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Informal Report

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**Uranium Hydrogeochemical and
Stream Sediment Reconnaissance of the
Trinidad NTMS Quadrangle, Colorado**

University of California



LOS ALAMOS SCIENTIFIC LABORATORY

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Thomas A. Weaver

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URANIUM HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE
OF THE TRINIDAD NTMS QUADRANGLE, COLORADO

by

Wayne A. Morris, Carol M. LaDelfe,
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ABSTRACT

During the field seasons of 1976 and 1977, 1060 natural water and 1240 waterborne sediment samples were collected from 1768 locations in the Trinidad, Colorado, NTMS quadrangle. The samples from this 19 600-km² area were analyzed at the Los Alamos Scientific Laboratory for total uranium. The uranium concentrations in waters ranged from less than the detection limit of 0.02 parts per billion (ppb) to 88.3 ppb, with a mean value of 4.05 ppb. The concentrations in sediments ranged from 1.3 parts per million (ppm) to 721.9 ppm, with a mean value of 5.55 ppm. Based on simple statistical analyses of these data, arbitrary anomaly thresholds were set at 20 ppb for water samples and 12 ppm for sediment samples. By this definition, fifty-eight water and 39 sediment samples were considered anomalous.

At least five areas delineated by the data appear to warrant more detailed investigations. Twenty-six anomalous water samples outline a broad area corresponding to the axis of the Apishapa uplift, seven others form a cluster in Huerfano Park, and five others outline a small area in the northern part of the San Luis Valley. Twenty-three anomalous sediment samples outline an area corresponding generally to Precambrian metamorphic rocks in the Culebra Range, and seven anomalous sediment samples form a cluster near Crestone Peak in the Sangre de Cristo Mountains.

I. INTRODUCTION

This report describes work done in the Trinidad, Colorado, National Topographic Map Series (NTMS) quadrangle (US Geological Survey, 1955) by the Los Alamos Scientific Laboratory (LASL) as part of the nationwide Hydrogeochemical and Stream Sediment Reconnaissance (HSSR). The HSSR, a part of the National Uranium Resource Evaluation (NURE) program sponsored by the US Department of Energy (DOE), is designed to identify areas having higher than normal concentrations of uranium in ground waters, surface waters, and water-transported sediments. The HSSR data will ultimately be combined with data from other NURE programs (e.g., from airborne radiometric surveys and geological investigations) to prepare an improved assessment of the potential uranium resources in the United States and to indicate areas favorable for uranium exploration by the private sector. The LASL is responsible for conducting the HSSR in the Rocky Mountain states of New Mexico, Colorado, Wyoming, and Montana, in parts of Texas, Oklahoma, Arizona, Utah, and Idaho, and in Alaska.

A total of 1060 water and 1240 sediment samples were collected from 1768 locations in the Trinidad quadrangle. The western half of the quadrangle was sampled by a private contractor during March, April, May, and July of 1976; the eastern half was sampled by another private contractor in September and October of 1977. The sample locations were specified by the LASL and the samples were collected using maps, field equipment, and materials supplied by the LASL. Throughout the study, standardized field and analytical techniques developed by the LASL (Sharp, 1977; Sharp and Aamodt, 1978; Hues et al, 1977), summarized in Appendix A, were utilized so that sample data in this report may be compared to those in other LASL HSSR reports in surrounding areas.

II. DESCRIPTION OF STUDY AREA

Geographic Setting

The Trinidad quadrangle covers approximately 19 600 km² in south-central Colorado (Fig. 1). The area is bounded by latitudes 37° and 38°N and longitudes 104° and 106°W and includes all of Costilla, most of Huerfano, and portions of Alamosa, Saguache, Custer, Conejos, Las Animas, Pueblo, and Otero Counties. Trinidad is the largest city in the quadrangle with a population of about 9900 (1970 census), followed by Alamosa and Walsenburg.

The western portion of the quadrangle lies within the Southern Rocky Mountain physiographic province and includes the San Luis Valley (Rio Grande rift), Sangre de Cristo Mountains, and Wet Mountains. The eastern portion is in the Rocky Mountain Piedmont province and includes the Raton basin and Apishapa uplift (Fig. 2).

Elevations in the study area range from 1400 m above sea level in the northeast corner of the quadrangle to 4400 m at Sierra Blanca Peak, 36 km east of Alamosa. Several other peaks in the Sangre de Cristo Mountains exceed 4000 m.

Climate

The climate of the Trinidad quadrangle area is semiarid to semihumid and cool. The average annual precipitation varies from less than 250 mm in the valleys to above 800 mm in the higher elevations of the Sangre de Cristo

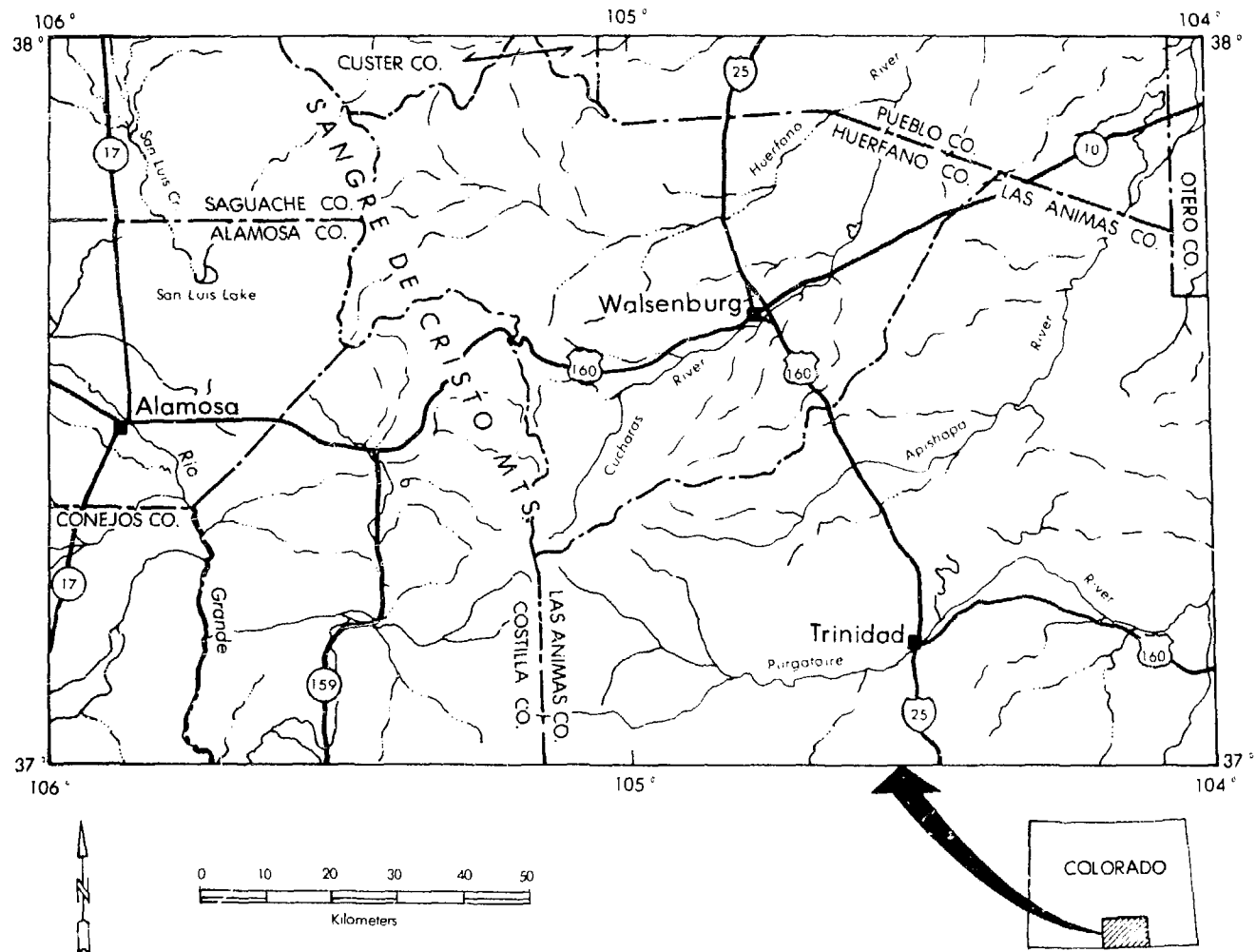


Fig. 1. Location and drainage map for the Trinidad quadrangle, Colorado.

Mountains. About 80% of the annual precipitation in the San Luis Valley occurs in late spring and summer from thermally induced thunderstorms.

Winter temperatures average just above 0°C for highs and around -10°C for lows; summer high temperatures average about 30°C and lows are near 5°C. The month preceding the beginning of sample collection in the western area was characterized by nearly twice the normal precipitation in the Rio Grande drainage basin. Excessive precipitation continued in that area through May 1976, resulting in mountain snow depths that precluded sampling higher altitudes before July. East of the Sangre de Cristo Mountains the weather was near normal during the spring of 1976. Temperatures during the 1977 sample collection period were slightly warmer than normal and the precipitation averaged less than half of normal. Samplers recorded the weather conditions at each sample location; these data are included in Appendixes B and C. Additional information on the climate of the Trinidad quadrangle is provided in reports by the National Oceanic and Atmospheric Administration (1976 and 1977).

Hydrology

Within the Trinidad quadrangle the Sangre de Cristo Mountains constitute the major drainage divide, separating the Rio Grande and Arkansas River drainage basins. The Rio Grande, with its tributaries, drains the southern portion of the San Luis Valley and flows south into New Mexico. The northern portion of the San Luis Valley is a closed basin with San Luis Lake as the sump. The Purgatoire River is the major perennial stream in the Great Plains area of the quadrangle and joins the Arkansas River east of the report area. The Huerfano, Cucharas, and Apishapa Rivers are intermittent streams that join the Arkansas northeast of the report area.

Ground water in the San Luis Valley is found in both unconfined and confined aquifers which are composed of Cenozoic sediments that are as much as 5790 m deep along the eastern side of the valley. The unconfined surface aquifer is tapped by the majority of domestic and agricultural wells in the valley. It has a thickness of up to 61 m and wells yield as much as 190 l/s with total dissolved solids ranging from 72 to 31 200 parts per million (ppm); maximum salinity is found in the closed basin surrounding San Luis Lake. Depth to water in the unconfined aquifer ranges from 0 to 34 m below the land surface. The confined aquifers have a total thickness of from 15 m to nearly 5790 m. Wells in this zone can yield up to 250 l/s and have total dissolved solids ranging from 60 to 2440 ppm. The piezometric surface of water from wells monitored in 1970 ranged from 41 m below to 19 m above the surface (Emery et al, 1972).

Ground water along the eastern slopes of the mountains and across the plains area of the quadrangle is primarily found in Cretaceous and younger rocks. The Coneyenne sandstone may yield significant quantities of water with quality ranging from good for domestic consumption to unfit even for stock use (McLaughlin et al, 1961). The Dakota sandstone generally provides a dependable source of small to moderate quantities of water for domestic and stock use, but in some places the water is unfit for any of these purposes (McLaughlin, 1956). Of the upper Cretaceous strata, the Fort Hays member of the Niobrara formation and the Codell sandstone member of the Carlile shale yield water to springs, and domestic and stock wells. The most dependable sources of ground water in the eastern third of the quadrangle are the unconsolidated alluvial aquifers that underlie the flood plains of the Purgatoire, Cucharas, Apishapa, and Huerfano Rivers and a number of their smaller tributaries (McLaughlin, 1956).

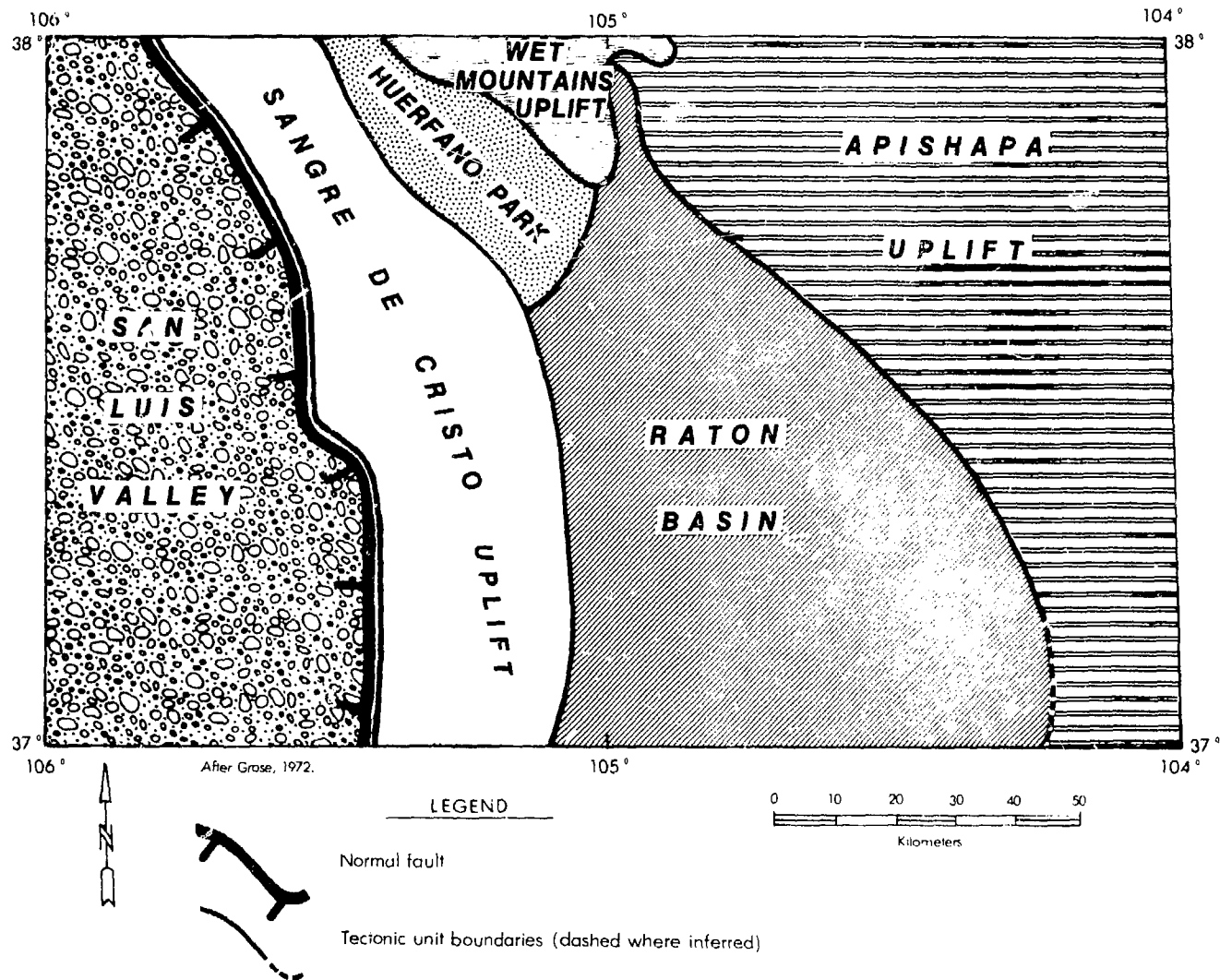


Fig. 2. Major structural features in the Trinidad quadrangle, Colorado.

III. GEOLOGY

Stratigraphy

The oldest rocks in the area are the Precambrian units exposed in the Sangre de Cristo and Wet Mountains. The Precambrian metamorphic units of the Sangre de Cristo Mountains include amphibolites, numerous varieties of dark-to medium-colored gneisses, metaquartzite, metasedimentary schist and gneiss, gneissic granodiorite, and alaskitic granite. Precambrian units exposed in the southern Wet Mountains are mapped as primarily alaskitic granite with hornblende gneiss and amphibolite on the east flank.

Comparison of the geologic maps of the Trinidad and Pueblo quadrangles (Johnson, 1969; Scott et al, 1978) reveals differences in naming and mapping of Precambrian units at their junction along 38°N latitude. The more recently mapped Pueblo quadrangle includes 1.7 billion-year-old gneiss flanking the 1.45 b.y. granite just north of the area in the Wet Mountains mapped simply as "alaskitic granite" on the Trinidad quadrangle. North of the area on the west flank of the Sangre de Cristo Range, mapped as "metasedimentary schist" on the Trinidad map, the Pueblo map indicates 1.45 b.y. quartz monzonite. This latter case suggests either a marked conflict in the classification of rock type or a contact between the two types along the 38°N latitude line, which is unlikely. The Wet Mountain situation could simply be the result of identification by different dating procedures used after the compilation of the Trinidad geologic map.

Paleozoic rock units exposed within the quadrangle are Pennsylvanian and Permian in age except for narrow outcrops of Ordovician and Devonian dolomite and quartzite along the west flank of the Sangre de Cristo Range. These Paleozoic rocks are found mainly on the east flank of the Sangre de Cristo Mountains, generally from just west of the crest to the faults bordering the east side. A gray limestone member of the Pennsylvanian Minturn formation forms the ridge of peaks in the Culebra Range. The Pennsylvanian and/or Permian Sangre de Cristo formation, comprised of predominantly fluvial, red, arkosic sandstones and conglomerates, is 2900 m thick at Whisky Pass and up to 4000 m thick near Crestone (Melton, 1925' where the conglomerate contains boulders up to 3 m in diameter (Bolyard, 1960).

Except for a narrow band of Triassic (?) Johnson Gap formation in the Culebra portion of the Sangre de Cristo Mountains, and a number of small areas of late Jurassic Morrison formation, Ralston Creek (?) formation, and Entrada sandstone in the Sangre de Cristo and Wet Mountains, Mesozoic deposition within the quadrangle is primarily represented by Cretaceous rocks, though the Apishapa and Purgatoire Rivers cut into Jurassic rocks at the crest of the Apishapa uplift. In the Raton basin the Cretaceous sequence is about 1340 m thick. Below the late Cretaceous Trinidad sandstone, 90% of the rocks are marine, predominantly shales (Cobban, 1956). Cretaceous rocks comprise essentially the entire surface of the quadrangle east and north of a north-northwest trending line approximately through Trinidad to the east flank of the Wet Mountains.

Rocks of the Raton formation were deposited in the Raton basin in the late Cretaceous and early Paleocene and have a thickness of up to 500 m southeast of the Spanish Peaks (Johnson and Wood, 1956). They contain most of the economic deposits of coal in southern Colorado and are comprised of sandstones, siltstones, and shales overlying a basal conglomerate. The remaining sediments which surface in the Raton basin and Huerfano Park are mostly Tertiary shales to arkosic conglomerates.

Tertiary to Quaternary alluvial gravels, sands, fan and pediment materials, stream deposits, and volcanic debris cover much of the San Luis Valley, Huerfano Park, and the graben northeast of Sierra Blanca. Among the youngest sediments are Pleistocene alluvial, morainal, and landslide deposits and Pleistocene to Recent eolian sands, primarily large sand dunes in the San Luis Valley.

Structure

Major structural units within the Trinidad quadrangle include the San Luis basin, Sangre de Cristo Mountains, Raton basin, Huerfano Park, Wet Mountains, and Apishapa uplift. The tilted graben of the San Luis basin and the Sangre de Cristo horst display a bedrock offset of several thousand meters along the Rio Grande rift, which extends north from approximately Chihuahua, Mexico, to at least central Colorado (Chapin, 1971). However, the 11 000-m structural relief reported for the San Luis basin may be in error (Cordell, 1978). Huerfano Park contains about 4600 m of Phanerozoic sediments (Briggs and Goddard, 1956), indicating at least 5900 m of bedrock relief between the park and the adjacent Wet Mountains. The Raton basin is structurally contiguous with Huerfano Park and extends south as far as Las Vegas, New Mexico; total thickness of sediment in the Colorado portion of the Raton basin is perhaps 7600 m (Baltz, 1965). The surface of the early Cretaceous Dakota sandstone is only 1400 m higher in the Apishapa uplift than in the Raton basin (Doeringsfeld et al, 1956), indicating the change toward the Great Plains structure in the eastern third of the quadrangle.

