
402550	46-43.419	-103.213	-3-12-	4.2	5.7	0.73	16	91	420	15	0.8	22	13	4.6
402551	46-43.395	-103.241	-3-15-	2.1	3.2	0.66	9	59	320	10	0.5	15	10	3.0
402553	46-43.351	-103.412	-3-15-	3.5	5.7	0.61	11	110	660	21	0.8	20	17	5.0
402554	46-43.361	-103.334	-3-12-	1.8	2.7	0.65	7	54	310	12	0.8	16	12	3.2
402565	46-43.713	-102.170	-3-12-		3.6									
402566	46-43.716	-102.158	-3-12-	3.1	3.0	1.0	13	55	390	16	0.5	32	10	3.4
402567	46-43.717	-102.129	-3-12-	2.6	2.9	0.89	11	66	220	21	0.5	36	13	2.4
402568	46-43.709	-102.084	-3-12-	2.9	4.6	0.63	8	57	540	15	0.8	22	9	3.6

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
402569	46-43.710	-102.083	-3-15-	3.2	3.0	1.1	5	51	410	15	0.5	25	8	2.6
402570	46-43.719	-102.037	-3-12-	3.0	3.5	0.85	6	92	470	22	0.4	37	20	2.8
402571	46-43.722	-102.032	-3-12-	3.8	3.6	1.1	9	79	560	17	0.7	31	15	3.8
402572	46-43.721	-102.030	-3-12-	4.0	3.4	1.2	9	140	710	30	0.4	37	30	3.0
402573	46-43.722	-102.200	-3-12-	2.8	2.9	0.96	9	51	430	16	0.6	27	9	2.7
402574	46-43.705	-102.200	-3-15-	2.1	2.5	0.84	5	39	370	13	0.4	20	6	2.6
402575	46-43.735	-102.230	-3-15-	2.7	2.9	0.92	13	68	520	20	0.6	35	10	3.0
402576	46-43.734	-102.244	-3-12-	4.7	6.6	0.71	13	58	670	12	0.5	17	4	4.2
402577	46-43.807	-102.209	-3-12-	2.5	3.1	0.81	11	52	410	16	0.5	25	7	2.8
402578	46-43.807	-102.240	-3-12-	2.1	3.3	0.64	10	44	460	12	0.5	21	6	2.4
402579	46-43.806	-102.249	-3-12-	2.6	3.2	0.86	8	46	480	12	0.3	21	6	1.9
402580	46-43.973	-102.141	-3-12-	2.3	2.5	0.92	9	59	380	18	0.5	28	10	2.6
402581	46-43.961	-102.139	-3-12-	3.6	3.2	1.1	9	58	360	18	0.5	35	12	3.5
402583	46-43.904	-102.159	-3-12-	4.3	4.0	1.1	8	68	500	15	0.4	29	15	6.2
402584	46-43.899	-102.159	-3-15-	2.8	4.1	0.69	8	45	340	8	0.6	17	7	3.2
402585	46-43.888	-102.159	-3-12-	3.2	3.5	0.92	8	43	400	9	0.6	19	8	5.1
402586	46-43.843	-102.067	-3-15-	2.2	2.6	0.85	10	47	430	14	0.5	27	8	2.9
402587	46-43.844	-102.067	-3-15-	2.5	2.7	0.93	13	60	460	19	0.6	36	11	3.3
402589	46-43.849	-102.031	-3-15-	3.7	4.3	0.85	13	65	490	25	0.9	52	14	4.0
402590	46-43.856	-102.060	-3-15-	2.3	3.0	0.76	11	50	440	14	0.5	28	10	3.5
402591	46-43.886	-102.080	-3-12-	2.4	2.8	0.87	10	45	350	13	0.5	26	8	2.9
402592	46-43.894	-102.060	-3-12-	2.8	3.0	0.94	11	51	290	12	0.6	21	8	3.5
402593	46-43.895	-102.018	-3-15-	2.8	2.9	0.95	8	75	450	14	0.8	24	16	6.6
402595	46-43.965	-102.082	-3-12-	4.6	4.3	1.1	7	87	500	17	0.9	33	20	6.0
402596	46-43.965	-102.108	-3-12-	2.2	2.9	0.77	9	50	390	12	0.9	21	9	3.4
402597	46-43.965	-102.292	-3-15-	2.2	2.9	0.74	8	63	470	11	0.6	24	14	5.2
402598	46-43.965	-102.300	-3-12-	3.0	3.3	0.92	9	62	390	18	0.5	31	12	3.6
402599	46-43.980	-102.360	-3-12-	2.7	3.0	0.89	10	90	560	16	1.0	30	20	7.5
404008	46-43.351	-103.708	-3-12-	6.5	7.7	0.84	7	48	360	11	1.2	19	10	3.7
404013	46-43.268	-103.643	-3-15-	5.5	5.4	1.0	7	47	350	12	0.8	20	11	3.0
404016	46-43.556	-103.716	-3-15-	1.8	2.9	0.62	4	95	720	27	0.9	40	28	13.
404018	46-43.624	-103.717	-3-15-	1.9	2.8	0.70	4	57	430	16	0.4	25	18	2.7
404019	46-43.638	-103.729	-3-15-	2.0	3.1	0.64	10	66	580	19	0.6	24	21	6.9
404020	46-43.646	-103.743	-3-15-	1.8	2.3	0.80	7	50	1100	19	0.7	19	14	3.5
404021	46-43.671	-103.723	-3-15-	2.5	3.0	0.85	10	72	610	25	0.8	30	24	2.1
404022	46-43.700	-103.684	-3-12-	3.1	3.9	0.78	12	77	560	25	0.5	39	25	1.4
404023	46-43.704	-103.694	-3-12-	3.7	4.5	0.82	6	83	1200	120	0.6	37	27	7.8
404024	46-43.735	-103.720	-3-12-	4.8	5.8	0.83	8	77	580	32	1.1	35	24	1.7
404034	46-43.671	-103.759	-3-15-	1.9	2.6	0.70	8	58	540	18	0.9	23	18	5.0
404036	46-43.724	-103.832	-3-15-	2.1	2.4	0.88	6	52	440	14	0.7	26	17	2.3
404037	46-43.699	-103.842	-3-15-	1.6	2.3	0.70	7	48	450	14	0.6	25	14	2.2
404038	46-43.677	-103.843	-3-15-	3.3	3.3	0.99	8	69	500	14	0.7	25	18	3.8
404115	46-43.493	-103.805	-3-15-	2.1	2.5	0.86	10	82	490	19	0.3	39	22	3.3
404119	46-43.461	-103.992	-3-15-	3.4	3.3	1.0	8	74	630	14	0.4	34	14	3.0
404121	46-43.414	-103.919	-3-15-	3.8	3.7	1.0	6	59	500	16	0.5	34	14	4.2
404139	46-43.457	-103.776	-3-15-	2.1	2.7	0.79	8	66	400	17	0.9	41	19	4.4
404142	46-43.387	-103.785	-3-15-	11.	13.	0.88	5	54	320	11	1.3	20	8	3.1
404144	46-43.455	-103.824	-3-15-	3.5	3.8	0.92	8	63	660	17	0.6	32	18	1.8
404145	46-43.560	-103.844	-3-15-	2.2	2.4	0.91	8	50	370	15	0.5	33	17	2.7
404146	46-43.570	-103.857	-3-15-	1.4	1.8	0.78	5	29	230	9	0.3	26	9	1.2
404147	46-43.508	-103.789	-3-15-	2.6	2.8	0.94	3	35	280	12	0.5	39	13	1.5
404152	46-43.548	-103.411	-3-15-	2.5	2.2	1.1	4	39	470	14	0.4	26	15	4.7
404155	46-43.568	-103.630	-3-15-	2.1	2.5	0.85	5	60	500	16	0.5	23	20	3.7
404156	46-43.639	-103.603	-3-12-	3.2	3.1	1.0	5	65	650	27	1.0	48	21	5.7
404158	46-43.657	-103.591	-3-12-	2.0	2.8	0.71	5	52	410	12	0.2	30	18	2.2