Igneous History

Small intrusions of Precambrian diorite, diabase, and gabbro, as well as a variety of hypabyssal rocks, occur among the metamorphics of the southern Sangre de Cristo Range, and many of the metamorphics of the Sangre de Cristo and Wet Mountains were originally basic to granitic igneous rocks. There is little evidence at this time for any relationship between Precambrian and Phanerozoic tectonic events in the Rocky Mountain region (Grose, 1972), and the billion years or more between igneous episodes in this area emphasizes this gap.

Cenozoic igneous features in all of the structural provinces of the Trinidad quadrangle include sole injections and intrusions of stocks, laccoliths, plugs, dikes, and sills, ranging in composition from ultrabasic to silicic (Johnson, 1960). Cenozoic lavas form the San Luis Hills and San Pedro Mesa in the San Luis Valley, the summit of Raton Mesa, and numerous flows in the Sangre de Cristo and Wet Mountains and the San Luis Valley. A cinder cone west of Mesita in the San Luis Valley is representative of igneous activity in the area within the last 10 000 years.

IV. URANIUM OCCURRENCES

Eight uranium occurrences, listed in Table I and plotted on Plate I, are reported in the Trinidad quadrangle. Three have produced uranium and five are undeveloped. Six of the eight occurrences are in Permian or Pennsylvanian and Permian rocks of the Sangre de Cristo formation. The Stumbling Stud and Loco Alice occurrences are vein deposits, but uranium associated with carbonaceous sedimentary material is most common in the others (Finch, 1967).

TABLE I

REPORTED URANIUM OCCURRENCES IN THE TRINIDAD QUADRANGLE, COLORADO

<u>Name</u>	<u>Latitude</u>	<u>Longitude</u>	<u>County</u>	<u>Comments</u>	<u>Source</u>
Pan Dye No. 1	37° 14'	105° 34'	Las Animas	Autunite, uraninite, and carnotite from the Pan Dye No. 1 property.	Finch, 1967
Spanish Peaks	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the Spanish Peaks area.	Finch, 1967
City Slicker claim, McGuire Lake, etc.	37° 14'	105° 34'	Huerfano	Carbonized logs, plant trash, and other uranium-bearing materials.	Brown and Malan, 1954
Stumbling Stud and other prospects	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the Stumbling Stud locality.	Finch, 1967
Security Exploration Co. property, Buckhorn and Mitzy claims, and other prospects	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the Security Exploration Co. property.	Finch, 1967
McGuire and Santa Rosa claims	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the McGuire and Santa Rosa claims.	Finch, 1967
Panor Lake claim and Lake Allen (McGuire-Thompson ranch)	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the Panor Lake claim and Lake Allen (McGuire-Thompson ranch).	Finch, 1967
King Madan No. 2	37° 14'	105° 34'	Huerfano	Uraninite, autunite, and carnotite from the King Madan No. 2 property.	Finch, 1967

The active uranium production that has taken place in the three areas of the quadrangle has had a cumulative economic value of no more than one million dollars from any one area (Mardirosian, 1976). Uranium in the City Slicker claim area near La Veta Pass is in the form of autunite and carnotite in coal seams, carbonized logs, and plant trash (Brown and Malan, 1954). The Buckhorn and Mitzy claims and Security Exploration property in Huerfano Park have produced uraninite and autunite from carbonized plant remains found in sandy shale and arkosic sandstones of the Tertiary Farisita formation (Finch, 1967). Carnotite and autunite were found in vein deposits in fluorite-cemented Dakota sandstone in the Stumbling Stud locality, near Badito Cone at the southern end of the Wet Mountains (Finch, 1967).

V. ANALYTICAL AND STATISTICAL DATA FOR URANIUM CONCENTRATIONS IN WATER AND SEDIMENT SAMPLES

During this reconnaissance 1060 water samples and 1240 sediment samples were collected and analyzed using the standard procedures outlined in Appendix A. Appendix B contains listings of field data and measured uranium concentrations for water samples; Appendix C contains similar listings for sediment samples. All uranium concentrations in waters are reported in parts per billion (ppb) and in sediments in ppm. Appendix D has an explanation of the codes used in the data listings and a key to the sample types. A sample

location overlay is provided as Plate I; uranium concentration overlays for water and sediment samples are presented as Plates II and III, respectively. All overlays are at a 1:250 000 scale and are to be used with both the NTMS topographic map and the US Geologic Survey geologic map of the Trinidad quadrangle. Note that the LASL sample location numbers on Plate I differ from those in the text and Appendixes B and C in that the leading two alphanumeric characters have been dropped from the location numbers printed on the plate (e.g., location C28001 in the Appendixes appears as 8001 on Plate I).

Uranium Concentrations in Water Samples

A semilogarithmic histogram of frequency versus uranium concentration for all 1060 waters from the Trinidad quadrangle is shown in Fig. 3. Table II summarizes the number of samples and the minimum, maximum, mean ($\bar{x}$), and standard deviation (σ) of the uranium concentrations for all waters as well as for individual water sample types. Although the uranium concentrations in water from different sources might not be directly comparable, in this evaluation all waters are considered as one population because the mean and standard deviation of the uranium concentrations from almost all source types are nearly equal.

Early in the LASL HSSR program water samples were taken from natural and artificial ponds in areas where streams and wells were sparse or non-existent. Subsequent evaluation of the uranium data from the samples taken from these sources showed that, in general, the uranium concentrations in ponds do not correlate with those of other sample types in the sample area. This is particularly true for shallow, artificial ponds in arid or semiarid climates where the average uranium concentrations may be an order of magnitude greater than those from other sources due to concentration mechanisms such as those described by Fix (1956). Furthermore, in the Rocky Mountain region there are usually not enough natural ponds in any one area to make an areal assessment using ponds only. Consequently, ponds were dropped from the LASL program beginning with the 1977 field season, except for those in Alaska where natural ponds are a primary sample source (Sharp, 1977). Since part of the Trinidad quadrangle was sampled in 1976 and part in 1977, natural and artificial pond

TABLE II
SUMMARY OF URANIUM DATA FOR WATER SAMPLES
FROM THE TRINIDAD QUADRANGLE, COLORADO

<u>Sample Type</u>	<u>Number of Samples</u>	<u>Minimum (ppb)¹</u>	<u>Maximum (ppb)</u>	<u>Mean (ppb)</u>	<u>Standard Deviation</u>
All Waters	1060	0.01	88.30	4.05	8.80
Streams	344	0.04	81.90	4.00	8.90
Springs	169	0.07	53.80	4.13	8.03
Wells	498	0.01	88.30	4.10	9.14
Artificial Ponds ^a	26	0.10	16.90	2.72	4.10
Natural Ponds ^a	23	0.03	38.10	4.73	9.22

^a Pond water samples were not collected east of 104°52'30"W longitude.

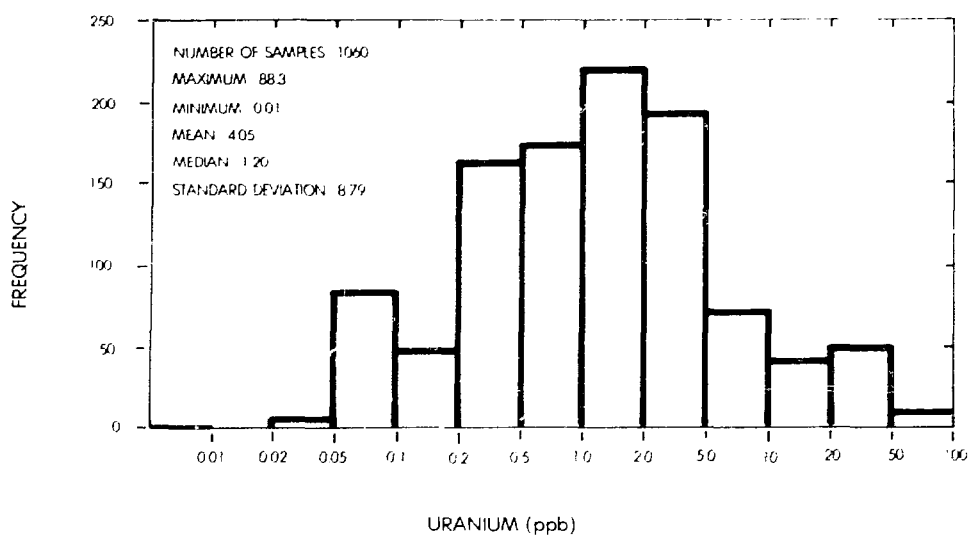


Fig. 3. Semilogarithmic histogram of the uranium concentrations in waters from the Trinidad quadrangle, Colorado.

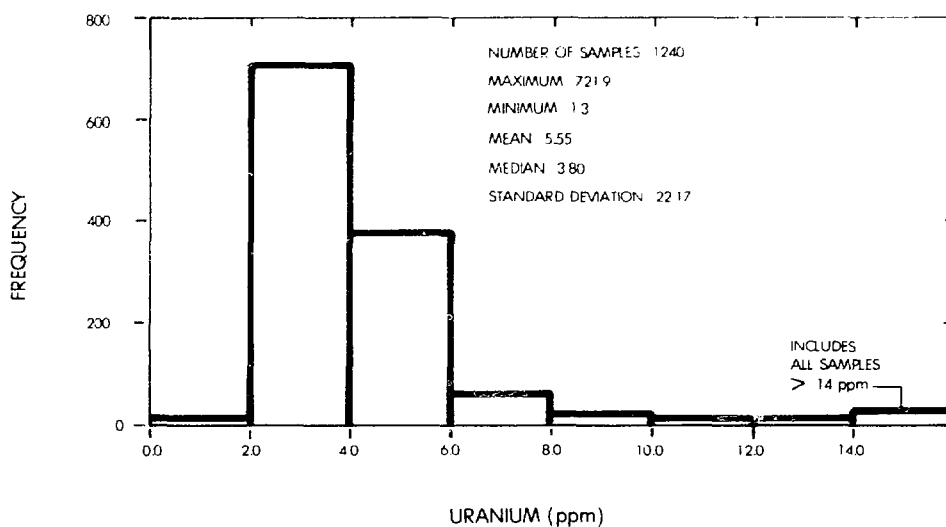


Fig. 4. Histogram of the uranium concentrations in sediments from the Trinidad quadrangle, Colorado.

samples were collected in the western portion but not in the eastern portion (east of 104°52'30"W longitude) of the quadrangle.

An arbitrary anomaly threshold for waters in the Trinidad quadrangle has been set at 20 ppb, which corresponds roughly to $\bar{x} + 2\sigma$ for all waters. There are 58 samples (5.5% of the total) with uranium values above 20 ppb; they are indicated on Plate II by the two largest concentration symbols. Table III provides the relevant data for these 58 water samples. Eight uranium values (less than 1% of the total) are above 50 ppb, represented by the largest symbol on Plate II. The highest in the study is 88.3 ppb in the well water from location C28722 on a tributary to Costilla Creek in the southern part of the San Luis Valley.

Twenty-six water samples with uranium concentrations greater than 20 ppb (one sample containing over 50 ppb) were taken from locations in the Cretaceous rocks of the Apishapa uplift, an area with no known uranium occurrences. These sample locations appear as Cluster I on Plate II and are tabulated with relevant data in Table III. The majority of these anomalous samples were collected from locations in the upper Cretaceous section (predominantly shale), which has yielded water samples with very high uranium values in the adjacent Lamar quadrangle (Shannon, 1979, in preparation). Ten other anomalous uranium concentrations (three greater than 50 ppb) were noted from locations underlain by these units in the eastern part of the quadrangle. The specific conductances of several of the samples within Cluster I and of the anomalous samples from locations east and south of the cluster are near 10 000 μmhos (Table III), indicating a high level of dissolved solids in the water. The high uranium content of the samples from this area could be attributed either to the high level of dissolved solids or to the generally high abundance of uranium in shales.

One ground and six surface water sample locations that have waters with anomalous uranium concentrations form Cluster II (Plate II and Table III) in Huerfano Park; two of the values are greater than 50 ppb. Also, several near-anomalous samples come from locations in or near this cluster and three of the eight documented uranium occurrences in the quadrangle are in or around the Huerfano Park area. Most of the high values are from locations in the Tertiary Huerfano and Farisita formations. South of Cluster II, near the center of the Trinidad quadrangle, a number of stream waters collected from the Cucharas River and its tributary, Middle Creek, contain uranium values which generally exceed 5 ppb. These values are associated with the City Slicker claim at the head of this drainage system.

Five locations with anomalous water samples (one over 50 ppb) from both surface and ground water sources in the northwest corner of the quadrangle form Cluster III (Plate II and Table III). This is in an area of interior drainage where natural concentration by evaporation might be expected (Fix, 1956). But the specific conductances of both surface and ground water samples are much lower here than in the Apishapa uplift and the highest uranium value (53.7 ppb) is in ground water from a free-flowing (artesian) well 24-m deep. Therefore, surface conditions (evaporation) may not be the dominant influence on uranium concentrations in this area.

In the southern portion of the San Luis Valley, along the Rio Grande, the water sampling coverage is poor because there are few wells and little surface water. However, there are seven ground water samples and one surface water sample from this region that show anomalous uranium concentrations. One of these comes from a well (sample location C28722) that is approximately 140-m deep and may penetrate more than one aquiclude along which concentration of

TABLE III

RELEVANT DATA FOR WATER SAMPLES FROM THE TRINIDAD QUADRANGLE, COLORADO,
WITH URANIUM CONCENTRATIONS GREATER THAN 20 PPB

	Sample Location Number	Sample Type	Total Uranium (ppb)	Specific Conductance (μ mhos/cm)	pH	Geology/Remarks
Cluster I	C28084	Spring	53.8	7800	7.0	This broad area parallels the axis of the Apishapa uplift with most samples from areas underlain by Cretaceous Miobara formation.
	C28377	Spring	49.9	10 000	7.6	
	C28365	Well	48.0	8100	7.3	
	C28097	Well	44.2	4025	7.5	
	C28609	Well	42.7	4600	7.6	
	C28612	Spring	40.0	1950	7.1	
	C28360	Stream	34.4	6100	7.9	
	C28621	Stream	33.4	3200	6.9	
	C28335	Well	33.0	1750	7.5	
	C28366	Well	31.8	7800	6.9	
	C29427	Well	30.8	205	6.9	
	C28389	Spring	30.3	10 010	7.9	
	C28114	Well	29.6	1100	7.2	
	C28115	Well	29.1	2300	7.1	
	C28379	Well	28.6	10 000	7.1	
	C28155	Well	27.1	900	8.0	
	C28412	Stream	26.6	6500	7.2	
	C28006	Well	24.9	5090	7.7	
	C28617	Well	24.7	454	7.2	
	C28374	Well	24.1	7500	8.3	
	C28012	Well	22.7	4050	7.1	
	C28120	Well	21.9	2490	7.5	
	C28403	Well	21.6	4800	7.0	
	C28380	Stream	21.3	8010	7.9	
	C28095	Spring	20.8	4950	6.4	
	C28378	Stream	20.6	4100	7.8	
Cluster II	C29262	Stream	58.3	800	8.0	This area of Huerfano Park is underlain by Tertiary Huerfano and Fari-sita formations, includes one known occurrence, and is near two other occurrences.
	C29497	Stream	52.0	2200	8.2	
	C29171	Stream	40.6	195	8.2	
	C29190	Natural Pond	38.1	925	8.3	
	C29175	Well	29.7	1825	7.9	
	C29176	Spring	28.4	1900	8.5	
Cluster III	C29511	Stream	23.8	1250	8.8	This is an area of interior drainage, artesian wells, and is underlain by Tertiary and Quaternary Alamosa and Santa Fe formations.
	C29704	Well	53.7	60	8.4	
	C29144	Stream	38.7	490	8.3	
	C29140	Stream	26.9	500	6.4	
	C29702	Well	22.7	4050	7.1	
Others	C29706	Natural Pond	21.3	500	8.0	Generally east and south of Cluster I; area underlain by Cretaceous sandstones and shales.
	C28478	Stream	81.9	10 480	8.4	
	C28283	Well	57.7	6650	6.4	
	C28484	Stream	55.9	10 330	8.7	
	C28501	Well	44.8	1800	6.9	
	C28293	Stream	44.3	5000	8.2	
	C28236	Well	31.6	1000	8.4	
	C28205	Well	29.8	4900	7.4	
	C28228	Spring	24.7	6100	7.4	
	C28170	Well	24.1	14 000	7.7	
	C28722	Well	88.3	600	7.8	
	C28741	Well	39.5	260	8.0	
	C28764	Well	36.6	468	7.1	
	C29129	Well	30.3	545	8.7	
	C28993	Well	30.2	600	6.9	
	C28718	Well	25.2	410	8.3	
	C28681	Stream	25.1	700	8.2	
	C29050	Spring	24.0	70	7.6	
	C28970	Well	20.2	500	8.0	
	C29493	Stream	25.3	1300	8.2	
						From Raton basin region near Tertiary intrusives.

soluble minerals could occur, while a second is from a well (sample location C28718) near an inferred fault shown on the geologic map of the Trinidad quadrangle. The source locations of these anomalous samples and several near-anomalous ones encircle the volcanic buttes of the San Luis Hills, an area where no water samples could be collected. These locations are spread over a large area and are not in a cluster; however, the high percentage of them that provided samples with elevated uranium contents suggest further investigations in the area may be worthwhile. There are no documented uranium occurrences in this area or in the tributary drainage basins nearby.

Uranium Concentrations in Sediment Samples

Figure 4 is a histogram of frequency versus uranium concentration for all 1240 sediment samples from the Trinidad quadrangle. Table IV is a summary of number of samples and the minimum, maximum, mean, and standard deviation of the uranium concentrations for all sediments as well as for individual sediment types. As noted in the discussion of water samples, samples from natural or artificial ponds were taken only in the western portion of the quadrangle.

An arbitrary anomaly threshold for sediments has been set at 12 ppm, which is approximately equal to $\bar{x} + 2\sigma$ if five very high uranium concentrations (81.9 to 721.9 ppm) are eliminated from the calculation. Inclusion of these high values results in an anomaly threshold of 50 ppm, which would designate only those five samples as anomalous. Relevant data for the 39 samples (3% of the total) with uranium concentrations greater than 12 ppm are shown in Table V. Thirty of the locations from which these samples come are grouped

TABLE IV
SUMMARY OF URANIUM DATA FOR SEDIMENT SAMPLES
FROM THE TRINIDAD QUADRANGLE, COLORADO

<u>Sample Type</u>	<u>Number of Samples</u>	<u>Minimum (ppm)</u>	<u>Maximum (ppm)</u>	<u>Mean (ppm)</u>	<u>Standard Deviation</u>
All Sediments	1240	1.3	721.90	5.55	22.17
All sediments ^a	1235	1.3	47.20	4.56	3.33
Wet Spring	153	1.3	721.90	12.80	62.02
Wet Spring ^a	149	1.3	47.20	5.29	5.30
Wet Stream	334	1.6	81.90	5.95	6.16
Wet Stream ^a	333	1.6	45.90	5.73	4.55
Wet Pond ^b	48	2.0	13.00	4.08	2.06
Dry Spring	12	2.5	4.50	3.64	0.56
Dry Stream	645	1.6	26.20	3.93	1.53
Dry Pond ^b	48	1.6	6.50	3.30	0.97

^a For statistical comparison samples with uranium values greater than 50 ppm have been excluded.