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. ST LAT	SAMPLE LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
404166	46-43.715	-103.510	-3-12-	2.1	2.9	0.72	7	81	310	21	0.4	35	22	3.2
404168	46-43.739	-103.520	-3-12-	3.0	3.5	0.86	3	33	480	9	1.0	34	9	7.3
404169	46-43.767	-103.571	-3-12-	3.9	4.0	0.98	10	74	750	29	0.7	57	25	15.
404170	46-43.774	-103.531	-3-12-	4.6	6.4	0.72	9	68	1000	26	1.4	45	21	12.
404171	46-43.784	-103.514	-3-12-	15.	16.	0.89	7	67	1200	17	1.2	41	18	7.3
404174	46-43.791	-103.564	-3-12-	4.5	5.5	0.81	7	81	1400	28	1.2	57	26	96.
404175	46-43.791	-103.560	-3-12-	7.3	9.3	0.78	8	67	1000	19	1.1	46	19	13.
404176	46-43.776	-103.602	-3-12-	2.6	4.2	0.63	<2	75	1700	28	1.0	60	32	290.
404179	46-43.862	-103.624	-3-12-	3.0	3.9	0.77	12	63	760	26	1.1	57	24	33.
404180	46-43.870	-103.622	-3-12-	2.7	5.2	0.52	9	75	680	47	1.8	43	33	10.
404181	46-43.873	-103.613	-3-12-	3.0	4.7	0.64	12	59	730	30	1.5	60	26	110.
404182	46-43.890	-103.589	-3-12-	2.6	3.9	0.66	10	86	540	49	0.9	35	39	150.
404185	46-43.949	-103.594	-3-12-	2.8	3.6	0.78	11	73	600	52	1.9	40	32	10.
404186	46-43.968	-103.621	-3-12-	2.7	3.7	0.72	9	90	500	36	1.4	43	37	7.4
404187	46-43.952	-103.576	-3-12-	2.8	3.7	0.76	12	87	460	48	1.3	40	33	8.4
404189	46-43.910	-103.591	-3-12-	2.6	3.4	0.76	9	67	470	25	1.1	36	22	5.9
404190	46-43.944	-103.531	-3-15-	2.5	3.4	0.74	7	64	400	20	1.1	31	18	8.9
404191	46-43.953	-103.508	-3-15-	3.2	4.1	0.78	8	69	610	31	1.6	30	24	7.2
404192	46-43.965	-103.501	-3-15-	4.9	5.6	0.88	12	86	660	32	1.4	37	30	39.
404194	46-43.924	-103.526	-3-12-	1.9	3.2	0.61	9	66	480	33	1.1	70	21	16.
404195	46-43.920	-103.514	-3-12-	3.5	4.8	0.74	13	58	670	16	0.7	60	21	33.
404283	46-43.792	-103.713	-3-12-	2.3	3.7	0.61	12	80	570	43	1.1	35	37	5.2
404285	46-43.772	-103.843	-3-15-	2.3	3.6	0.63	11	81	300	15	0.4	21	18	3.1
404295	46-43.788	-103.792	-3-15-	1.7	2.6	0.67	9	61	510	19	0.7	22	16	3.2
404297	46-43.804	-103.795	-3-12-	2.2	2.9	0.77	5	64	710	25	1.4	21	16	1.8
404299	46-43.773	-103.866	-3-15-	2.8	3.0	0.92	7	62	460	23	0.3	29	15	3.4
404300	46-43.895	-103.691	-3-12-	3.2	3.9	0.81	5	72	460	54	1.0	36	28	3.8
404301	46-43.894	-103.705	-3-12-	2.1	2.5	0.80	<2	100	500	45	1.3	23	57	4.2
404305	46-43.867	-103.674	-3-12-	2.6	2.8	0.93	<2	79	470	55	1.4	31	31	21.
404308	46-43.782	-103.729	-3-12-	2.8	3.1	0.89	5	68	420	31	0.7	23	20	1.7
404309	46-43.768	-103.661	-3-12-	3.0	3.7	0.82	17	66	520	22	0.6	31	24	1.7
404310	46-43.768	-103.654	-3-12-	3.5	4.3	0.82	5	70	540	38	0.8	46	25	45.
404314	46-43.440	-103.775	-3-15-	2.2	2.3	0.97	6	46	420	13	0.6	24	12	1.6
404318	46-43.387	-103.867	-3-15-	3.1	3.8	0.82	10	60	440	16	0.7	25	13	2.1
404319	46-43.658	-103.414	-3-15-	3.5	3.7	0.95	10	65	440	29	0.8	44	20	6.5
404320	46-43.654	-103.412	-3-12-	4.9	4.4	1.1	12	51	500	23	1.5	38	17	3.2
404321	46-43.711	-103.460	-3-12-	4.2	4.1	1.0	<2	64	640	20	0.8	46	20	19.
404324	46-43.551	-103.386	-3-15-	3.3	2.5	1.3	9	40	350	54	0.3	22	11	5.4
404327	46-43.548	-103.888	-3-15-	2.5	1.8	1.4	7	35	290	13	<0.1	22	10	2.7
404328	46-43.553	-103.933	-3-12-	2.8	3.4	0.83	8	62	430	19	2.2	44	24	2.5
404329	46-43.542	-103.969	-3-15-	3.0	3.0	0.99	6	61	400	23	<0.1	57	21	4.0
404330	46-43.569	-103.953	-3-15-	1.6	1.5	1.1	9	25	210	9	0.3	22	8	1.1
404332	46-43.605	-103.955	-3-15-	2.9	2.9	0.99	3	49	360	17	0.1	54	19	2.8
404333	46-43.604	-103.930	-3-15-	2.4	2.5	0.96	6	42	450	15	0.3	33	14	1.8
404334	46-43.582	-103.907	-3-15-	2.6	2.8	0.92	7	46	370	14	0.2	29	13	2.5
404344	46-43.779	-103.404	-3-12-	4.4	6.4	0.69	9	72	770	17	1.3	38	19	11.
404345	46-43.758	-103.394	-3-15-	7.9	9.7	0.81	15	75	400	27	1.0	40	19	3.7
404352	46-43.804	-103.421	-3-12-	7.9	11.	0.71	19	49	600	47	1.0	40	14	7.1
404353	46-43.846	-103.402	-3-12-	4.9	11.	0.46	3	54	700	15	0.6	43	20	4.8
404354	46-43.874	-103.440	-3-12-	7.8	11.	0.69	4	67	810	23	0.9	46	29	12.
404357	46-43.845	-103.342	-3-15-	3.5	4.3	0.80	10	63	750	20	0.8	42	19	15.
404359	46-43.850	-103.307	-3-15-	1.5	1.8	0.84	11	36	290	7	0.8	15	11	3.5
404360	46-43.852	-103.306	-3-15-	1.5	2.3	0.67	8	42	390	12	0.7	19	14	3.5
404362	46-43.877	-103.336	-3-15-	3.2	4.2	0.75	7	73	740	29	0.8	33	31	12.
404364	46-43.983	-103.348	-3-15-	2.9	3.6	0.82	11	90	500	28	1.5	38	32	4.6

Table B-3, Continued

PARTIAL DATA LISTING FOR STREAM SEDIMENT OF THE HOT SPRINGS QUADRANGLE

HOT SPRINGS QUADRANGLE - SEDIMENT

OR SAMPLE NUMBER	D. O. E. SAMPLE ST LAT	LONG	NUMBER L TY REP	U (PPM)	U-NT (PPM)	U/TU	TH (PPM)	V (PPM)	P (PPM)	CU (PPM)	SE (PPM)	LI (PPM)	NI (PPM)	AS (PPM)
404366	46-43.880	-103.275	-3-15-	1.7	2.4	0.71	7	50	600	18	0.5	38	18	3.1
404450	46-43.222	-103.942	-3-15-	5.9	6.5	0.90	10	250	1000	53	5.3	47	44	15.
404451	46-43.225	-103.950	-3-15-	6.4	5.6	1.1	10	210	1000	37	3.5	42	33	9.0
404453	46-43.187	-103.845	-3-15-	6.1	5.5	1.1	7	160	730	29	1.0	59	25	7.9
404528	46-43.652	-103.974	-3-15-	2.4	2.7	0.89	7	47	390	18	0.3	46	19	3.6
404529	46-43.679	-103.997	-3-15-	2.8	3.0	0.95	8	48	430	16	0.3	39	17	4.5
404530	46-43.664	-103.920	-3-15-	2.4	2.5	0.96	6	54	470	20	0.4	29	16	3.8
404536	46-43.328	-103.900	-3-12-	4.3	4.7	0.91	12	110	680	22	1.4	54	22	1.7
404537	46-43.321	-103.897	-3-15-	6.7	6.3	1.1	13	160	710	35	1.2	47	37	7.8
404538	46-43.361	-103.985	-3-12-	7.0	7.2	0.98	11	130	630	29	1.5	45	31	6.8

APPENDIX C

MICROFICHE OF FIELD AND LABORATORY DATA

APPENDIX C

MICROFICHE OF FIELD AND LABORATORY DATA

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	Thorium	TH
		Titanium	TI
Uranium Measured by Mass Spectrometry[b]	U-MS	Vanadium	V
		Yttrium	Y
Uranium Measured by Neutron Activation	U-NT	Zinc	ZN
Arsenic	AS	Zirconium	ZR
Selenium	SE	Sulfate (ppm)	SO, SO_4
Silver	AG	Chloride (ppm)	CL
Aluminum	AL	Conductivity from Lab (μmhos/cm)	CT-L
Boron	B	Conductivity from Field (μmhos/cm)	CT-F
Barium	BA	Dissolved Oxygen (ppm)	DO
Beryllium	BE	Temperature (°C)	TP, TEMP
Calcium	CA	pH	PH
Cerium	CE	pH Measured by Lo Ion Paper	PH-P
Cobalt	CO	Total Alkalinity (ppm)	T-AK
Chromium	CR	M Alkalinity (ppm)	T-AK
Copper	CU	P Alkalinity (ppm)	P-AK, LIP
Iron	FE	Carbonate (ppm)	CB
Potassium	K		
Lithium	LI	$CB = \begin{cases} 0 & \text{if } pH \le 8.3 \\ \dfrac{3.42 \times M\text{-}AK}{5.61 + 10^{(11-pH)}} & \text{if } pH > 8.3 \end{cases}$	
Magnesium	MG		
Manganese	MN		
Molybdenum	MO	Bicarbonate (ppm)	BC
Sodium	NA		
Niobium	NB	$BC = \begin{cases} \dfrac{2.62 \times M\text{-}AK}{4.3 + 10^{(7-pH)}} & \text{if } pH \le 8.3 \\ 0.61 \times M\text{-}AK - CB & \text{if } pH > 8.3 \end{cases}$	
Nickel	NI		
Phosphorus	P	U-NT/U-FL	U/U, TUU
Lead	PB	U-FL/U-NT	U/TU
Platinum	PT	TH/U-NT	TH/U
Scandium	SC	1,000·U/SP	U/SP
Silicon	SI	1,000·U/B	U/B
Strontium	SR	1,000·U/SO	U/SO, USO

(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.

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**

UCN-11882 (1 6-77)

Type of Vegetation (55) (Within 1 Km Upstream)

- C — Conifer
- & — Conifer & Deciduous
- D — Deciduous
- B — Brush
- G — Grass
- M — Moss
- L — Lichen
- Ø — Other

Density of Vegetation (56) (Within 1 Km Upstream)

- B — Barren
- S — Sparse
- M — Moderate
- D — Dense
- V — Very Dense

Local Relief (57) (Within 1 Km Upstream)

- F — Flat (<2m)
- L — Low (2–15m)
- G — Gentle (15–60m)
- M — Moderate (60–300m)
- H — High (>300m)
- Ø — Other

Weather

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

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

Classes of Contaminants (60)

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

Average Stream Velocity (m/sec) (61 62 63)

N = No Visible Movement
P = Stagnant Pool

64 65 66 — **Water Width (m)**

67 68 69 — **Average Depth (m)**

Water Level (70)

- D — Dry
- P — Pools
- L — Low
- N — Normal
- H — High
- F — Flood

Dominant Bed Material (71)

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

Sample Color (Except Plants)

Adj			Noun	
72	73	74	75	76

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

Odor of Sampled Material (77)