^b Wet and dry pond sediment samples were not collected east of 104°52'30"W longitude.

TABLE V

RELEVANT DATA FOR SEDIMENT SAMPLES FROM THE TRINIDAD QUADRANGLE, COLORADO,
WITH URANIUM CONCENTRATIONS GREATER THAN 12 PPM

	Sample Location Number	U(ppm)	Sediment Type	Geology/Remarks
Cluster IV	C29677	721.9	Wet spring	Crestone Peak area of Sangre de Cristo Mtns. Samples from area underlain by Precambrian metasediments or near contact with Permo-Pennsylvanian Sangre de Cristo formation.
	C29672	45.9	Wet stream	
	C29678	20.4	Wet stream	
	C29679	16.9	Wet stream	
	C29675	16.7	Wet spring	
	C29682	13.6	Wet stream	
	C29673	12.3	Wet stream	
Cluster V	C29312	241.9	Wet spring	Culebra Range cluster underlain predominantly by Precambrian metamorphic rock with some samples from near or over Permo-Pennsylvanian Sangre de Cristo formation.
	C29332	113.2	Wet spring	
	C29331	94.3	Wet spring	
	C29325	81.9	Wet stream	
	C29329	47.2	Wet spring	
	C29295	34.6	Wet spring	
	C28949	29.8	Wet stream	
	C29538	27.7	Wet stream	
	C29309	22.5	Wet stream	
	C29304	21.7	Wet spring	
	C29330	21.3	Wet spring	
	C29537	20.6	Wet stream	
	C29767	20.5	Wet stream	
	C29319	19.6	Wet spring	
	C29316	15.6	Wet stream	
	C29310	15.2	Wet stream	
	C29326	14.9	Wet stream	
	C29481	14.5	Wet stream	
	C29324	13.0	Wet stream	
	C29618	13.0	Wet natural pond	
	C28739	12.8	Wet stream	
	C29377	12.7	Wet stream	
	C29323	12.3	Wet stream	
Others	C28771	26.2	Dry stream	In pediment and alluvial gravels west of Culebra Range.
	C28882	12.4	Dry stream	
	C29402	14.2	Wet spring	Huerfano Park and Raton basin.
	C28001	13.9	Dry stream	
	C29176	13.5	Wet spring	
	C29421	12.4	Wet spring	
	C29448	38.8	Wet stream	East flank of Wet Mountains near Rye over Precambrian and Cretaceous rock.
	C29426	14.4	Wet stream	
	C29447	12.1	Wet stream	

into Clusters IV and V, which are outlined on Plate III; the other nine are from isolated individual locations. As was done with the waters, all sediments are considered as one population for the evaluation of the uranium data from the Trinidad quadrangle.

Seven locations which produced anomalous sediment samples form Cluster IV, situated south of the King Midas No. 8 occurrence in the northern part of the Sangre de Cristo Range. Five of these are near the faulted contact between the Permo-Pennsylvanian Sangre de Cristo formation and Precambrian metasediments; one of them (C29677) provided a sediment with 722 ppm uranium, the highest reported from the Trinidad quadrangle. Samples with uranium concentrations similar to those in Cluster IV have likewise been reported for locations in these same formations of the Sangre de Cristo Range in the Pueblo quadrangle, north of Cluster IV (Shannon, 1978). Structural traps formed by faults and other fractures are known to accumulate uranium-bearing minerals (Smith, 1974), which may account for these high values.

Cluster V, in the Culebra Range of the Sangre de Cristo Mountains (south of Veta Pass), contains 23 locations where sediment samples have more than 12 ppm uranium. None of the three documented uranium occurrences in Permian sedimentary rock in the Culebra Range are in this cluster; Fan Dyke No. 1 and Spanish Peaks are on the east slope of the mountains, while Loco Alice is on the west slope but north of the cluster. Nineteen of the anomalous uranium values in sediments are from areas underlain by Precambrian rock, and sixteen of these are on the west slope of the mountains; the other four are from areas of Quaternary rocks further west. Every drainage in the cluster on the west slope of the mountains has at least one anomalous sediment. Trinchera Creek and its tributaries at the north end and Culebra, Vallejos, and San Francisco Creeks at the south end of the cluster each have four. Several near-anomalous sediments are also in and west of the cluster, particularly along Ventero Creek, where it is intersected by an inferred fault.

The other anomalous samples come from isolated locations and are not considered likely to be of great significance. However, three locations (C29448, C29426, and C29446) are along two separate drainages in a small outcrop of Precambrian hornblende gneiss and amphibolite on the east flank of the Wet Mountains. Of the several other exposures of this rock in the quadrangle (all are small), only that along Trinchera Creek had samples taken directly from it. This area, which is in Cluster V, produced high uranium values. No known occurrences are located in this immediate area, but there are documented occurrences in the Wet Mountain Precambrian core, immediately north of 38°N latitude in the Pueblo quadrangle (Simon, 1956).

VI. SUMMARY AND CONCLUSIONS

Natural water and waterborne sediment samples were collected from 1768 locations over the 19 600-km² area of the Trinidad quadrangle. The sampling was carried out in two phases--during the spring and summer of 1976 and in the fall of 1977. The density of sample locations averaged 1 per 11 km², and 1060 water samples and 1240 waterborne sediment samples were taken, for a total of 2300 samples. Of these, 58 waters and 39 sediments have uranium concentrations above an arbitrary anomaly threshold of 20 ppb and 12 ppm, respectively.

The uranium data of this study correlate significantly with known uranium occurrences in the Trinidad quadrangle and the data from other LASL HSSR reports. Of the eight reported occurrences, four are reflected in the high

uranium contents in individual water samples taken near them, three had no samples taken nearby, and one was not detected in samples down-drainage. However, all the reported occurrences are near clusters of locations that produced anomalous water or sediment samples. The uranium values in the water samples from the mountains are generally low compared to those from the basins, but the uranium concentrations in the sediment samples from the mountains are generally higher. This general observation was reported earlier for other areas of similar geology and topography (Morris, 1977; Broxton and Bolivar, 1978).

The evaluation of data in this report is not intended to be in depth, but rather to provide some "ground truth" and generally verify the data while delineating clusters of water and sediment samples that have high uranium concentrations in their respective total populations. It is recognized that each total population may contain several individual ones, perhaps corresponding to exposures of the various rock types, geomorphic provinces, topography, sample source type, etc., each of which could have its own "anomaly threshold." Therefore, a more detailed evaluation could greatly enhance the value of the data reported, particularly in such areas of near-anomalous samples as that along the Cucharas River.

Nevertheless, on the basis of the evaluation, further investigations are recommended for the areas in the Apishapa uplift, Huerfano Park, and San Luis Valley that are delineated by clusters of anomalous water samples. The Apishapa uplift group is the largest and has the most anomalous samples, but because of the shales exposed in the area and the generally high level of dissolved solids in the water, it may not be the most important. The Huerfano Park area is surrounded by three known uranium occurrences (two that have produced uranium) and is in a basin of Tertiary sandstones. The San Luis Valley area is small but is clearly defined in a background of relatively low uranium concentrations in water.

Based on the sediment data, further field studies are recommended for the entire west slope of the Culebra Range and for the Crestone Peak area in the Sangre de Cristo Range. Both these areas have suitable source rocks and their similarity in geologic setting to that of the Schwartzwalder deposit in the Front Range, which has uranium mineralization occurring in fractures in Precambrian metamorphic rock (Smith, 1974), is striking: Precambrian rocks in thrust contact with those of Permo-Pennsylvanian age.

Although the area on the east slope of the Wet Mountains is not markedly evidenced by a broadly defined anomaly cluster, further sediment sampling to study the gap that exists between the three locations providing anomalous samples reported here and North Peak and Greenhorn Mountain, to the west, would seem worthwhile. This is primarily because of its similarity to the Trinchera Creek area in the Culebra Range cluster, where comparable geologic features as well as locations with anomalous sediment samples also occur.

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APPENDIX A

SUMMARY OF STANDARD LASL HSSR FIELD AND ANALYTICAL PROCEDURES

APPENDIX A

SUMMARY OF STANDARD LASL HSSR FIELD AND ANALYTICAL PROCEDURES

I. FIELD PROCEDURES

Water Sampling

Water samples are taken directly from the source wherever possible, filtered through a 0.45- μ membrane filter into one each, prewashed and sealed, 41-ml reactor "rabbit" and 25-ml vial (both polyethylene), and both are then acidified to a pH of ≤ 1 with 8N, reagent-grade, HNO_3 . All sample containers are doubly labeled with preprinted, adhesive labels carrying the same sample location number preprinted on the field data form. Springs are sampled as near to their point of emergence as possible; stream waters are taken from fast-flowing current away from the bank; ponds (including small lakes and reservoirs) are sampled from just below the surface, away from the bank; and well waters are taken near the wellhead if the well is pumping or from a holding tank if not.

Sediment Sampling (Wet or Dry)

Enough fine-grained, organic-rich, water-transported sediment to yield a composite sample of 25 g after processing (as indicated below) is taken from beneath the water level (where water exists) at three closely adjacent spots at each location. This is done with a polyethylene scoop, after the water sample (if any) is taken. The sediment is put into a new, clean, and originally sealed, rip-top polyethylene bag and properly double-labeled for delivery (with the field data form) to the contractor's drying facility. After drying at $\leq 100^\circ\text{C}$, each sample is sieved through stainless steel sieves to -100 mesh. The -100 mesh fraction is put into a prewashed, 25-ml polyethylene vial, appropriately double-labeled (using labels from the data form), and sealed for shipment to the LASL.

Field Measurements

The air temperature, taken in the shade at the time of sampling, is recorded to the nearest whole degree Celsius. The water temperature is measured in the source water and recorded to the nearest one-tenth degree Celsius. All temperature measurements are made with quality, precalibrated thermometers. The pH of the source water is measured with a calibrated, portable pH meter or multi-range pH paper, and recorded to the nearest one-tenth of a pH unit. The specific conductance ($\mu\text{mho/cm}$) of the source water is measured with a calibrated, temperature compensated (25°C) portable meter after the attached sample cup has first been rinsed three times in the source water. The scintillometer readings, taken on a flat, dry spot within a few meters of the sample location, are measured with a portable scintillometer. Two readings are recorded, the first with a radiation shield in place (blocking out ground radiation), and the second with the shield removed. The readings (in counts/s) are converted by computer (using a calibration factor obtained from testing of the specific scintillometer on a calibration block) to give the equivalent uranium (eU) value set forth in the data listing.

Field Observations

These represent the best subjective judgment of the field sampler on location, and include very general descriptions of the local bedrock, sediment,

water, vegetation, terrain, weather, possible contaminants, and water well configuration, if applicable. Since these observations are subjective and made quickly in the field they should be held subordinate to any formally documented information such as that provided by published topographic or geologic maps, etc.

Sample Location Verification

Each contractor is supplied field maps with the desired sample types and locations symbolically premarked at the LASL. The maps are normally USGS quadrangles (either 7.5' or 15'), but where not available, Forest Service, State Highway, or other reasonably detailed maps are provided. As each location is sampled, a unique sample location number, preprinted on transparent adhesive labels provided with the identically numbered field data forms, is pasted over the precisely marked site on the field map. The latitude and longitude of each location is computed by the sampling contractor. Every location is later checked (and corrected if necessary) at the LASL by overlaying computer-produced location plots on the field maps used. The latitudes and/or longitudes are corrected if the overlay locations are displaced by more than 300 m from the locations marked on the field maps. When a desired location cannot be sampled as specified, an alternate sample type or location as near as possible to the original one is picked, and the new sample type and/or location is/are marked on the field map and properly labeled as above. The verification, then, is carried out in the same manner.

II. ANALYTICAL PROCEDURES

Water Samples Analyzed for Uranium by Fluorometry

In a controlled laboratory environment, two NaF (98%)-LiF (2%) flux pellets are prepared and placed on platinum dishes. The 25-ml water vial is shaken vigorously and two 0.20-ml aliquots of water are withdrawn and dropped onto the flux pellets, then evaporated under a heat lamp. The sample fluxes are then heated until fused. After they cool, they are excited with ultraviolet radiation in the fluorometer, and the fluorescence of each is read, recorded, and put through a computer routine using standards and blanks run at the same time to obtain the two uranium concentrations. The single uranium concentration of the water samples given in the data listing is the average obtained from the duplicate aliquots. The lower limit of detection for each aliquot by the normal procedure is 0.2 ppb. (Several samples with less than 0.2 ppb were reanalyzed using a concentration method that lowers the lower detection limit to 0.02 ppb; the numbers in parentheses that follow are for those samples.) When a lower concentration than 0.2 ppb (0.02 ppb) is found in an aliquot, it is arbitrarily averaged into the data listings as 0.1 ppb (0.01 ppb). Therefore, whenever the uranium concentration in a water sample run by fluorometry is given as some value less than 0.2 ppb (0.02 ppb), one of the two aliquots had a uranium concentration that was too low to detect. If the listed uranium value is 0.1 ppb (0.01 ppb), both aliquots were below the detectable limit. Analytical precision at the lower limit of detection is $\sim 30\%$; however, it improves to $\sim 10\%$ one order of magnitude above the lower limit.

Water Samples Analyzed for Uranium by Delayed-Neutron Counting

Only waters from the western portion of the quadrangle found by fluorometry to have >10 ppb uranium, those from the eastern portion found to have

>40 ppb uranium, or those with interference problems were assayed using DNC. Samples taken in the 41-ml rabbits are thoroughly cleaned (exterior) before analysis. Samples received in 25-ml vials (used exclusively in some of the early work) are transferred to clean, labeled, 41-ml rabbits before being analyzed. Each water sample is weighed, and its weight (less that of the rabbit) and location number are recorded. The rabbits are then loaded into a 25-sample transfer clip. The reactor pneumatic transfer system and background radiation levels are checked, and the system is calibrated using four standards. The transfer clip is installed on the pneumatic feed line, and the count control is set (typically, a 60-s irradiation, a 30-s delay, and a 60-s count are used, but this can be changed to accommodate abnormally high or low uranium concentrations). The samples are cycled through the system and the uranium concentration is automatically measured, computed in ppb, and entered into the data base. Analytical precision for those few waters analyzed by the DNC method is as good or better than that by fluorometry.

Statistical treatments of uranium concentrations obtained on the same suites of samples both by fluorometry and DNC have shown that there is no significant difference between results of the two analytical methods as used at the LASL. This analytical comparability is rechecked periodically.

Uranium Analysis of Sediment Samples

All sediment samples are analyzed for total uranium by DNC. A split of each sample (dried and sieved as described) is transferred to a clean 4-ml rabbit, weighed (less the tare), and recorded along with the appropriate location number. The readied rabbits are loaded into a 50-sample transfer clip. The reactor pneumatic transfer system and background radiation levels are checked, and the system is calibrated as above. The transfer clip is installed and the count control is set (typically, a 20-s irradiation, a 10-s delay, and a 20-s count are used). The samples are cycled through the system and the uranium concentration is automatically measured, computed in ppm, and entered into the data base. The lower detection limit for uranium in sediment analyzed by the DNC method is 0.5 ppb (not ppm), and is so low that it has never been reached with a natural sediment sample. Using the DNC method for uranium in sediments, the precision is 4% or better for all analyses.

APPENDIX B

LISTINGS OF FIELD DATA AND URANIUM CONCENTRATIONS FOR WATER SAMPLES

(See Appendix D for Code to Listings)

APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

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APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

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APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

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APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

DOE SAMPLE NUMBER										LAS: SAMPLE LOCATION, NUMBER AND FIELD DATA										CONCENTRATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
STATE	LATITUDE	LONGITUDE	DOE LAB	SAMPLE TYPE	DATE	TIME SAMPLED	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. TRANSFER	AD. 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APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

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DOE SAMPLE NUMBER					LASH SAMPLE LOCATION NUMBER AND FIELD DATA										CONCENTRATION	
STATE	LATITUDE	LONGITUDE	DOE LAB	SAMPLE TYPE	REPLICATE	LASH SAMPLE LOCATION	TIME SAMPLED	WATER	WATER SAMPLES ANALYZED BY FLUOROMETRY OR DDC	DATE	TIME	WATER	WATER SAMPLES ANALYZED BY FLUOROMETRY OR DDC	DATE	TIME	
0A-37.4006-105.0754-2-01-	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15	14-02-29	141-04/02/75-15
0A-37.4008-105.0767-2-00-	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15	14-02-29	142-04/02/75-15
0A-37.3911-105.1034-2-01-	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16	14-02-29	143-04/02/75-16
0A-37.4767-105.0678-2-00-	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17	14-02-29	144-04/02/75-17
0A-37.4714-105.0757-2-01-	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17	14-02-29	145-04/02/75-17
0A-37.4594-105.1086-2-01-	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18	14-02-29	146-04/02/75-18
0A-37.4592-105.1111-2-01-	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18	14-02-29	147-04/02/75-18
0A-37.4875-105.0632-2-00-	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18	14-02-29	148-04/02/75-18
0A-37.4947-105.7194-2-01-	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18	14-02-29	149-04/02/75-18
0A-37.9758-105.6537-2-01-	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18	14-02-29	150-04/02/75-18
0A-37.9892-105.7458-2-10-	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18	14-02-29	151-04/02/75-18
0A-37.5022-105.7034-2-00-	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18	14-02-29	152-04/02/75-18
0A-37.5025-105.7551-2-00-	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18	14-02-29	153-04/02/75-18
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0A-37.5297-105.0011-2-01-	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19	14-02-29	155-04/02/75-19
0A-37.5267-105.1186-2-01-	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19	14-02-29	156-04/02/75-19
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0A-37.5586-105.0764-2-00-	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19	14-02-29	169-04/02/75-19
0A-37.5361-105.0088-2-01-	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19	14-02-29	170-04/02/75-19
0A-37.5547-105.1103-2-01-	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19	14-02-29	171-04/02/75-19
0A-37.5564-105.1303-2-01-	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19	14-02-29	172-04/02/75-19
0A-37.5636-105.1234-2-00-	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19	14-02-29	173-04/02/75-19
0A-37.5633-105.1436-2-00-	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19	14-02-29	174-04/02/75-19
0A-37.5744-105.1708-2-01-	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19	14-02-29	175-04/02/75-19
0A-37.5733-105.1731-2-01-	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19	14-02-29	176-04/02/75-19
0A-37.5844-105.1792-2-01-	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19	14-02-29	177-04/02/75-19
0A-37.6092-105.2158-2-00-	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19	14-02-29	178-04/02/75-19
0A-37.6167-105.2164-2-00-	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19	14-02-29	179-04/02/75-19
0A-37.6022-105.2300-2-01-	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19	14-02-29	180-04/02/75-19
0A-37.5925-105.2647-2-01-	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19	14-02-29	181-04/02/75-19
0A-37.6487-105.26																

APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

[illegible]

[illegible]

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APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

[illegible]

APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

DOE SAMPLE NUMBER				LASL SAMPLE LOCATION NUMBER AND FIELD DATA				CONCENTRATION			
STATE	LATITUDE	LONGITUDE	DOE LAB	SAMPLE TYPE	REF. DATE	DATE	TIME SAMPLED	WATER SAMPLES	ANALYZED BY	FLUORIMETRY OR GNC	UNITS IN
											DOE
OR-37-0272-105.4372-2-06-					0-C29511-04/14/74-14-	7.0	7.0	7.0	7.0	7.0	0.30
OR-37-0361-105.4375-2-06-					0-C29520-04/14/74-14-	4.0	7.1	7.1	7.1	7.1	0.19
OR-37-0178-105.4317-2-07-					0-C29521-04/14/74-14-	1.0	1.0	1.0	1.0	1.0	0.10
OR-37-0294-105.4046-2-10-					0-C29522-04/14/74-14-	2.0	4.0	4.0	4.0	4.0	0.10
OR-37-0314-105.4374-2-10-					0-C29523-04/14/74-14-	3.0	4.0	4.0	4.0	4.0	0.16
OR-37-0953-105.4344-2-07-					0-C29524-04/15/74-11-	7.0	7.0	7.0	7.0	7.0	0.44
OR-37-0708-105.4744-2-07-					0-C29525-04/15/74-11-	6.0	1.5	7.0	7.0	7.0	0.77
OR-37-0647-105.4514-2-07-					0-C29526-04/15/74-13-	8.0	4.0	4.0	4.0	4.0	0.70
OR-37-0961-105.4517-2-07-					0-C29527-04/15/74-13-	9.0	7.6	7.6	7.6	7.6	0.30
OR-37-0456-105.4566-2-07-					0-C29528-04/15/74-14-	12.0	4.0	7.6	7.6	7.6	0.10
OR-37-0961-105.4139-2-06-					0-C29531-04/15/74-14-	7.0	4.0	7.1	7.1	7.1	0.25
OR-37-0892-105.4362-2-07-					0-C29532-04/15/74-14-	5.0	7.3	7.3	7.3	7.3	0.10
OR-37-0158-105.4047-2-07-					0-C29533-04/15/74-17-	4.0	2.5	7.1	7.1	7.1	0.16
OR-37-0419-104.9047-2-06-					0-C29535-04/15/74-19-	4.0	5.2	7.3	7.3	7.3	0.10
OR-37-0144-105.2700-2-07-					0-C29536-04/14/74-13-	3.0	7.0	7.2	7.2	7.2	1.21
OR-37-0583-105.2746-2-07-					0-C29537-04/14/74-14-	4.0	7.4	7.4	7.4	7.4	0.47
OR-37-0156-105.4710-2-07-					0-C29538-04/14/74-15-	4.0	2.6	7.6	7.6	7.6	1.03
OR-37-0406-105.3403-2-07-					0-C29540-04/14/74-17-	9.0	1.0	5.7	5.7	5.7	5.74
OR-37-1233-105.3074-2-07-					0-C29541-04/14/74-17-	20.0	0.0	7.9	7.9	7.9	2.72
OR-37-0853-105.3400-2-07-					0-C29542-04/14/74-18-	12.0	0.0	7.9	7.9	7.9	0.54
OR-37-0911-105.3483-2-06-					0-C29551-04/14/74-13-	0.0	0.0	7.9	7.9	7.9	0.39
OR-37-0964-105.3481-2-07-					0-C29552-04/14/74-14-	0.0	0.0	7.9	7.9	7.9	1.25
OR-37-0719-105.2520-2-06-					0-C29554-04/14/74-14-	5.0	4.0	7.9	7.9	7.9	0.31
OR-37-0900-105.3400-2-07-					0-C29555-04/14/74-13-	4.0	7.8	7.9	7.9	7.9	0.10
OR-37-0972-105.3400-2-08-					0-C29556-04/14/74-14-	2.0	7.2	7.9	7.9	7.9	0.10
OR-37-0944-105.3432-2-07-					0-C29557-04/14/74-14-	2.0	7.2	7.9	7.9	7.9	1.29
OR-37-0974-105.3435-2-07-					0-C29558-04/14/74-14-	2.0	7.2	7.9	7.9	7.9	0.54
OR-37-2106-105.3435-2-07-					0-C29559-04/14/74-14-	1.0	3.2	7.9	7.9	7.9	1.13
OR-37-0974-105.3435-2-07-					0-C29560-04/14/74-14-	4.0	2.8	7.9	7.9	7.9	1.54
OR-37-1975-104.9331-2-07-					0-C29561-04/14/74-14-	3.0	3.6	7.9	7.9	7.9	1.04
OR-37-1983-104.9331-2-07-					0-C29562-04/14/74-14-	2.0	4.2	7.9	7.9	7.9	1.04
OR-37-2303-104.9331-2-07-					0-C29563-04/14/74-14-	0.0	4.2	7.9	7.9	7.9	1.04
OR-37-1425-104.9331-2-07-					0-C29564-04/14/74-14-	0.0	4.2	7.9	7.9	7.9	1.04
OR-37-1403-104.9331-2-06-					0-C29565-04/14/74-14-	7.0	5.6	7.9	7.9	7.9	1.04
OR-37-1950-104.9331-2-06-					0-C29566-04/14/74-14-	13.0	0.0	7.9	7.9	7.9	0.83
OR-37-1975-104.9331-2-07-					0-C29567-04/14/74-14-	11.0	0.0	7.9	7.9	7.9	2.39
OR-37-2339-104.9331-2-07-					0-C29568-04/14/74-14-	9.0	1.5	7.9	7.9	7.9	1.69
OR-37-2444-104.9331-2-06-					0-C29569-04/14/74-14-	9.0	1.5	7.9	7.9	7.9	1.69
OR-37-2467-104.9331-2-07-					0-C29570-04/14/74-14-	10.0	0.0	7.9	7.9	7.9	1.72
OR-37-2499-105.4517-2-07-					0-C29571-04/14/74-14-	10.0	0.0	7.9	7.9	7.9	1.31
OR-37-2494-105.4517-2-07-					0-C29572-04/14/74-14-	5.0	1.2	7.9	7.9	7.9	0.72
OR-37-2500-105.4517-2-07-					0-C29573-04/14/74-14-	3.0	2.5	7.9	7.9	7.9	1.04
OR-37-2758-105.4517-2-07-					0-C29574-04/14/74-14-	3.0	2.5	7.9	7.9	7.9	1.15
OR-37-2061-105.4517-2-07-					0-C29575-04/14/74-14-	1.0	1.5	7.9	7.9	7.9	1.10
OR-37-2003-105.4517-2-07-					0-C29576-04/14/74-14-	5.0	0.0	7.9	7.9	7.9	0.94
OR-37-1564-105.4517-2-07-					0-C29577-04/14/74-14-	9.0	4.5	7.9	7.9	7.9	1.05
OR-37-1522-105.4517-2-07-					0-C29578-04/14/74-14-	9.0	4.0	7.9	7.9	7.9	1.71
OR-37-1522-105.4517-2-07-					0-C29579-04/14/74-14-	9.0	7.2	7.9	7.9	7.9	1.17

APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

DOE SAMPLE NUMBER						LAST SAMPLE LOCATION NUMBER AND FIELD DATA														U CONCENTRATION									
STATE	LATITUDE	LONGITUDE	DOE LAB	SAMPLE TYPE	REP. DATE	LAST SAMPLE LOCATION NUMBER	TIME SAMPLED		AS TEMPERATURE	DATE	TEMPERATURE	WIND DIRECTION	WIND SPEED	SEA STATE	PH	SOLAR RADIATION	TOTAL CLOUDS	WATER TEMPERATURE	WATER DEPTH	WATER TYPE	WATER COLOR	WATER TASTE	WATER SMELL	WATER ANALYZED BY	WATER SAMPLES	ANALYZED BY	FLUOROMETRY OR DNC	UNITS IN	ppb
							DATE	TIME																					
08-37.1383-105.0434-2-01-	0-C29595-04/14/75-12-	2	6.8	-	7.7	127-	5-3-1-4-1-3-3-1-2-2-3-3-2-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.47	
08-37.1661-105.1019-2-06-	0-C29596-04/14/75-14-	2	6.8	-	7.3	152-	14-3-1-3-6-2-2-1-2-4-3-3-2-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.58	
08-37.0466-105.4228-2-10-	0-C29598-04/17/75-12-	2	3.9	-	7.7	270-	12-4-5-6-2-3-2-3-2-2-5-3-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.92	
08-37.1756-105.3149-2-07-	0-C29602-04/17/75-16-	2	3.9	-	4.6	364-	21-2-4-5-6-2-3-2-2-3-2-4-5-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.47	
08-37.1736-105.2725-2-07-	0-C29603-04/17/75-17-	2	1.9	-	7.7	290-	8-2-4-3-6-2-2-1-2-3-2-6-5-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.07	
08-37.1444-105.0972-2-01-	0-C29604-04/14/75-	5	2.0	-	7.7	147-	12-3-6-4-4-7-3-1-2-1-4-5-2-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.27	
08-37.1258-105.1039-2-01-	0-C29605-04/14/75-15-	2	4.6	-	7.7	122-	7-1-4-3-4-7-3-1-2-1-3-4-5-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.99	
08-37.1311-105.0481-2-01-	0-C29606-04/14/75-15-	2	7.2	-	7.3	122-	6-3-1-3-4-7-3-1-2-1-4-3-2-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.18	
08-37.1533-105.0047-2-01-	0-C29608-04/18/75-9-	2	4.0	-	7.1	422-	2-4-7-4-1-2-2-1-2-4-6-3-3-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.48	
08-37.1542-105.0064-2-01-	0-C29609-04/18/75-9-	2	4.0	-	7.0	325-	16-2-7-4-1-2-2-1-2-4-6-3-3-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.30	
08-37.1375-104.9794-2-08-	0-C29613-04/19/75-10-	2	6.2	-	9.1	722-	10-3-1-1-1-3-2-2-1-3-3-2-2-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.11	
08-37.1486-104.9222-2-08-	0-C29615-04/19/75-11-	11	7.4	-	9.2	1350-	8-4-1-1-1-3-2-2-1-3-3-2-2-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	
08-37.1683-104.8756-2-01-	0-C29616-04/19/75-11-	7	11.2	-	9.0	555-	11-4-1-4-1-2-2-2-4-2-3-2-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.38	
08-37.1186-105.0322-2-10-	0-C29617-04/19/75-11-	8	7.4	-	9.5	545-	11-3-1-4-7-1-3-2-1-4-3-2-3-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.21	
08-37.0967-105.1172-2-04-	0-C29618-04/19/75-15-	2	1.2	-	7.3	100-	17-3-1-3-4-7-3-1-2-1-4-5-5-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.32	
08-37.0750-105.1039-2-01-	0-C29619-04/19/75-15-	2	3.4	-	7.4	120-	7-4-2-3-3-3-2-3-1-2-1-4-5-5-	1	-	-	-	-																	

APPENDIX B (continued). Field Data and Uranium Concentrations for Water Samples

[illegible]

[illegible]

APPENDIX C

LISTINGS OF FIELD DATA AND URANIUM CONCENTRATIONS
FOR SEDIMENT SAMPLES

(See Appendix D for Code to Listings)

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

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[illegible]

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

55

[illegible]

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

DOE SAMPLE NUMBER					LASE SAMPLE LOCATION NUMBER AND FIELD DATA										CONCENTRATION	
STATE	LAITUDE	LONGITUDE	DOE LAB	SAMPLE #	DATE	TIME SAMPLED	LA	LONG	ALT	WIND	WAVE	TEMP	WIND	WAVE	TEMP	CONCENTRATION
0A-37.9964-105.3391-2-12-	0-C29552-04/14/75-14-	0-0.0-	8.9-	172-	10-1-6-1-4-3-3-1-2-3-3-2-3-	-	-	-	-	-	-	-	-	-	-	3.10
0A-37.9928-105.3175-2-13-	0-C29553-04/14/75-14-	17-1-6-4-1-	-	-	2-2-3-1-2-3-	-	-	-	-	-	-	-	-	-	-	3.60
0A-37.9719-105.2650-2-13-	0-C29554-04/14/75-14-	0-6.5-	7.0-	255-	0-1-1-5-6-2-6-1-	-	-	-	-	-	-	-	-	-	-	3.10
0A-37.9700-105.2642-2-13-	0-C29555-04/14/75-15-	10-1-6-4-3-4-	-	-	3-6-2-5-	-	-	-	-	-	-	-	-	-	-	3.30
0A-37.9900-105.2772-2-12-	0-C29556-04/14/75-15-	5-6.0-	9.4-	150-	17-1-6-1-4-3-3-1-2-4-3-5-3-	-	-	-	-	-	-	-	-	-	-	3.10
0A-37.9719-105.3359-2-14-	0-C29557-04/14/75-13-	0-7.0-	3.1-	177-	11-4-1-6-4-1-2-2-	-	-	-	-	-	-	-	-	-	-	2.70
0A-37.9742-105.3344-2-13-	0-C29558-04/14/75-15-	0-	-	-	14-3-1-6-4-1-	-	-	-	-	-	-	-	-	-	-	2.90
0A-37.9714-105.3642-2-13-	0-C29559-04/14/75-17-	0-	-	-	0-1-1-5-6-	-	-	-	-	-	-	-	-	-	-	3.20
0A-37.9622-105.3230-2-13-	0-C29560-04/14/75-17-	6-	-	-	5-4-1-5-8-	-	-	-	-	-	-	-	-	-	-	3.70
0A-37.9044-105.3319-2-13-	0-C29561-04/14/75-18-	1-	-	-	15-3-1-6-4-	-	-	-	-	-	-	-	-	-	-	3.20
0A-37.9044-105.3333-2-12-	0-C29562-04/14/75-18-	0-	7.2-	8.2-	5-1-1-6-8-2-3-2-2-6-1-2-3-	-	-	-	-	-	-	-	-	-	-	3.40
0A-37.9983-105.3272-2-13-	0-C29563-04/14/75-18-	2-	-	-	18-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	2.90
0A-37.9978-105.3225-2-12-	0-C29564-04/14/75-18-	2-	0.0-	9.5-	2-1-1-5-8-2-2-1-2-3-1-2-3-	-	-	-	-	-	-	-	-	-	-	2.90
0A-37.2106-105.0206-2-12-	0-C29565-04/14/75-18-	1-	7.2-	8.8-	0-1-6-2-6-3-1-2-3-1-2-5-	-	-	-	-	-	-	-	-	-	-	4.00
0A-37.2078-105.0000-2-12-	0-C29566-04/15/75-10-	4-	2.8-	6.4-	11-1-7-5-8-3-3-1-2-4-3-2-5-	-	-	-	-	-	-	-	-	-	-	4.60
0A-37.1975-104.9731-2-12-	0-C29567-04/15/75-10-	3-	2.6-	5.0-	41-1-1-2-1-1-3-1-2-6-3-3-5-	-	-	-	-	-	-	-	-	-	-	4.40
0A-37.2303-104.9953-2-12-	0-C29571-04/15/75-11-	0-	4.2-	5.7-	8-3-1-1-3-1-3-3-1-2-4-3-4-3-	-	-	-	-	-	-	-	-	-	-	4.80
0A-37.2303-104.9933-2-12-	0-C29572-04/15/75-10-	0-	6.2-	5.5-	5-3-1-3-1-3-3-1-2-4-3-4-3-	-	-	-	-	-	-	-	-	-	-	3.70
0A-37.1625-104.9633-2-12-	0-C29573-04/15/75-12-	7-	5.4-	5.6-	16-3-7-2-7-3-2-3-3-3-3-	-	-	-	-	-	-	-	-	-	-	5.90
0A-37.1706-104.9542-2-13-	0-C29574-04/15/75-12-	10-	-	-	10-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	5.00
0A-37.1803-104.9281-2-11-	0-C29575-04/15/75-13-	13-11.0-	-	5.5-	4-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	5.00
0A-37.1556-104.9203-2-13-	0-C29576-04/15/75-13-	13-	-	-	0-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	4.20
0A-37.1950-104.8842-2-11-	0-C29577-04/15/75-14-	11-17.0-	-	5.8-	0-3-7-5-7-1-2-2-1-	-	-	-	-	-	-	-	-	-	-	4.90
0A-37.1975-104.8775-2-12-	0-C29578-04/15/75-15-	0-11.5-	-	5.9-	7-3-1-6-6-2-2-1-2-4-3-6-2-	-	-	-	-	-	-	-	-	-	-	3.90
0A-37.2044-104.8836-2-13-	0-C29579-04/15/75-15-	11-	-	-	7-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	4.90
0A-37.2039-104.8851-2-13-	0-C29580-04/15/75-15-	11-	-	-	0-4-1-6-1-	-	-	-	-	-	-	-	-	-	-	5.00
0A-37.2642-104.8956-2-9b-	0-C29581-04/15/75-15-	12-	-	-	11-3-1-6-7-	-	-	-	-	-	-	-	-	-	-	3.80
0A-37.2339-104.8019-2-13-	0-C29582-04/15/75-16-	0-12.2-	-	5.2-	4-1-1-6-6-1-3-2-2-4-3-2-2-	-	-	-	-	-	-	-	-	-	-	4.80
0A-37.2317-104.9214-2-13-	0-C29583-04/15/75-16-	12-	-	-	4-3-1-6-1-	-	-	-	-	-	-	-	-	-	-	3.10
0A-37.2303-104.9208-2-13-	0-C29584-04/15/75-16-	17-	-	-	4-1-1-6-1-	-	-	-	-	-	-	-	-	-	-	5.50
0A-37.2444-104.9650-2-11-	0-C29585-04/15/75-16-	10-2.9-	-	5.3-	5-1-1-6-1-1-3-1-	-	-	-	-	-	-	-	-	-	-	4.90
0A-37.2467-104.9633-2-12-	0-C29586-04/15/75-16-	10-0.4-	-	5.1-	5-1-1-6-1-2-2-1-1-1-3-4-2-	-	-	-	-	-	-	-	-	-	-	4.70
0A-37.2389-105.0517-2-12-	0-C29587-04/16/75-10-	5-1.2-	-	7.9-	10-1-6-4-2-2-2-1-2-2-3-3-2-	-	-	-	-	-	-	-	-	-	-	3.90
0A-37.2494-105.1050-2-12-	0-C29588-04/16/75-10-	3-2.5-	-	9.0-	4-1-4-3-4-6-3-1-2-2-3-4-5-	-	-	-	-	-	-	-	-	-	-	4.50
0A-37.2500-105.1042-2-12-	0-C29589-04/16/75-10-	3-2.5-	-	9.0-	11-1-6-3-4-6-3-1-2-2-3-4-5-	-	-	-	-	-	-	-	-	-	-	6.00
0A-37.2061-105.0500-2-12-	0-C29591-04/16/75-11-	5-2.0-	-	7.4-	5-3-7-3-1-1-3-2-1-2-1-3-3-2-	-	-	-	-	-	-	-	-	-	-	6.50
0A-37.2003-105.0681-2-13-	0-C29592-04/16/75-	0-6.5-	-	7.0-	0-3-1-6-4-1-1-3-2-	-	-	-	-	-	-	-	-	-	-	4.90
0A-37.1564-105.0414-2-12-	0-C29593-04/16/75-11-	6-6.0-	-	4.2-	11-3-1-3-1-3-3-1-2-4-3-3-2-	-	-	-	-	-	-	-	-	-	-	8.20
0A-37.1522-105.0450-2-12-	0-C29594-04/16/75-12-	0-7.2-	-	7.4-	10-3-5-3-5-3-3-1-2-4-3-2-2-	-	-	-	-	-	-	-	-	-	-	5.20
0A-37.1383-105.0694-2-12-	0-C29595-04/16/75-12-	3-6.8-	-	7.7-	5-3-1-1-6-1-3-3-1-2-2-3-3-2-	-	-	-	-	-	-	-	-	-	-	5.50
0A-37.1561-105.1019-2-11-	0-C29596-04/16/75-14-	0-2.8-	-	7.3-	14-3-1-3-6-2-2-1-2-4-3-3-2-	-	-	-	-	-	-	-	-	-	-	5.20
0A-37.0444-105.4153-2-13-	0-C29597-04/17/75-11-	3-	-	-	14-0-	-	-	-	-	-	-	-	-	-	-	6.80
0A-37.0464-105.4228-2-14-	0-C29598-04/17/75-12-	2-7.9-	-	7.7-	12-4-	-	-	-	-	-	-	-	-	-	-	5.10
0A-37.0197-105.4236-2-13-	0-C29599-04/17/75-12-	2-	-	-	18-4-	-	-	-	-	-	-	-	-	-	-	6.60
0A-37.0039-105.4764-2-13-	0-C29600-04/17/75-14-	1-	-	-	14-2-0-6-6-	-	-	-	-	-	-	-	-	-	-	2.90
0A-37.0042-105.4778-2-13-	0-C29601-04/17/75-15-	2-	-	-	12-3-8-4-6-	-	-	-	-	-	-	-	-	-	-	3.10
0A-37.1756-105.3159-2-12-	0-C29602-04/17/75-16-	2-2.9-	-	8.6-	21-2-6-6-5-6-2-3-2-2-3-2-6-5-	-	-	-	-	-	-	-	-	-	-	3.90
0A-37.1736-105.2825-2-12-	0-C29603-04/17/75-17-	3-1.9-	-	7.7-	8-2-4-3-6-2-2-1-2-2-3-4-5-	-	-	-	-	-	-	-	-	-	-	6.80
0A-37.1258-105.1039-2-12-	0-C29605-04/16/75-15-	5-6.6-	-	7.7-	7-1-6-3-4-3-3-1-2-1-3-4-5-	-	-	-	-	-	-	-	-	-	-	10.10
0A-37.1311-105.0681-2-12-	0-C29606-04/16/75-15-	4-7.2-	-	7.8-	6-3-1-3-4-3-3-1-2-1-4-3-2-2-	-	-	-	-	-	-	-	-	-	-	5.30
0A-37.1325-105.0508-2-13-	0-C29607-04/16/75-15-	9-	-	-	8-3-1-5-8-	-	-	-	-	-	-	-	-	-	-	3.90