- N — None
- S — H_2S
- Ø — Other

78 R — **Results Request** (Use Remarks)

1 — 2 Card Number

PLANT SAMPLE

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

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

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

Name of Tree, Deciduous (26)

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

Name of Tree, Conifer (27)

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

Name of Bush (28)

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

Name of Moss (29)

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

Algae (30)

- G — Blue-Green
- B — Brown
- Ø — Other

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

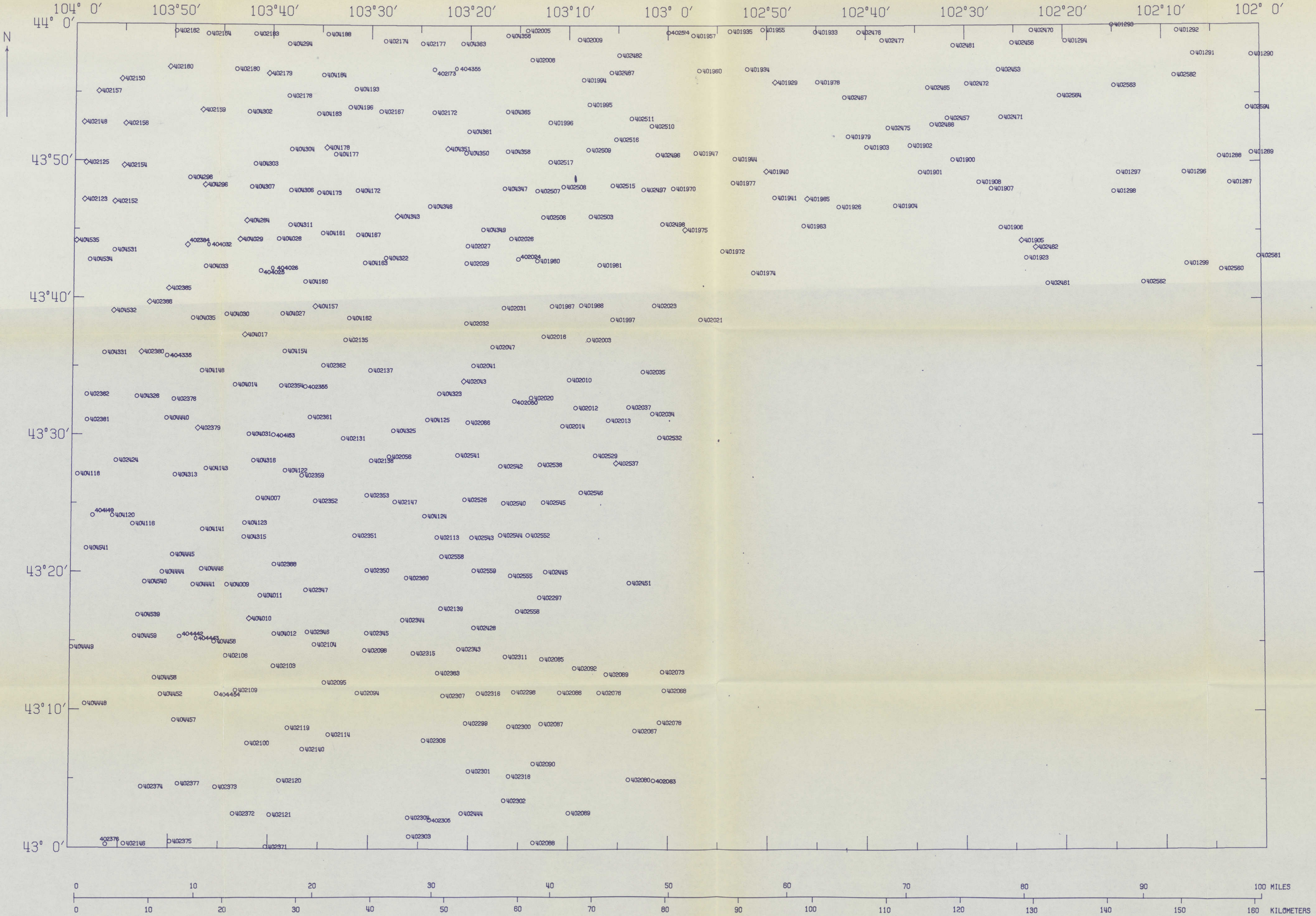
Lake Area

56 57 58 59 (sq km)

REMARKS (Card 4)

MICROFICHE OF FIELD AND LABORATORY DATA

CONTENTS



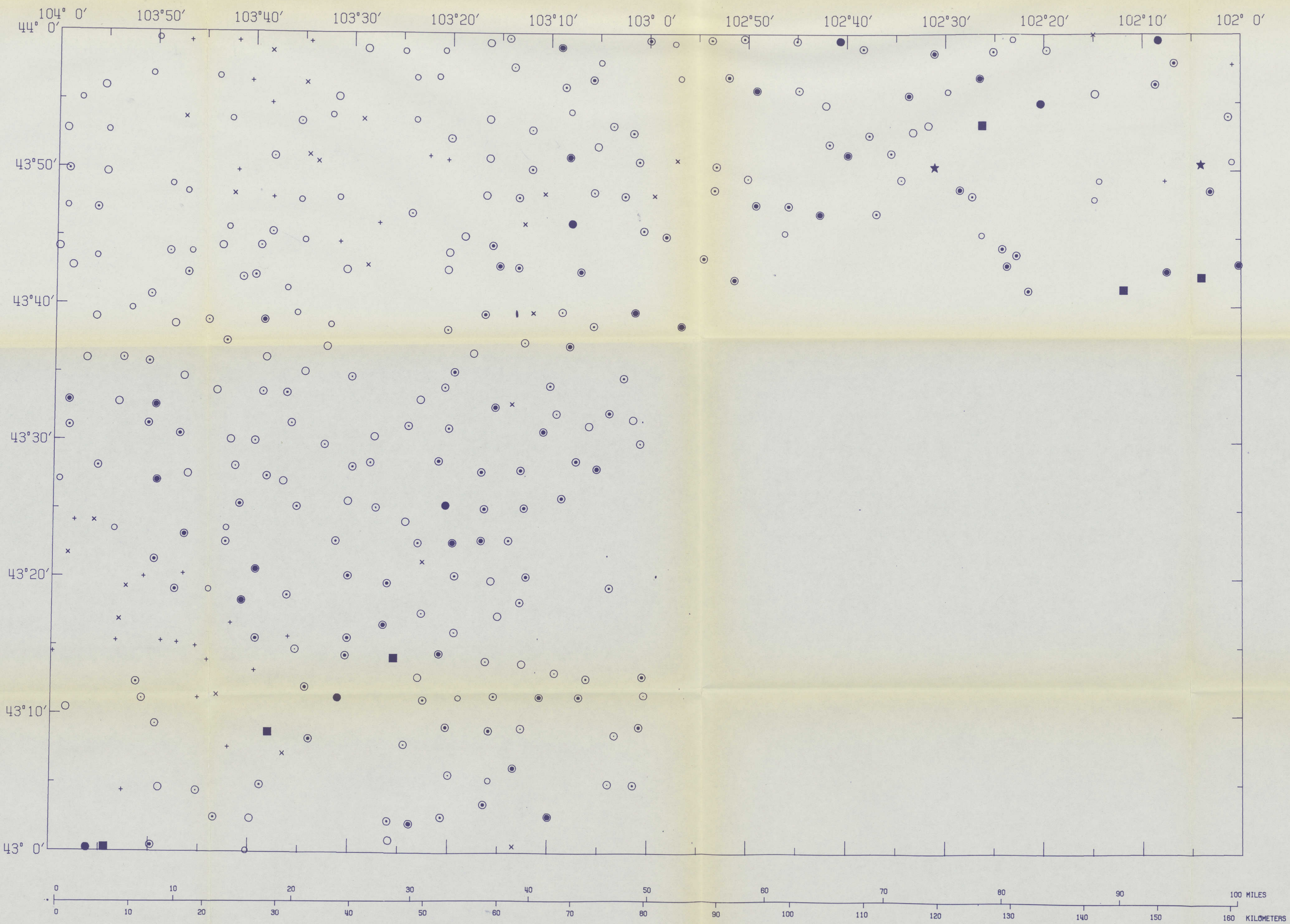
LEGEND

- ○ WELL WATER
- ◇ SPRING WATER

PLATE 1
HOT SPRINGS QUADRANGLE
GROUNDWATER
SAMPLE LOCATION MAP

SCALE 1: 250000

340 SAMPLES PLOTTED



SYMBOL RANGES FOR PLOTTED VARIABLE (X)

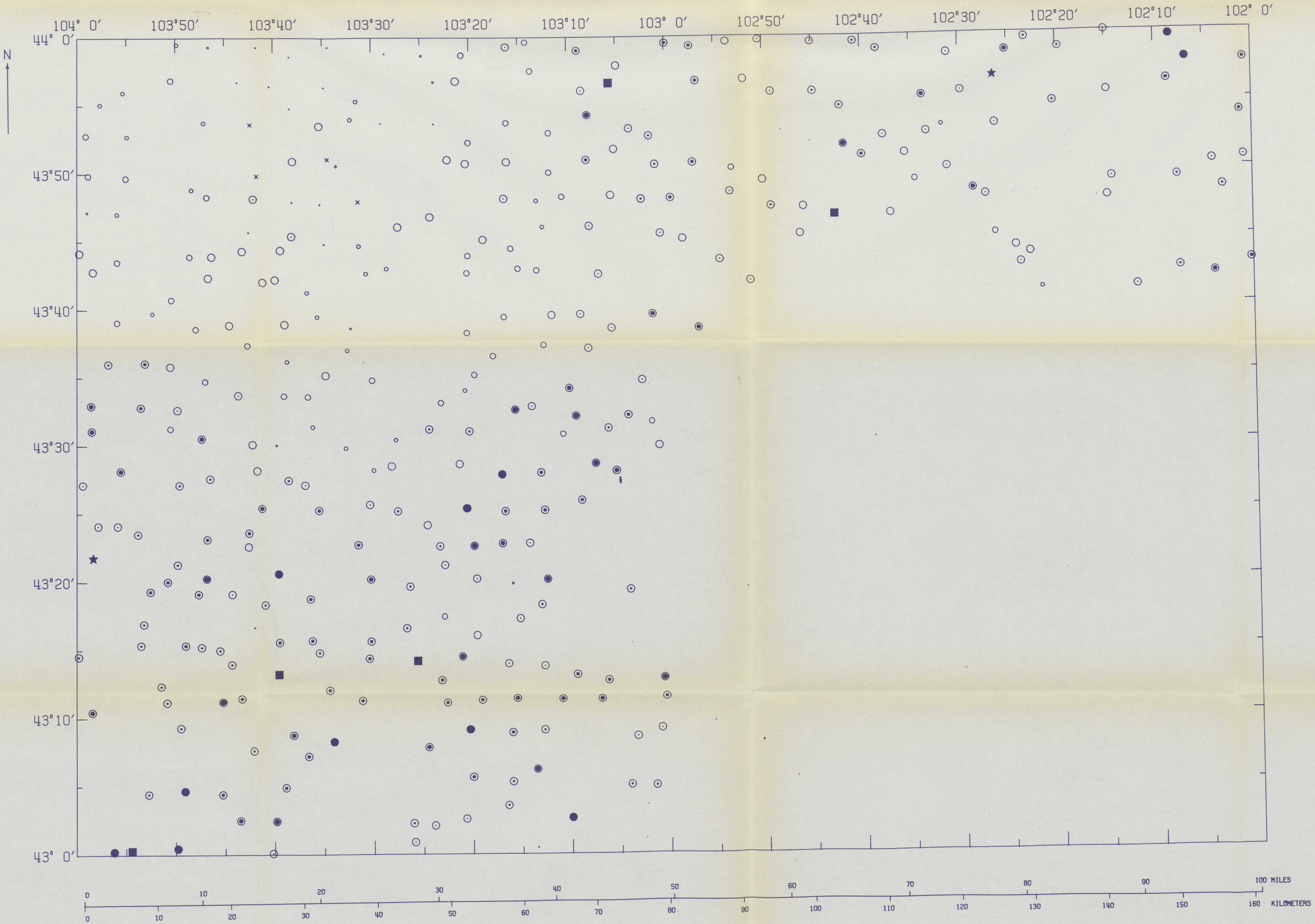
+	0.0 ≤ X < 0.20
×	0.20 ≤ X < 0.50
○	0.50 ≤ X < 2.00
○	2.00 ≤ X < 5.00
⊙	5.00 ≤ X < 10.00
⊙	10.00 ≤ X < 17.00
⊙	17.00 ≤ X < 30.00
⊙	30.00 ≤ X < 45.00
⊙	45.00 ≤ X < 60.00
●	60.00 ≤ X < 92.00
■	92.00 ≤ X < 135.00
★	X ≥ 135.00

PLATE 2
HØT SPRINGS QUADRANGLE
SYMBØL PLØT
GRØUNDWATER

URANIUM (PPB)