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

DOE SAMPLE NUMBER				TIME SAMPLED				LASI SAMPLE LOCATION NUMBER AND FIELD DATA				SEDIMENT SAMPLES ANALYZED BY DELAYED NEUTRON COUNTING (DNC)			
STATE	LATITUDE	LONGITUDE	DOE LAB	SAMPLE TYPE	DOE CAT	LOCATION NUMBER	DATE	TIME	DEPTH	WIND DIRECTION	WIND SPEED	WAVE DIRECTION	WAVE PERIOD	WAVE HEIGHT	UNITS IN DPM
08-37.1533-105.0047-2-12-	0-029608	0-0418/76-9-	9-	4.0-	7.1-	439-	2-3-7-4-1-2-2-1-2-4-3-3-	3-	5.30						
08-37.1542-105.0044-2-12-	0-029609	0-0418/76-9-	9-	4.0-	7.0-	325-	15-3-7-6-1-2-2-1-2-4-4-3-3-	3-	3.70						
08-37.1486-104.9206-2-15-	0-029610	0-0419/76-10-	10-	2-	7.0-	325-	17-3-7-4-7-1-2-2-4-2-3-3-	3-	5.30						
08-37.1419-104.9430-2-15-	0-029611	0-0419/76-10-	10-	4-	7.0-	325-	5-3-1-4-1-1-2-2-1-3-3-3-3-	3-	5.90						
08-37.1394-104.9432-2-15-	0-029612	0-0419/76-10-	10-	4-	7.0-	325-	7-3-1-4-1-1-2-2-1-3-3-3-3-	3-	4.50						
08-37.1436-104.9433-2-15-	0-029613	0-0419/76-11-	11-	7.1-1.2-	9.0-	555-	11-3-1-4-1-1-2-2-1-3-3-3-3-	3-	5.00						
08-37.1683-104.9756-2-12-	0-029614	0-0419/76-11-	11-	7.1-1.2-	9.0-	555-	11-3-1-4-1-1-2-2-1-3-3-3-3-	3-	4.70						
08-37.1186-105.0132-2-14-	0-029615	0-0419/76-11-	11-	7.1-1.2-	9.0-	555-	11-3-1-4-1-1-2-2-1-3-3-3-3-	3-	4.20						
08-37.0967-105.1172-2-13-	0-029616	0-0419/76-15-	15-	2.1-2-	7.3-	190-	17-3-1-3-4-3-1-2-1-4-5-5-5-1-	1-	13.00						
08-37.0750-105.1030-2-12-	0-029617	0-0419/76-15-	15-	2.1-2-	7.3-	190-	7-3-1-3-4-3-1-2-1-4-5-5-5-1-	1-	9.10						
08-37.0742-105.1022-2-12-	0-029618	0-0419/76-15-	15-	4.5-3-	7.1-	172-	20-3-1-3-1-2-2-2-3-4-5-3-3-	3-	11.30						
08-37.0775-105.0931-2-12-	0-029619	0-0419/76-15-	15-	4.5-3-	7.1-	172-	18-1-4-4-1-1-6-1-1-3-6-3-3-	3-	9.60						
08-37.0750-105.0847-2-12-	0-029620	0-0419/76-15-	15-	4.5-3-	7.1-	172-	11-1-1-3-1-2-2-3-1-1-3-6-3-3-	3-	6.30						
08-37.0569-105.0847-2-12-	0-029621	0-0419/76-15-	15-	4.5-3-	7.1-	172-	5-3-1-4-7-1-1-5-1-1-3-6-3-3-	3-	4.00						
08-37.0572-105.0847-2-12-	0-029622	0-0419/76-15-	15-	4.5-3-	7.1-	172-	7-3-1-5-4-2-2-1-1-1-3-6-1-1-	1-	7.00						
08-37.0106-105.0522-2-11-	0-029623	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.90						
08-37.0242-104.9897-2-12-	0-029624	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	6.40						
08-37.0511-104.9957-2-12-	0-029625	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	7.70						
08-37.0597-104.9961-2-12-	0-029626	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.80						
08-37.0681-104.9475-2-15-	0-029627	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.20						
08-37.0667-104.9980-2-15-	0-029628	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.30						
08-37.0872-105.1422-2-15-	0-029629	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.10						
08-37.0761-104.9451-2-15-	0-029630	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.40						
08-37.0936-104.8828-2-15-	0-029631	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.70						
08-37.0156-104.9422-2-12-	0-029632	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.80						
08-37.0092-104.9419-2-11-	0-029633	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.30						
08-37.0017-104.9439-2-12-	0-029634	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.40						
08-37.0292-104.9400-2-11-	0-029635	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	6.20						
08-37.0303-104.9475-2-15-	0-029636	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.10						
08-37.1103-104.8841-2-15-	0-029637	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.30						
08-37.1075-104.9911-2-15-	0-029638	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.80						
08-37.3511-105.1053-2-12-	0-029639	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.20						
08-37.3403-105.0828-2-12-	0-029640	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.40						
08-37.3000-105.0533-2-12-	0-029641	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.40						
08-37.2983-105.0503-2-12-	0-029642	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	6.20						
08-37.2939-105.0575-2-12-	0-029643	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.50						
08-37.2822-105.0736-2-15-	0-029644	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.90						
08-37.2769-105.0734-2-12-	0-029645	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.30						
08-37.2675-105.1181-2-12-	0-029646	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	2.70						
08-37.2672-105.4500-2-12-	0-029647	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	5.20						
08-37.2528-105.4532-2-12-	0-029648	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	2.80						
08-37.2539-105.4540-2-12-	0-029649	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.90						
08-37.2517-105.4604-2-15-	0-029650	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	4.30						
08-37.2050-105.4619-2-15-	0-029651	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	10.40						
08-37.5022-105.4617-2-12-	0-029652	0-0419/76-15-	15-	4.5-3-	7.1-	172-	14-3-1-4-4-2-2-2-1-1-3-6-1-1-	1-	3.20						

APPENDIX C (continued). Field Data and Uranium Concentrations for Sediment Samples

[illegible]

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APPENDIX D

CODE TO DATA LISTINGS

Appendix D-I

Explanation of Codes Used

Appendix D-II

Key to Sample Types

APPENDIX D-I
EXPLANATION OF CODES USED

DOE SAMPLE NUMBER

STATE: A two-digit Federal Information Processing Standards (FIPS) code, designating the state from which each sample came. For the states being covered by the LASL, the code numbers are:

Alaska	= 02	Montana	= 30	South Dakota	= 46
Arizona	= 04	Nebraska	= 31	Texas	= 48
Colorado	= 08	New Mexico	= 35	Utah	= 49
Idaho	= 16	North Dakota	= 38	Wyoming	= 56
Kansas	= 20	Oklahoma	= 40		

LATITUDE AND LONGITUDE: Sample location, in degrees and decimal degrees to four places. Although generally much better, locational accuracy cannot be guaranteed closer than about 300 m (1000 ft).

DOE LAB: A Department of Energy (DOE) one-digit identifier designating the DOE laboratory responsible for taking the samples and data shown in the listings, as well as providing the analyses of the uranium and other elemental concentrations, if any. The LASL is designated by the numeral 2.

SAMPLE TYPE: A two-digit identifier which specifically designates the pertinent properties defining the sample type to which the listed data relate. For explanation of the code used, refer to the attached "Key to Sample Types," Appendix D-II.

REPLICATE: A three-digit sequential number assigned to indicate a multiple sample of a single sample type from a single location. The largest number in use indicates the most recent sample taken, and there will always be smaller sequential numbers representing earlier samples back to 000, which is the initial sample from any given location. Except in the case of special studies, there will be no replicate samples and this entry will therefore be 000.

LASL SAMPLE LOCATION NUMBER AND FIELD DATA

LASL SAMPLE LOCATION NUMBER: A unique six-place alphanumeric designator permanently assigned by the LASL to every location sampled. For internal use, these numbers are assigned in blocks to the various areas individually treated and reported upon, and therefore serve to generally locate the samples within various areas for which the LASL is responsible as follows.

<u>Location Numbers</u>	<u>State</u>
N00 001 through N99 999	= Principally New Mexico
C00 001 through C99 999	= Principally Colorado
W00 001 through W99 999	= Principally Wyoming
M00 001 through M99 999	= Principally Montana
A00 001 and above	= Alaska only
L00 001 and above	= Areas beyond the western boundary of LASL's region as established by DOE in 1977.
Ø00 001 and above	= Areas beyond the eastern boundary of LASL's region as established by DOE in 1977.

TIME SAMPLED: The DATE that the sample was taken, in terms of the number of the MONTH, followed by the DAY and finally the YEAR, separated by slashes, and then the TIME it was taken on that date to the nearest whole HOUR on a 24-hour clock.

AIR TEMPERATURE: The temperature that was measured in the shade at the time of sampling, to the nearest whole degree Celsius ($^{\circ}\text{C}$).

WATER TEMPERATURE: The temperature that was measured in the sample water (in situ whenever possible) at the time of sampling, to the nearest one-tenth of a degree Celsius (0.1°C).

COMMENTS: A "C" in this column indicates that some secondary comment not included in the listing was recorded at the sample location. This information will be used by the LASL in evaluating the data, and if appropriate, it will be mentioned in the final report.

SPECIAL MEASUREMENTS: An "S" in this column indicates that one or more field measurements in addition to those listed were made at the sample location. A description of any special parameters measured and the measured value at each sample location will be included in the final HSSR survey report on the area.

pH: The pH, to the nearest one-tenth (0.1) of a pH unit, that was measured in the water at the sample location at the time of sampling.

SPECIFIC CONDUCTANCE: The conductivity, in $\mu\text{mho/cm}$, that was measured in the water at the sample location at the time of sampling.

SCINTILLOMETER: The equivalent uranium (eU), in ppm, as measured on a flat ground surface within 10 m of the sample location using a scintillometer fitted with a differential gamma sampler (DGS). The effect of the DGS is to introduce a fixed geometry into the measurement and remove the background.

ROCK TYPE: The single digit in this column provides a general description of the dominant lithologic regime at or near the sample location, as given below.

1 = Sedimentary	3 = Igneous
2 = Metamorphic	4 = Unknown

ROCK COLOR: The single digit in this column provides an indication of the observed dominant color of local bedrock exposures at or near the sample location, as given below.

1 = White/Buff	4 = Pink/Red	7 = Gray
2 = Yellow	5 = Green	8 = Black
3 = Orange	6 = Brown	9 = Other

SEDIMENT TYPE: The single digit in this column provides a subjective evaluation of the dominant sediment type at the sample location, as given below.

1 = Boulders	4 = Sand	7 = Other
2 = Cobbles	5 = Mud	
3 = Gravel	6 = Muck	

SEDIMENT COLOR: The single digit in this column indicates the observed dominant color of the bottom sediment (stream channel, lake bed, etc.) at the sample location at the time of sampling, as given below.

1 = White/Buff	4 = Pink/Red	7 = Gray
2 = Yellow	5 = Green	8 = Black
3 = Orange	6 = Brown	9 = Other

WATER FLOW: The single digit in this column provides a subjective evaluation of the water movement at the sample location at the time of sampling, as given below.

1 = Stagnant	3 = Moderate	5 = Torrent
2 = Slow	4 = Fast	

WATER LEVEL: The single digit in this column provides a subjective estimate of water quantity at the time of sampling, relative to its usual condition at the sample location, as given below.

1 = Dry	3 = Normal	5 Flood
2 = Low	4 = High	

WATER COLOR: The single digit in this column provides a subjective evaluation of suspended load in the sample water as, given below.

1 = Clear	3 = Cloudy	5 = Algal
2 = Murky	4 = Muddy	6 = Other

STREAM CHANNEL: The single digit here gives a subjective evaluation of stream channel character at the sample location at the time of sampling, as given below.

1 = Depositing	2 = Eroding	3 = Unknown
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VEGETATION TYPE: The single digit in this column provides a subjective evaluation of the dominant plant type in the vicinity of the sample location, as given below.

1 = Conifers	4 = Grass	7 = Other
2 = Deciduous	5 = Moss	
3 = Brush	6 = Marsh	

VEGETATION DENSITY: The single digit in this column provides a subjective estimate of the amount of plant cover in the vicinity of the sample location, as given below.

1 = Barren	3 = Moderate	5 = Very Dense
2 = Sparse	4 = Dense	

RELIEF: The single digit in this column provides a subjective evaluation of the topography within a few hundred meters of the sample location, as given below.

1 = Flat	3 = Gentle (15-60 m)	5 = High (>300 m)
2 = Low (<15 m)	4 = Moderate (60-300 m)	6 = Other

WEATHER: The single digit in this column gives the observed climatic condition at the sample location at the time of sampling, as given below.

1 = Clear	3 = Overcast	5 = Snowy
2 = Partly cloudy	4 = Rainy	6 = Other

OWNERSHIP: When shown, the single digit here gives a broad classification of administrative responsibility or general ownership of the land at the sample location, as given below.

1 = Federal	3 = Private	5 = Other
2 = State	4 = Indian	

CONTAMINANTS: The single digit here indicates known or suspected local factors likely to influence analytical results, as given below.

1 = None	4 = Industry	7 = Urban
2 = Mining	5 = Sewage	8 = Recreation
3 = Agriculture	6 = Power generation	9 = Other

WELL TYPE: If a well water sample, the single digit in this column provides a general description of the type of well from which the sample was taken as given below.

1 = Windmill-stock	4 = Suction pump	7 = Hand bail
2 = Windmill-domestic	5 = Jet pump	8 = Unknown
3 = Submersible pump	6 = Large turbine	9 = Other

WELL DIAMETER: When shown, the one or two digits in this column give the measured or estimated inside diameter, in inches, of the well casing from which the water sample came.

WELL DEPTH: When shown, the one, two, or three digits in this column give the total drilled depth from the surface, in feet, of the well from which the sample came. Three 9s in this column indicates a well depth greater than 1000 ft.

WATER DEPTH: When shown, the one, two, or three digits in this column give the known depth, in feet, from the surface to the standing water in the well. A -1 in this column indicates a flowing artesian well.

URANIUM CONCENTRATION: The value given in this column is the analytically derived value of the total uranium concentration found in the water sample in ppb, or in the sediment sample in ppm. Those uranium concentrations in water that are shown with an asterisk were measured using a delayed-neutron counting method, while those without an asterisk were determined fluorometrically. The uranium analyses as determined by both of these methods at the LASL are directly comparable, as described in Appendix A.

APPENDIX D-II

KEY TO SAMPLE TYPES

This numerical key provides the necessary tie between the specific type or form of each sample taken and each individual suite of field and laboratory data to which the sample relates. It defines the various sample types collected by the LASL in the DOE HSSR for uranium.

The two-digit key number assigned to each sample type designates three distinct properties of the samples taken. These properties are: (a) The general sample source (spring or stream or dry stream, etc.); (b) The sample medium (water or sediment, etc.); and (c) The treatment given the sample in the field or laboratory prior to its analysis by the LASL.

The key numbers are inserted in the appropriate columns of the specially formatted DOE sample numbering system to positively identify the sample type for all LASL sample data submitted.

<u>KEY NO.</u>	<u>SOURCE</u> / <u>MEDIUM</u> / <u>TREATMENT</u>
01 -	<u>Spring water</u> sample <u>untreated</u> .
02 -	<u>Stream water</u> sample <u>untreated</u> .
03 -	<u>Well water</u> sample <u>untreated</u> .
04 -	<u>Natural pond water</u> sample <u>untreated</u> .
05 -	<u>Artificial pond water</u> sample <u>untreated</u> .
06 -	<u>Spring water</u> sample <u>filtered</u> through a 0.45- μ membrane filter <u>and acidified</u> to a pH of ≤ 1 with reagent-grade nitric acid (HNO_3).
07 -	<u>Stream water</u> sample <u>filtered</u> through a 0.45- μ membrane filter <u>and acidified</u> to a pH of ≤ 1 with reagent-grade nitric acid (HNO_3).
08 -	<u>Well water</u> sample <u>filtered</u> through a 0.45- μ membrane filter <u>and acidified</u> to a pH of ≤ 1 with reagent-grade nitric acid (HNO_3).
09 -	<u>Natural pond water</u> sample <u>filtered</u> through a 0.45- μ membrane filter <u>and acidified</u> to a pH of ≤ 1 with reagent-grade nitric acid (HNO_3).
10 -	<u>Artificial pond water</u> sample <u>filtered</u> through a 0.45- μ membrane filter <u>and acidified</u> to a pH of ≤ 1 with reagent-grade nitric acid (HNO_3).
11 -	<u>Wet spring sediment</u> sample <u>dried</u> at $\leq 100^\circ\text{C}$ <u>and sieved to -100 mesh</u> through stainless steel sieves.
12 -	<u>Wet stream sediment</u> sample <u>dried</u> at $\leq 100^\circ\text{C}$ <u>and sieved to -100 mesh</u> through stainless steel sieves.

- 13 - Wet natural pond sediment sample dried at $\leq 100^{\circ}\text{C}$ and sieved to -100 mesh through stainless steel sieves.
 - 14 - Wet artificial pond sediment sample dried at $\leq 100^{\circ}\text{C}$ and sieved to -100 mesh through stainless steel sieves.
 - 15 - Dry stream sediment sample dried at $\leq 100^{\circ}\text{C}$ (if necessary) and sieved to -100 mesh through stainless steel sieves.
 - 96 - Dry natural pond sediment sample dried at $\leq 100^{\circ}\text{C}$ (if necessary) and sieved to -100 mesh through stainless steel sieves.
 - 97 - Dry artificial pond sediment sample dried at $\leq 100^{\circ}\text{C}$ (if necessary) and sieved to -100 mesh through stainless steel sieves.
 - 98 - Other water
 - 99 - Other sediment
- These key numbers are to be used only for water (98) or sediment (99) samples coming from a special source and/or given a special treatment not described for any of the types of samples above. In this report, the 12 other sediments (99) are all dry spring sediment samples dried at $\leq 100^{\circ}\text{C}$ (if necessary) and sieved to -100 mesh through stainless steel sieves.