SCALE 1: 250000

340 SAMPLES PLØTTED



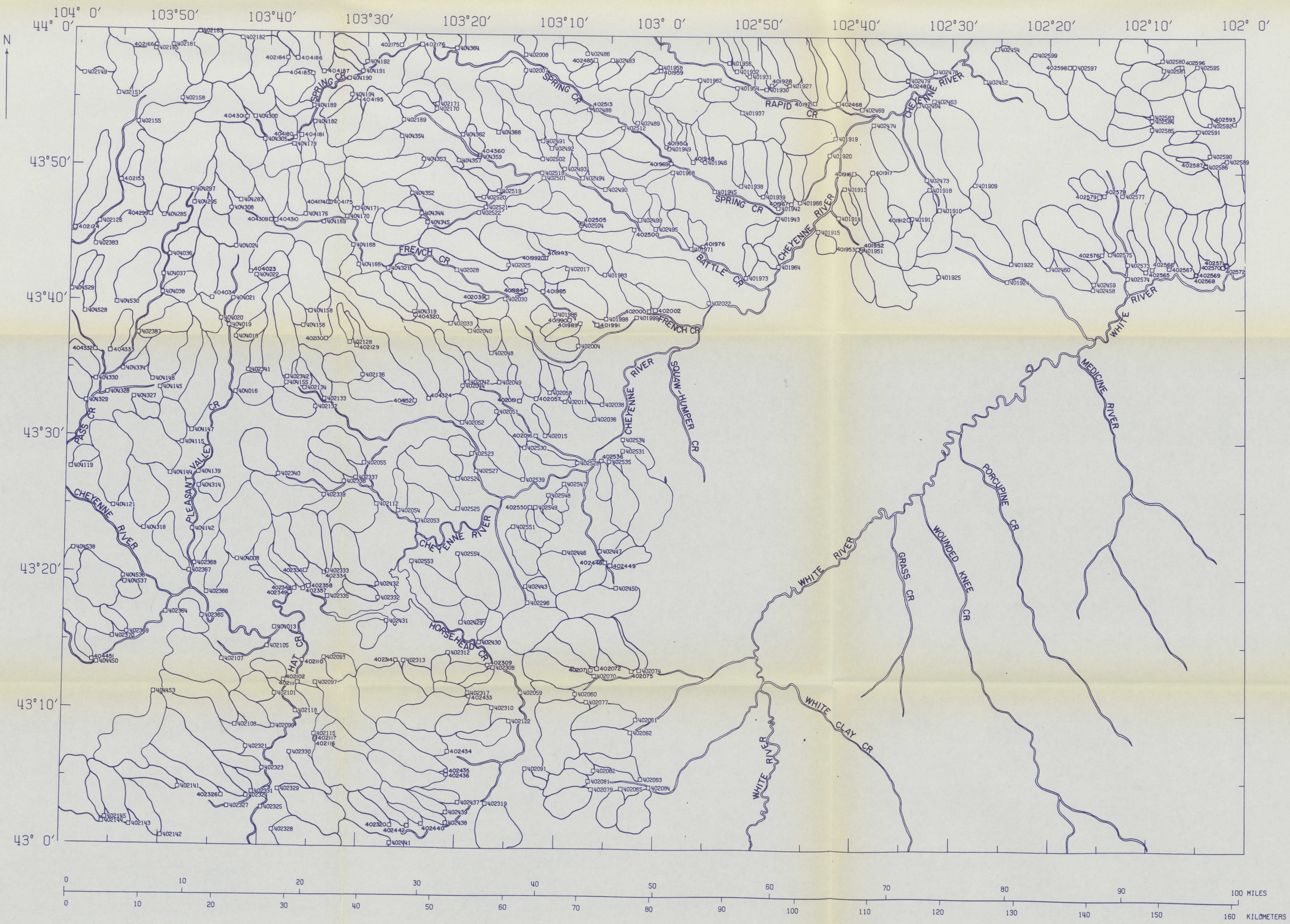
SYMBOL RANGES FOR PLOTTED VARIABLE (X)

Symbol	Range
+	0 ≤ X < 130
×	130 ≤ X < 250
·	250 ≤ X < 400
•	400 ≤ X < 450
∘	450 ≤ X < 600
○	600 ≤ X < 800
○	800 ≤ X < 1150
⊙	1150 ≤ X < 1800
⊙	1800 ≤ X < 2800
◉	2800 ≤ X < 3500
◉	3500 ≤ X < 4400
◉	4400 ≤ X < 5700
●	5700 ≤ X < 7400
■	7400 ≤ X < 9400
★	X ≥ 9400

PLATE 3
HOTSPRINGS QUADRANGLE
SYMBOL PLOT
GROUNDWATER
SPECIFIC CONDUCTANCE (UMHOS/CM)