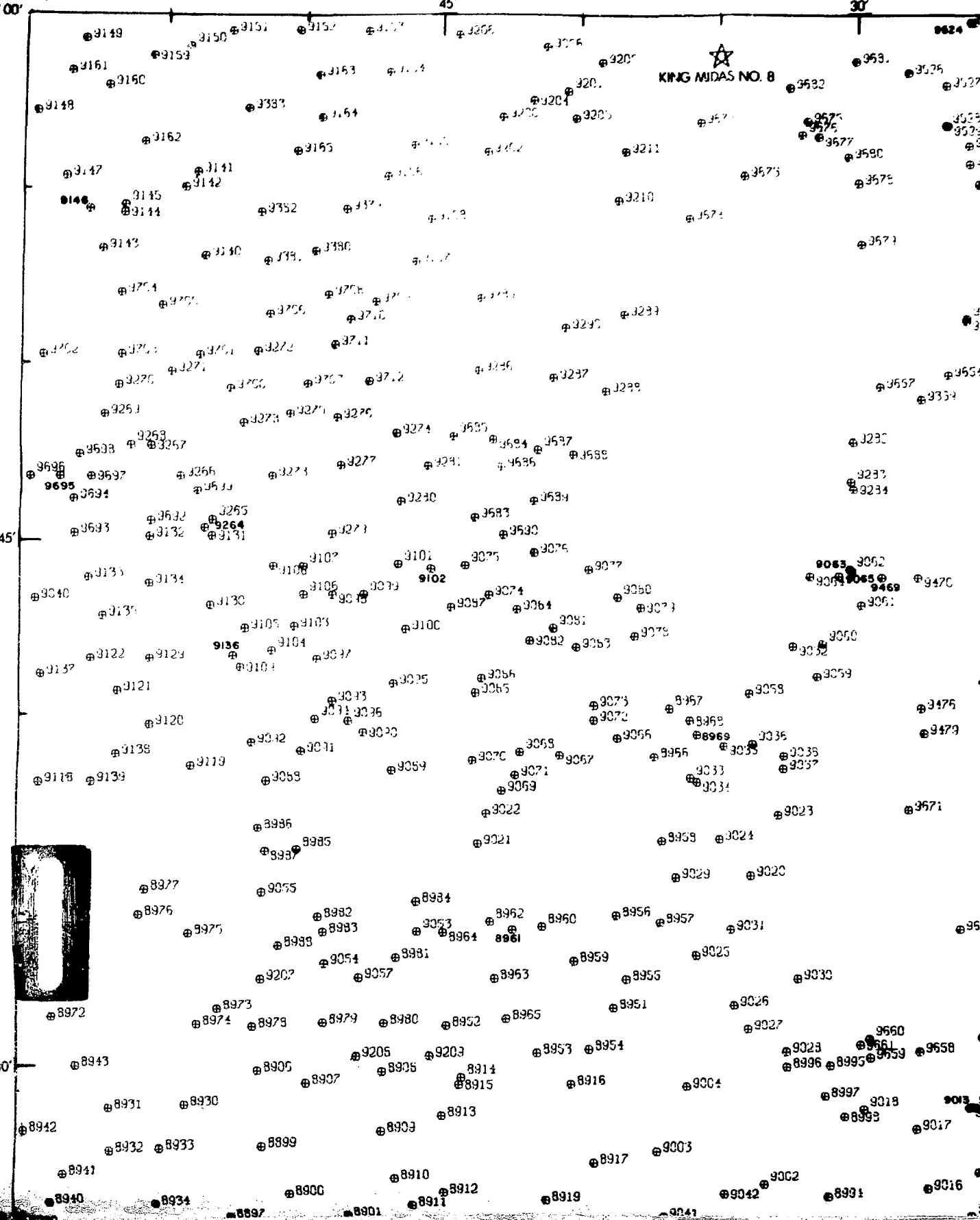
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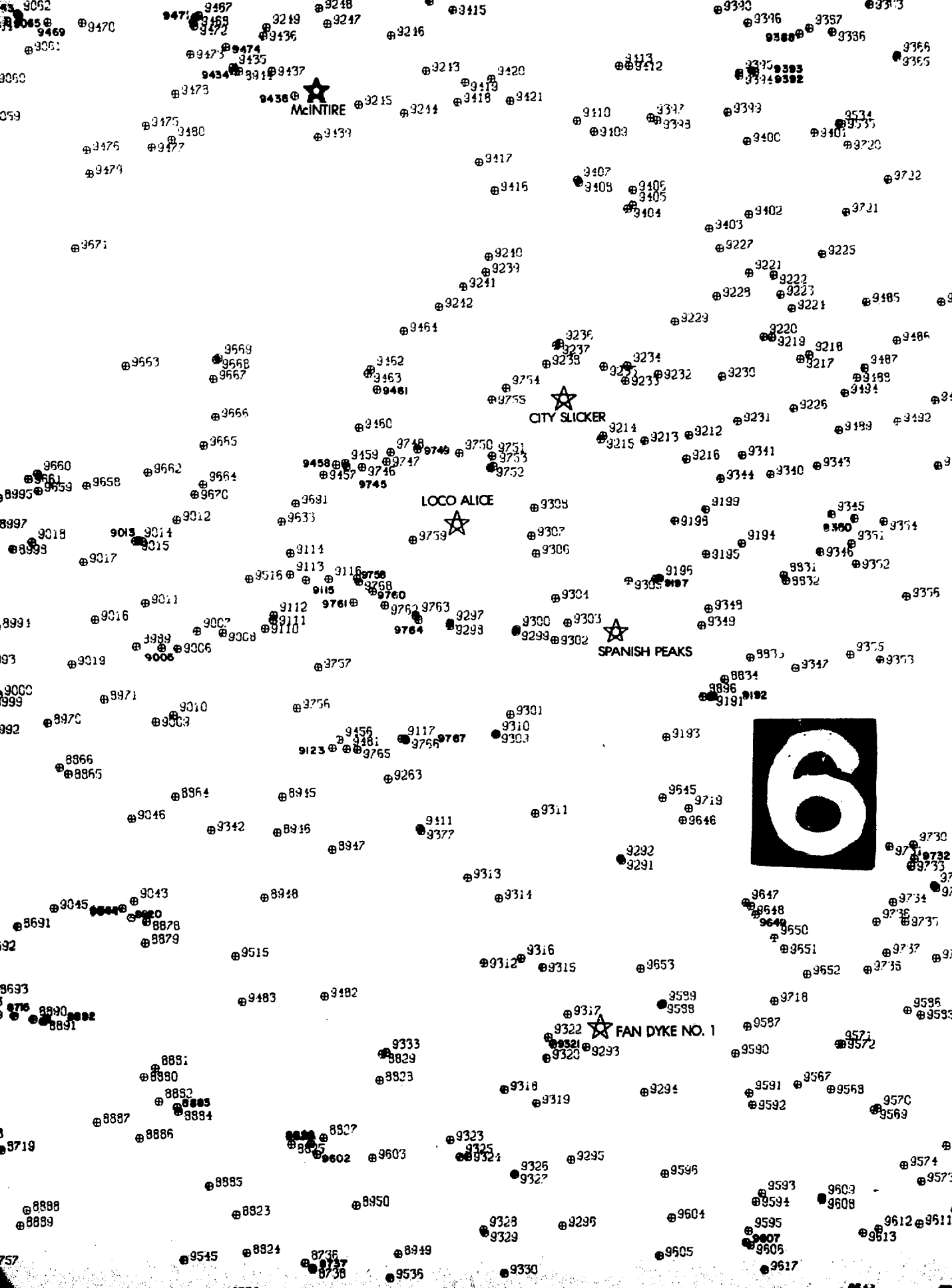
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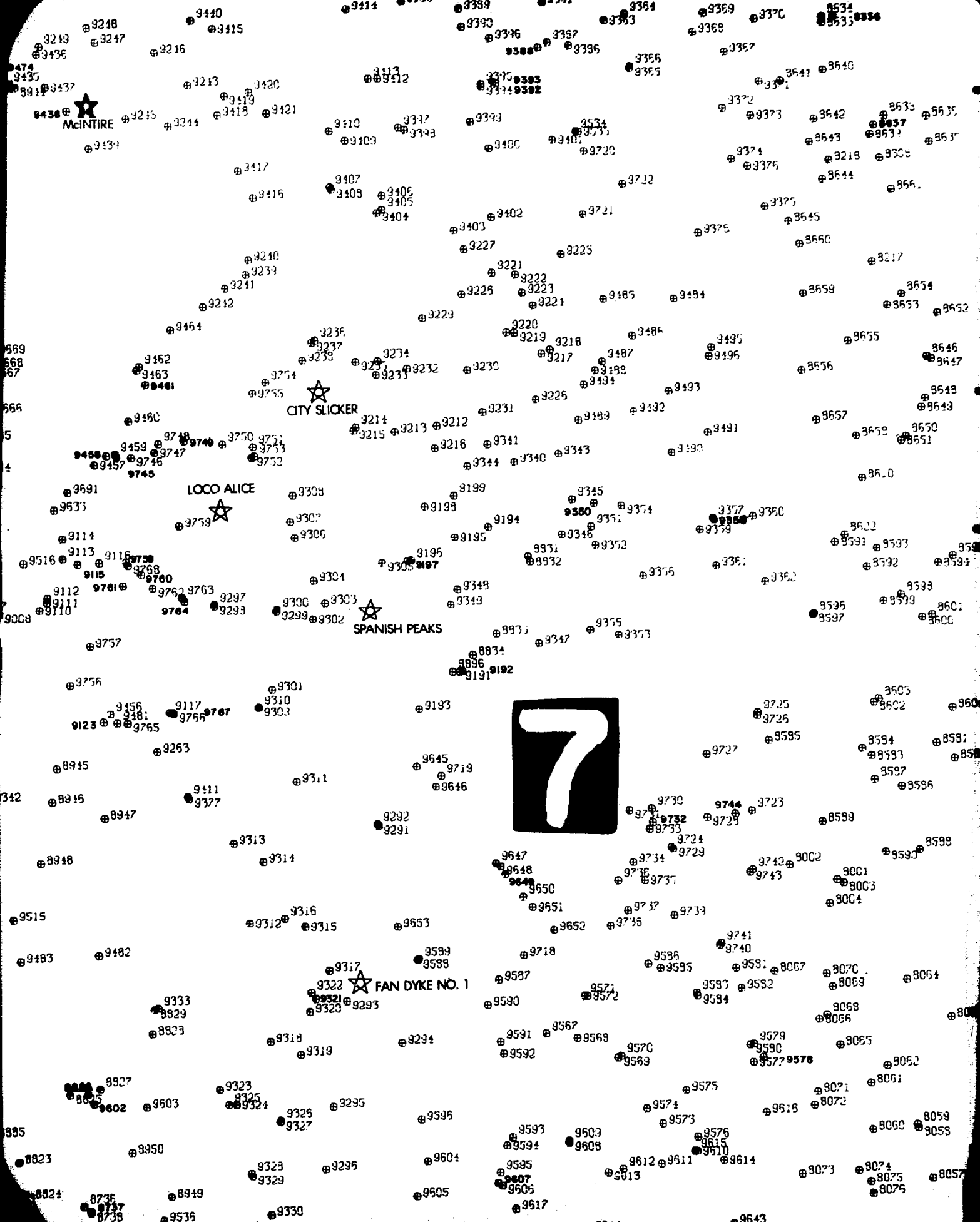
PLATE I

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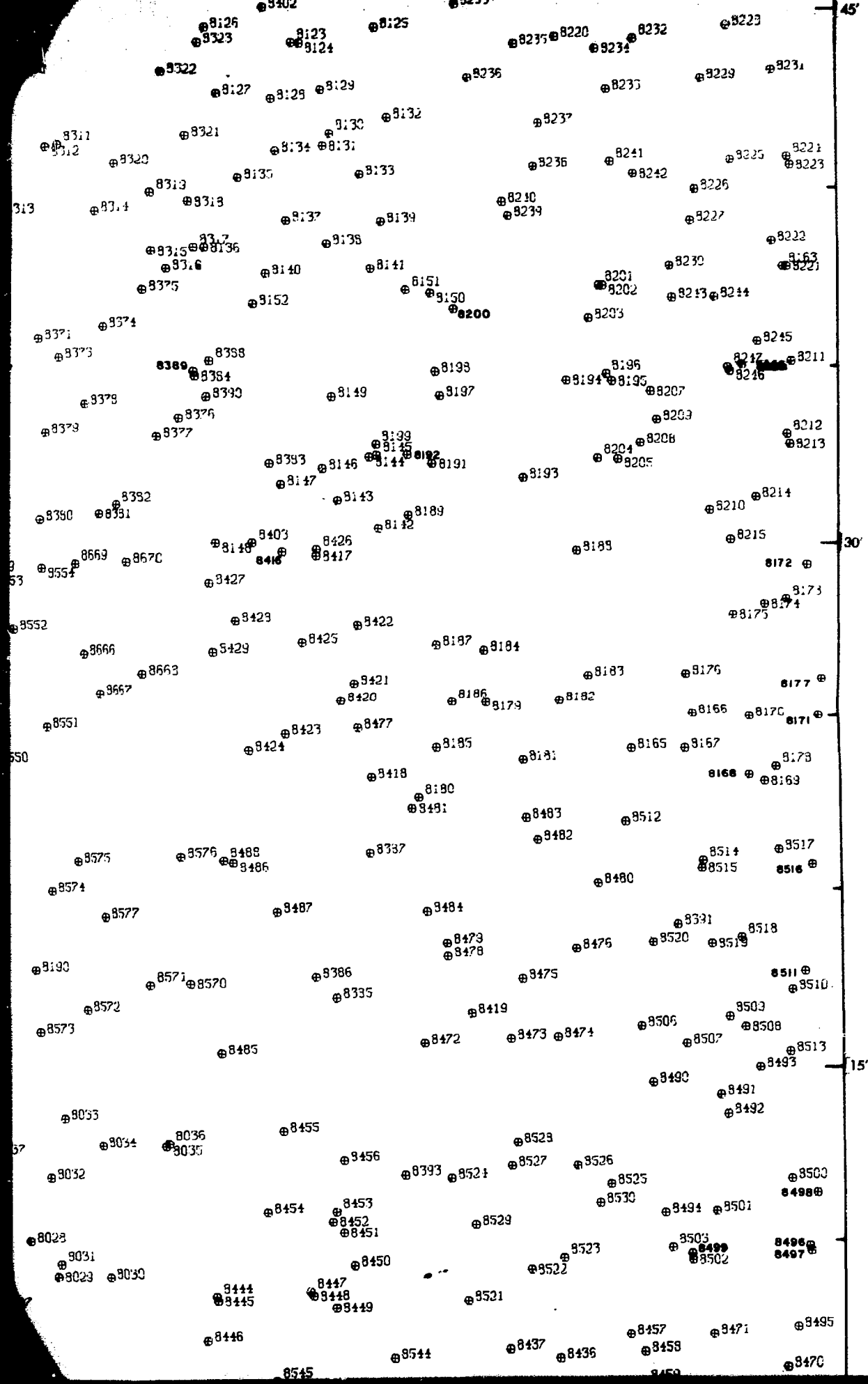
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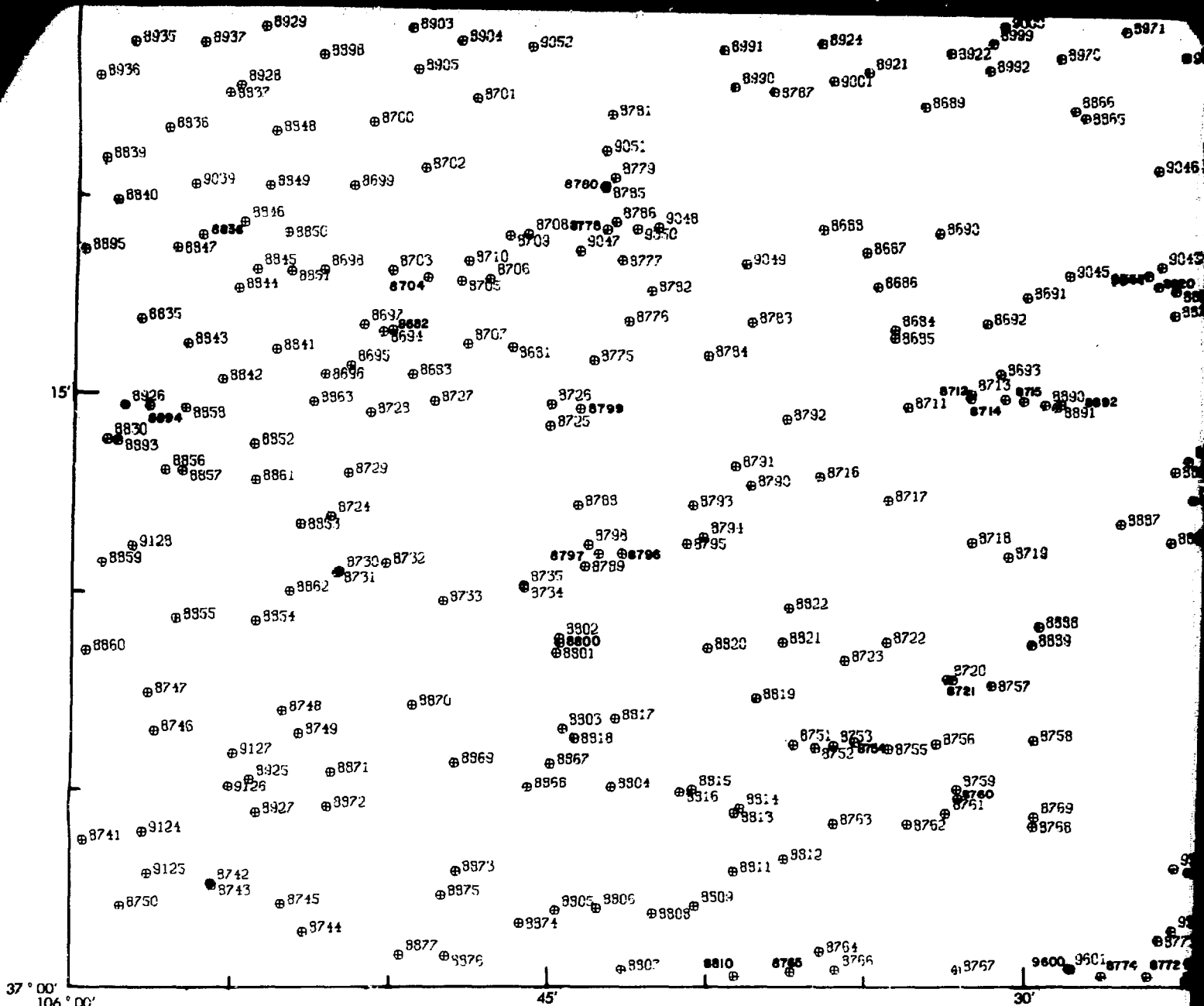
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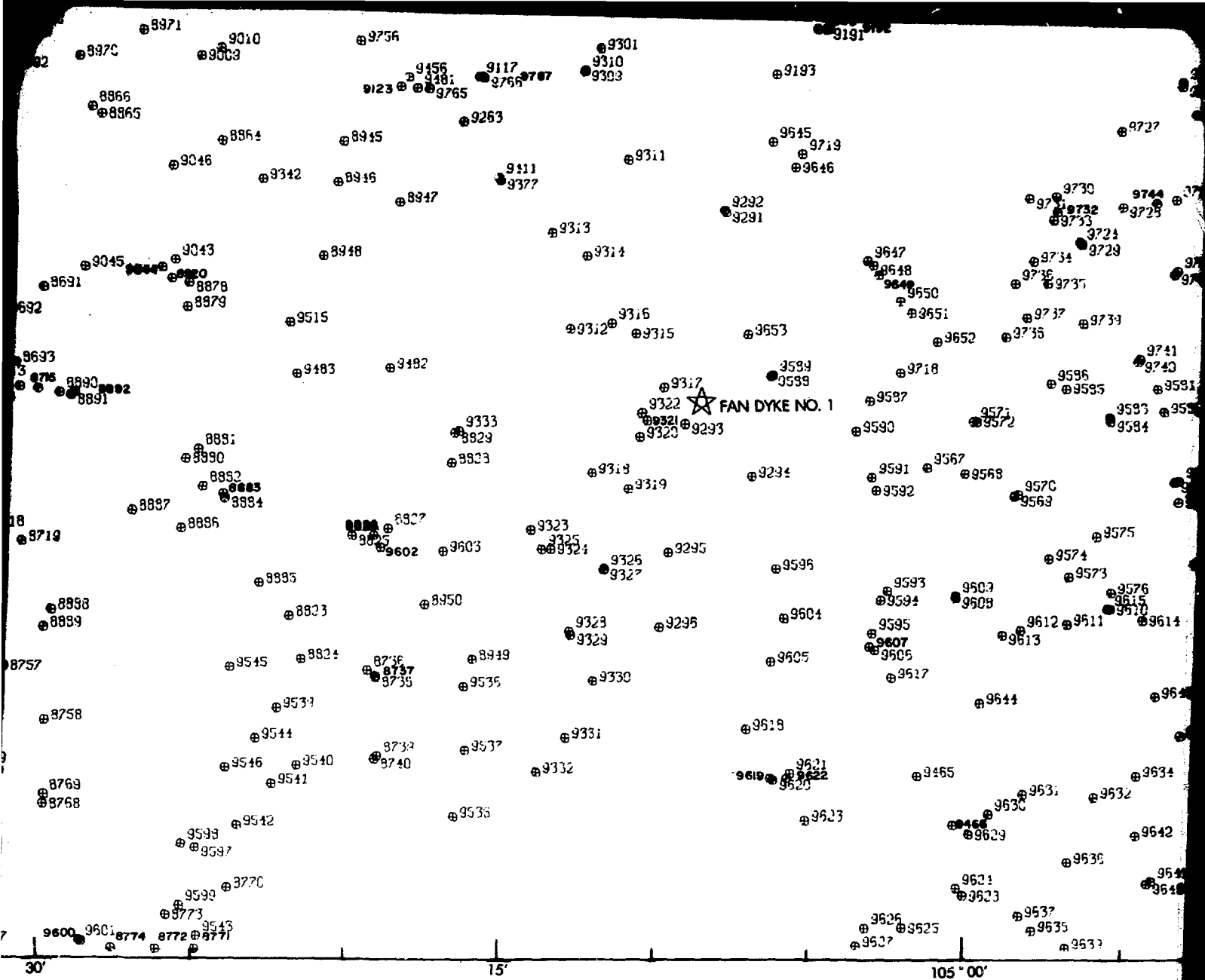