SCALE 1: 250000

340 SAMPLES PLOTTED



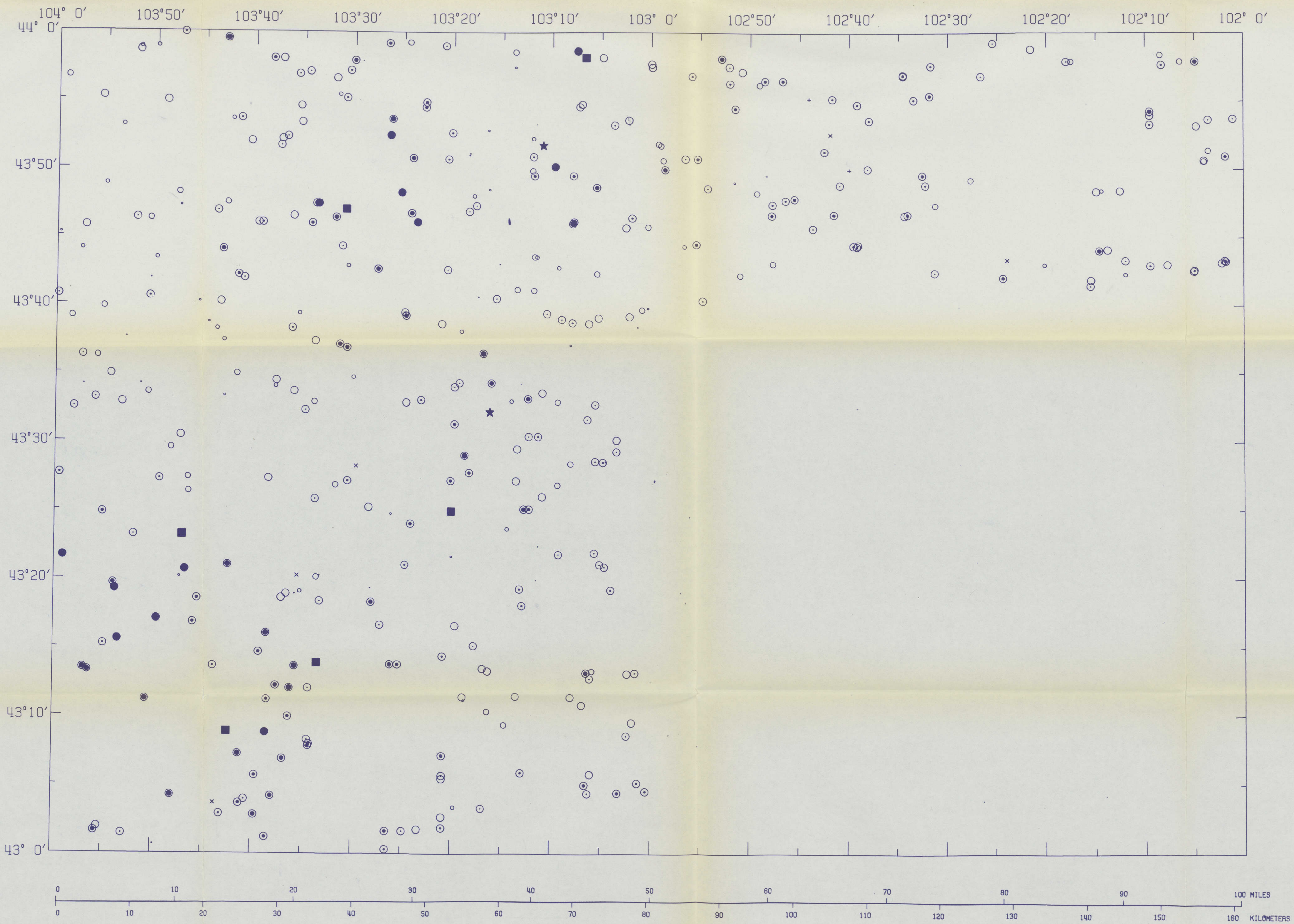
LEGEND

□ STREAM SEDIMENT

PLATE 4
HØTSPRINGS QUADRANGLE
STREAM SEDIMENT SAMPLE LØCATIØN AND DRAINAGE BASIN MAP

SCALE 1: 250000

391 SAMPLES PLOTTED

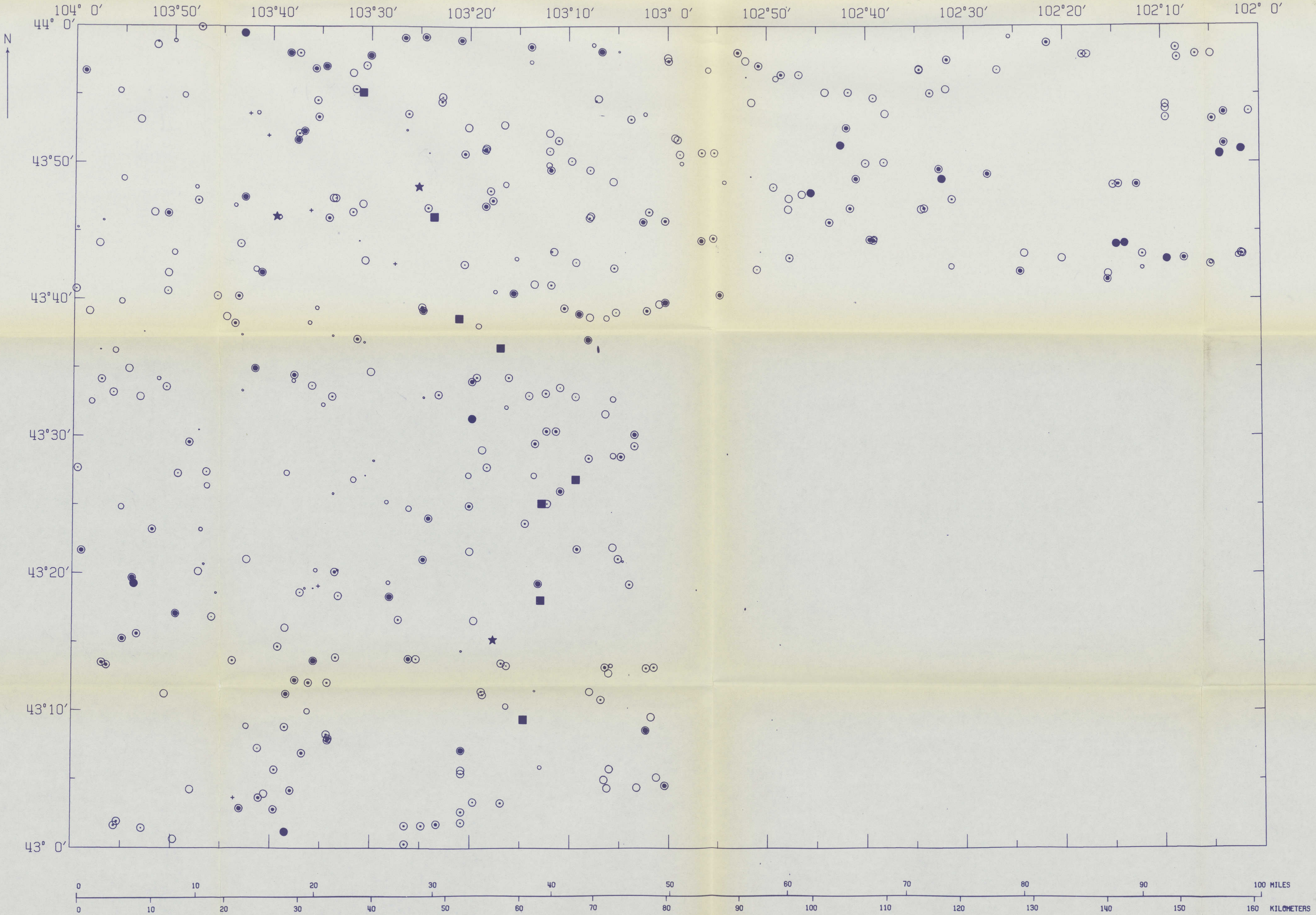


SYMBØL RANGES FØR PLØTTED VARIABLE (X)

Symbol	Range
+	0.0 ≤ X < 0.25
×	0.25 ≤ X < 1.27
·	1.27 ≤ X < 1.65
∘	1.65 ≤ X < 1.87
○	1.87 ≤ X < 2.13
○	2.13 ≤ X < 2.42
○	2.42 ≤ X < 2.76
⊙	2.76 ≤ X < 3.14
⊙	3.14 ≤ X < 3.60
⊙	3.60 ≤ X < 4.16
⊙	4.16 ≤ X < 5.03
◉	5.03 ≤ X < 6.53
●	6.53 ≤ X < 8.18
■	8.18 ≤ X < 15.02
★	X ≥ 15.02

PLATE 5
HØT SPRINGS QUADRANGLE
SYMBØL PLØT
STREAM SEDIMENT
URANIUM FLUOROMETRIC (ppm)