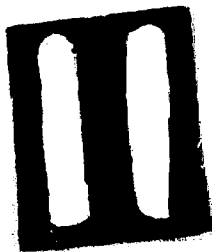
The LASL sample location numbers above are the same as those used in APPENDIXES B and C except the leading two alphanumeric characters have been dropped.

★ URANIUM OCCURRENCES

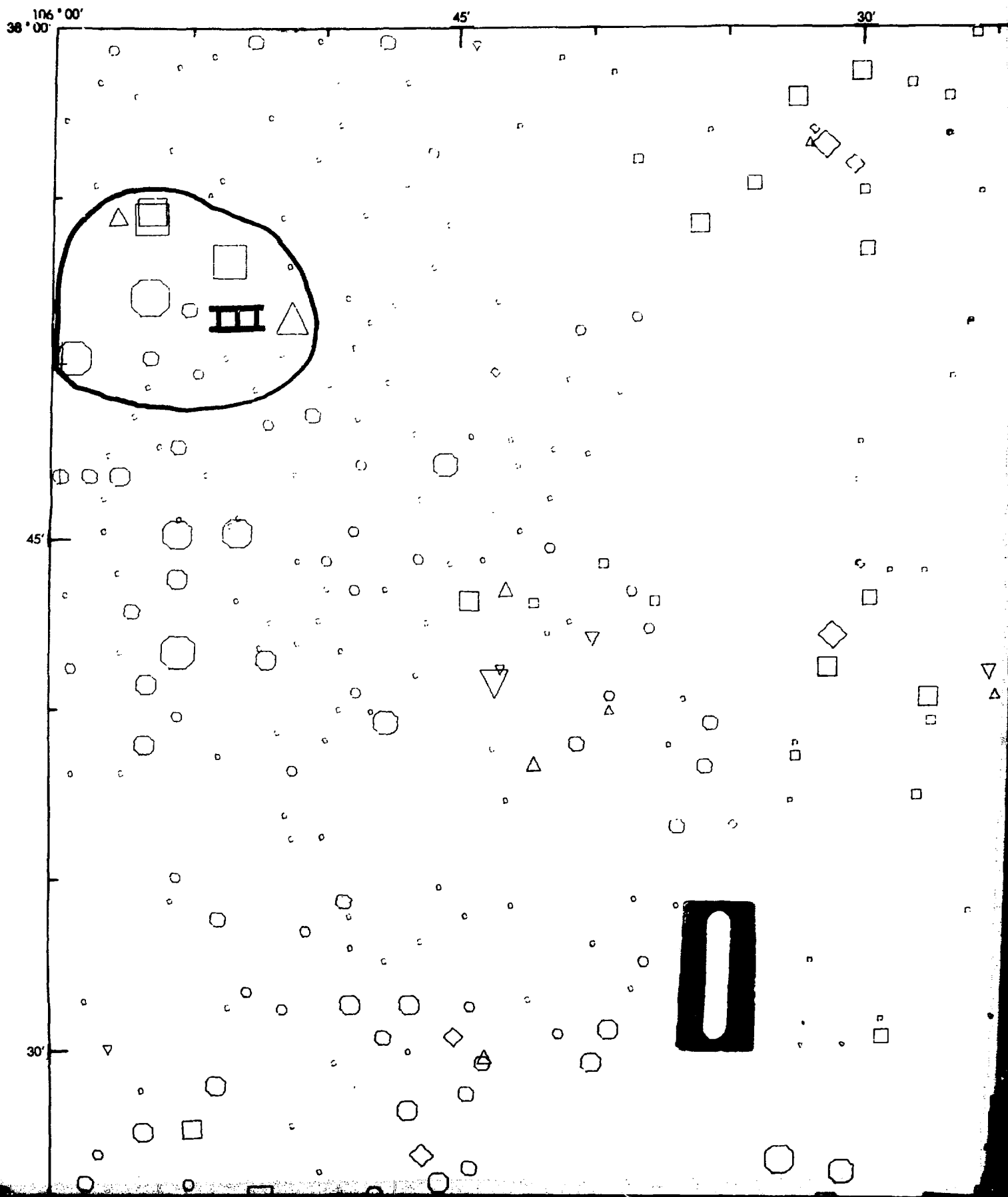
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SAMPLE LOCATION OVERLA
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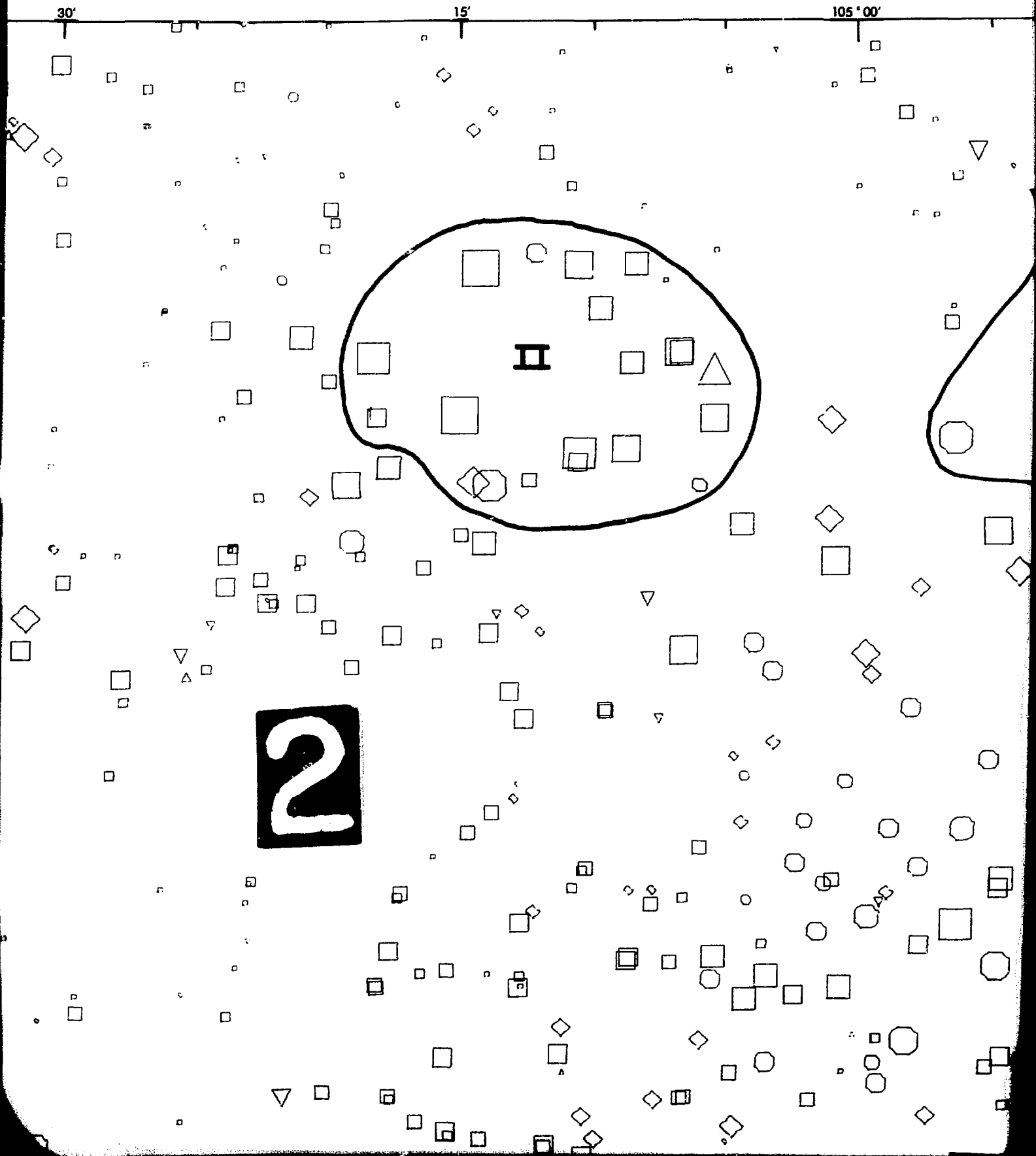
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105°00'

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105°00'

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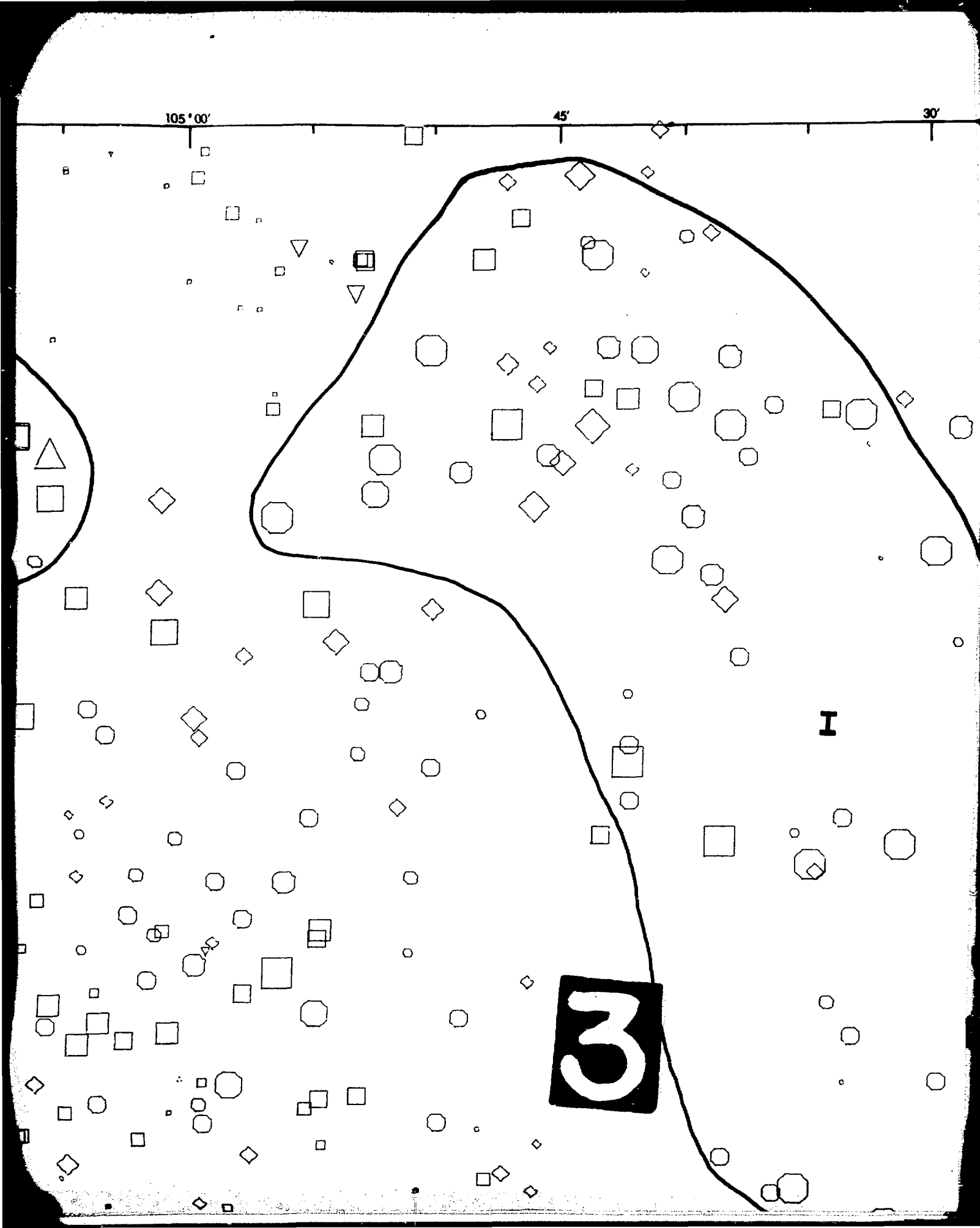
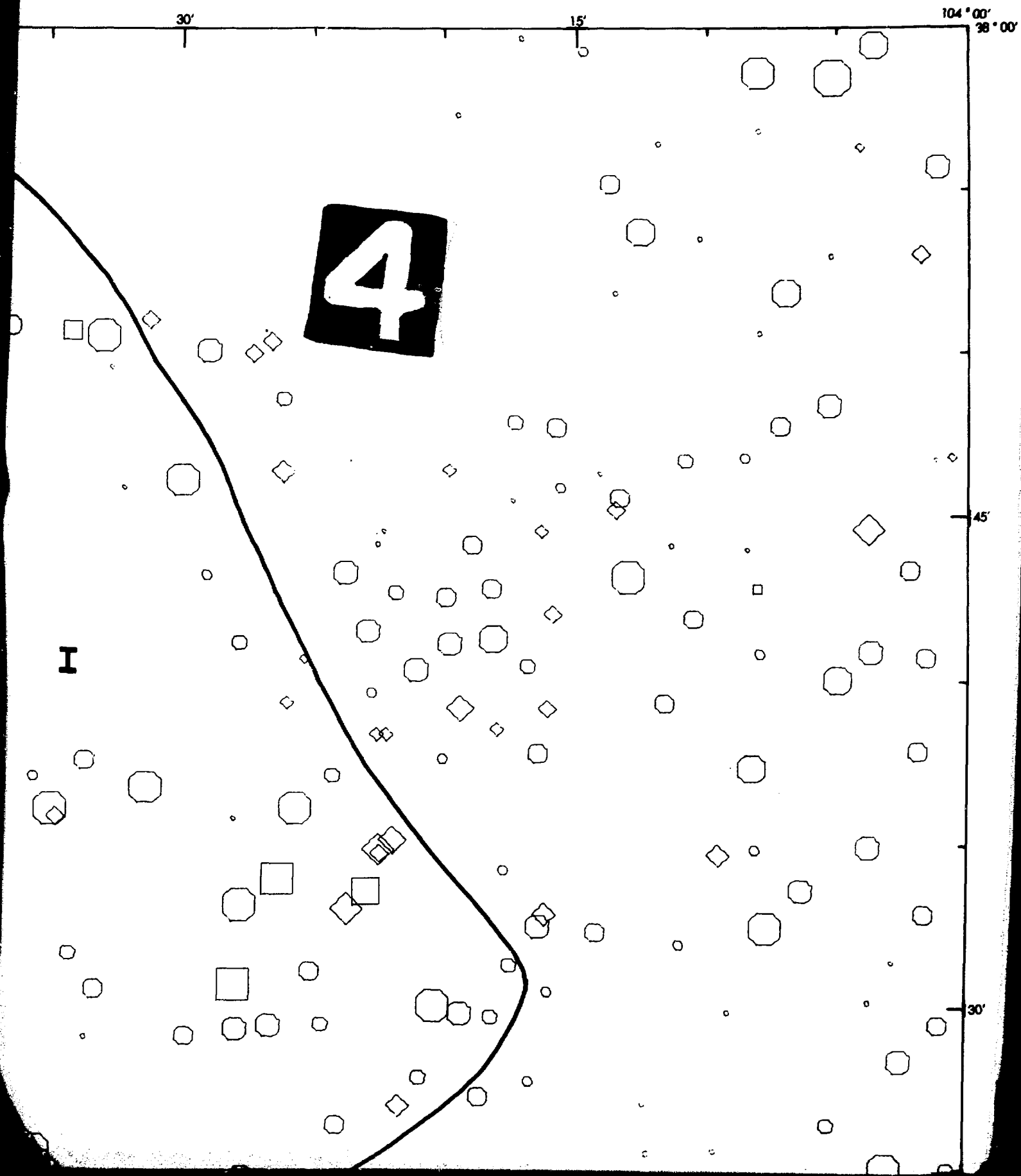