SCALE 1: 250000
394 SAMPLES PLØTTED

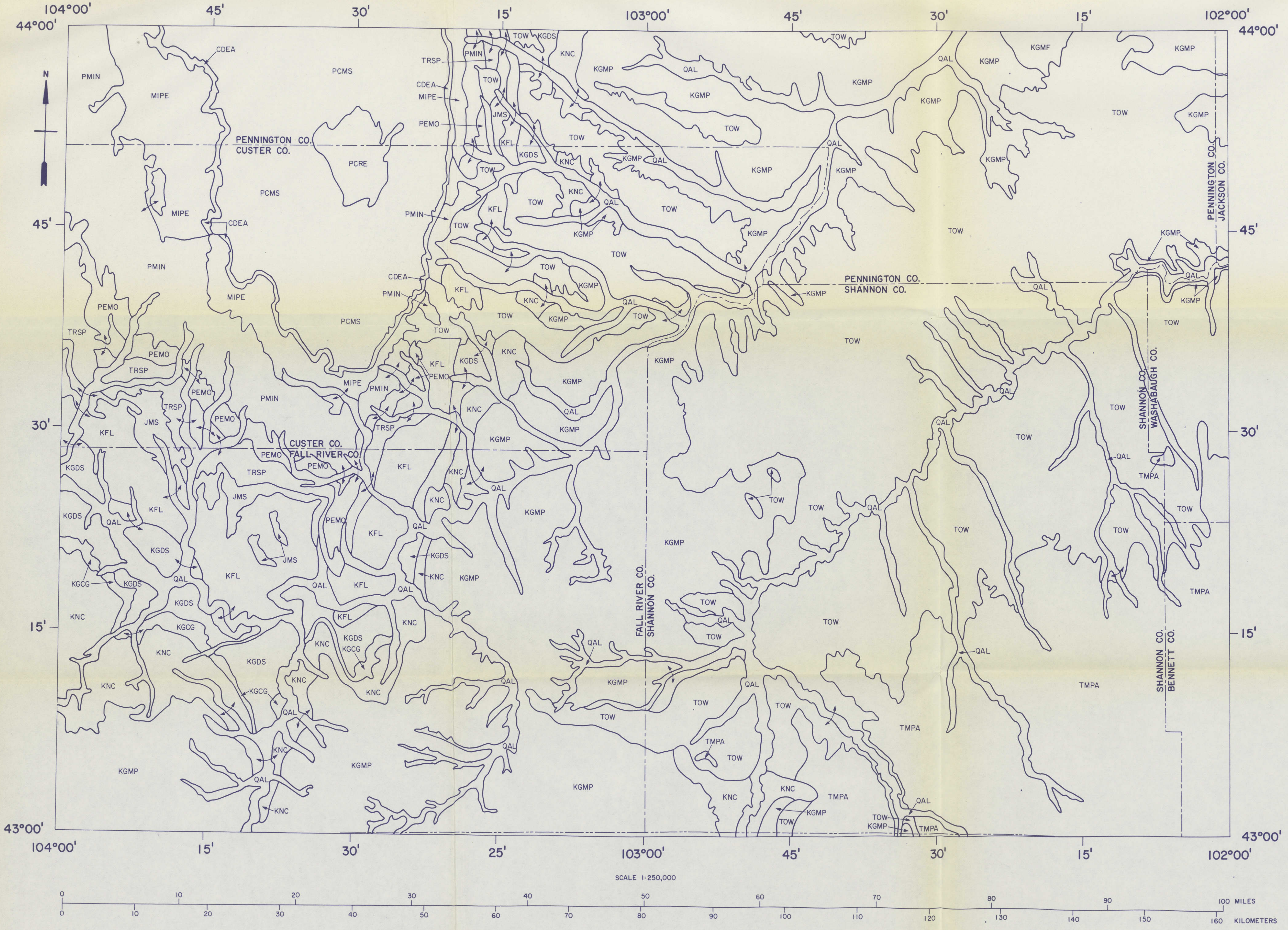


SYMBOL RANGES FOR PLOTTED VARIABLE (X)

Symbol	Range
+	0 ≤ X < 2
×	2 ≤ X < 3
·	3 ≤ X < 4
•	4 ≤ X < 5
∘	5 ≤ X < 6
○	6 ≤ X < 7
◯	7 ≤ X < 8
⊙	8 ≤ X < 9
⊙	9 ≤ X < 10
◉	10 ≤ X < 11
◉	11 ≤ X < 12
◉	12 ≤ X < 13
●	13 ≤ X < 15
■	15 ≤ X < 17
★	X ≥ 17

PLATE 6
HOT SPRINGS QUADRANGLE
SYMBOL PLOT
STREAM SEDIMENT
THORIUM (PPM)

SCALE 1: 250000
394 SAMPLES PLOTTED



STRATIGRAPHIC COLUMN FOR THE HOT SPRINGS QUADRANGLE

ERA	SYSTEM	SERIES	GEOLOGIC MAP CODE	GEOLOGIC GROUP	GEOLOGIC MEMBER	MAXIMUM THICKNESS METERS	MAXIMUM THICKNESS FEET
CENOZOIC	QUATERNARY		QAL	ALLUVIUM			
	TERTIARY	MIOCENE	TMPA	ARIKAREE GROUP	BRULE FORMATION	177	575
		OLIGOCENE	TOW	WHITE RIVER GROUP	CHADRON FORMATION	195	630
MESOZOIC	CRETACEOUS		KGMF		FOX HILLS FORMATION	23	75
			KGMP		PIERRE SHALE	407	1,336
			KNC		NIOBRARA FORMATION AND CARLILE FORMATION, UNDIVIDED	235	750
			KGCG		GREENHORN FORMATION	92	300
			KGDS	GRANEROS GROUP	BELLE FOURCHE SHALE, MOWRY SHALE, NEWCASTLE SANDSTONE AND SKULL CREEK SHALE	287	925
			KFL	INYAN KARA GROUP	FALL RIVER FORMATION LAKOTA FORMATION	216	700
	JURASSIC		JMS		MORRISON FORMATION SUNDANCE FORMATION	244	800
	TRIASSIC		TRSP		SPEARFISH FORMATION	210	700
PALEOZOIC	PERMIAN		PEMO		MINNEKAHTA LIMESTONE AND OPECHE SHALE	50	165
	PENNSYLVANIAN		PMIN		MINNELUSA FORMATION	427	1,400
	MISSISSIPPIAN		MIPE		PAHASAPA AND ENGLEWOOD LIMESTONES	[illegible]	529
	CAMBRIAN		CDEA		DEADWOOD FORMATION	122	400
PRECAMBRIAN			PCRE		HARNEY PEAK GRANITE, GRANITES UNDIFFERENTIATED AND PEGMATITE		
			PCMS		METAMORPHIC ROCK		

SOURCE OF GEOLOGY:
1. STACH, ROBERT, PRIVATE COMMUNICATION, SOUTH DAKOTA GEOLOGICAL SURVEY (1979)

LEGEND

COUNTY LINE — - — - —

GEOLOGIC CONTACT ————

PLATE 7

GENERALIZED GEOLOGIC MAP HOT SPRINGS QUADRANGLE, SOUTH DAKOTA