PLATE II



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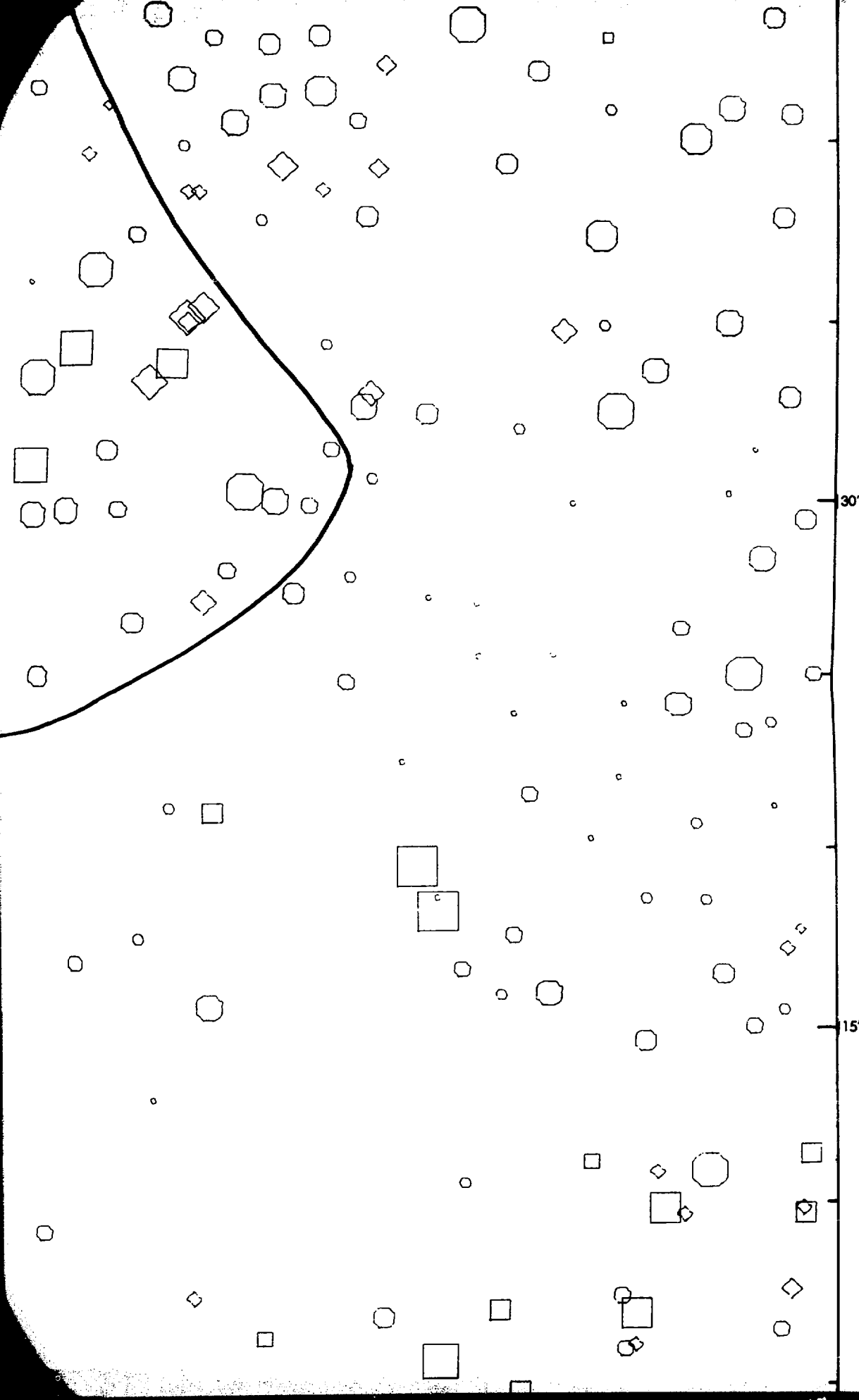
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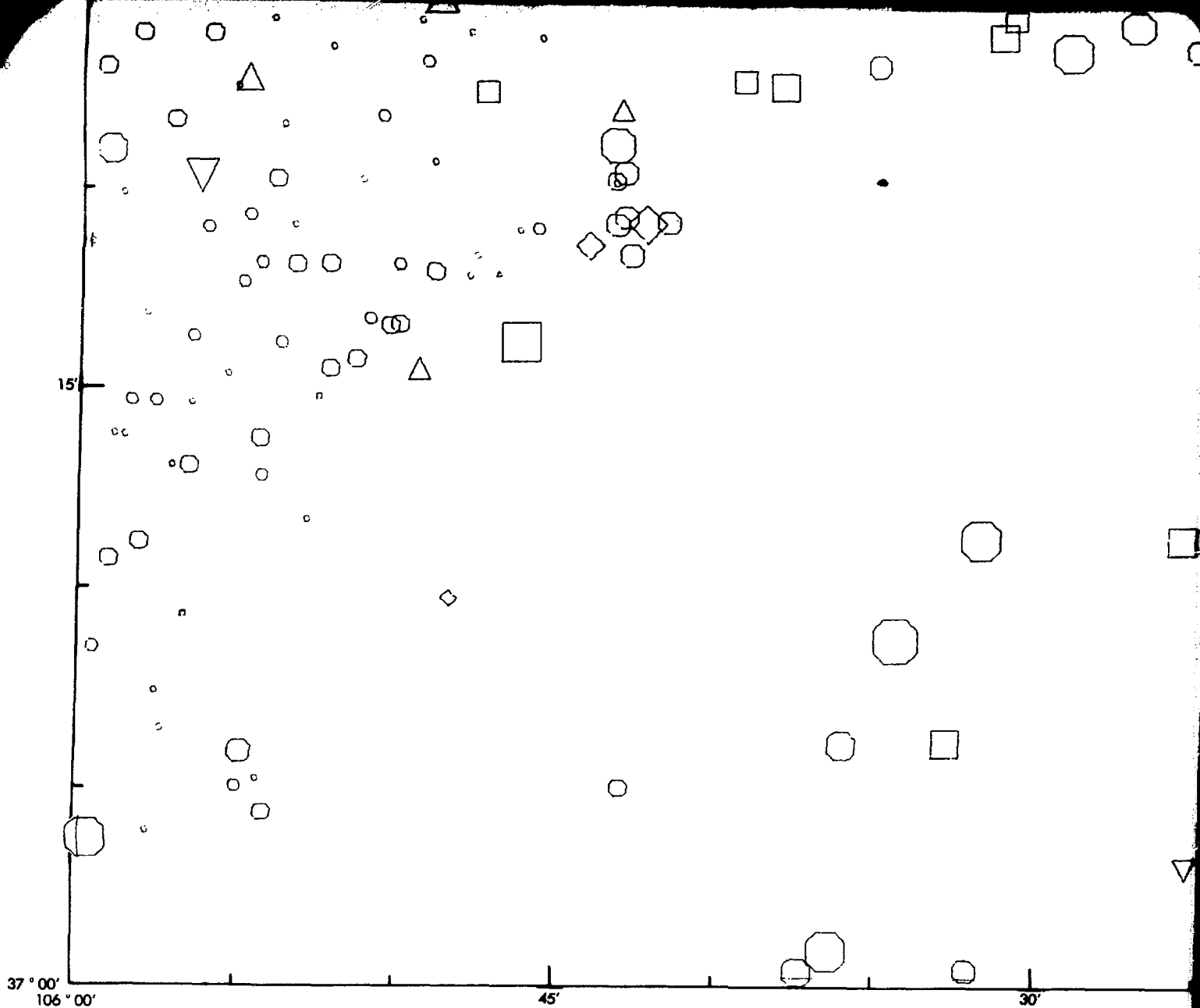
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LEGEND

SYMBOLS



Spring



Stream



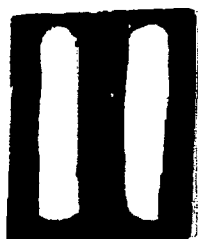
Well



Natural Lake or Pond

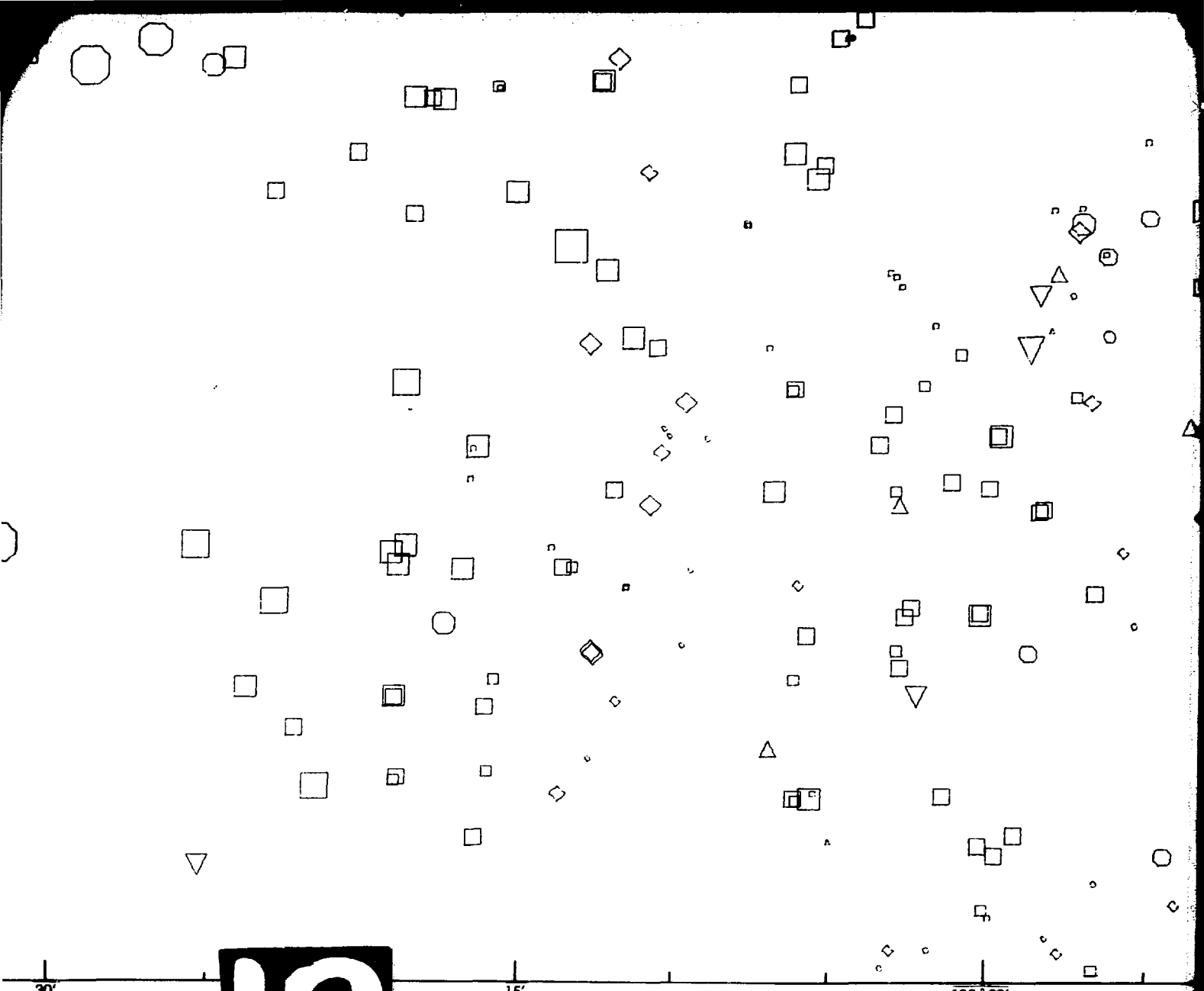


Artificial Lake or Pond



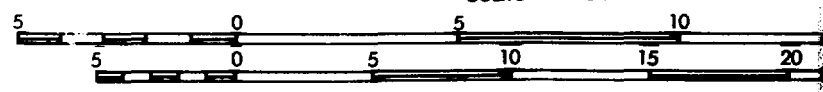
CONCENTRATIONS (ppb)

					0.00 - .50
					.51 - 1.00
					1.01 - 2.00
					2.01 - 5.00
					5.01 - 10.00
					10.01 - 20.00
					20.01 - 50.00
					> 50.00



12

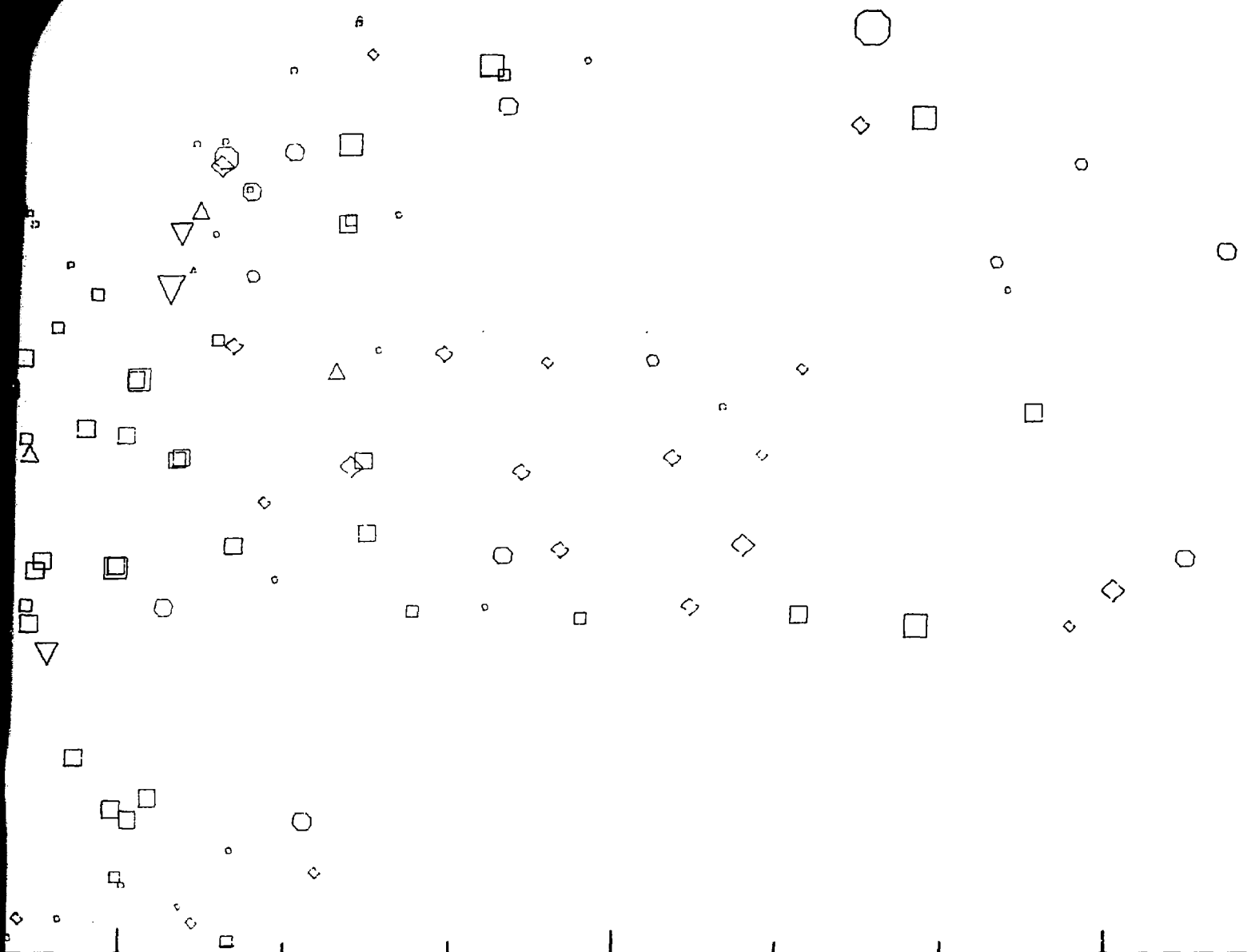
Scale 1:250 000



b)

- 0.00 - .50
- .51 - 1.00
- 1.01 - 2.00
- 2.01 - 5.00
- 5.01 - 10.00
- 10.01 - 20.00
- 20.01 - 50.00
- > 50.00

URANIUM CONCENTRATIONS (OVERLAY TO THE TRINIDAD NTMS QUADRANGLE

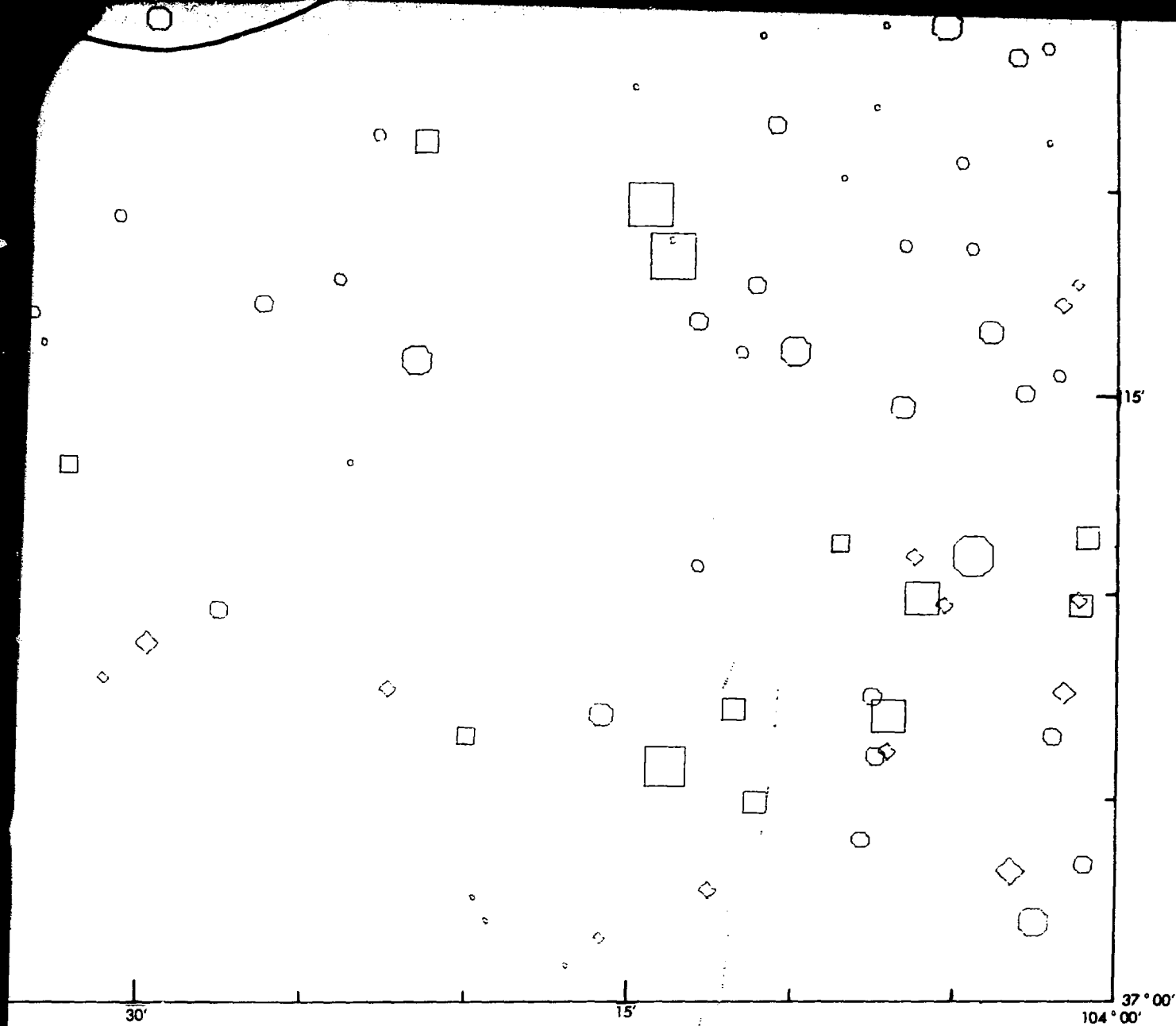


Scale 1:250 000

5 10 15 20 Miles
10 15 20 25 30 Kilometers

CONCENTRATIONS (ppb) IN WATERS
RELAY TO THE
QUADRANGLE, COLORADO

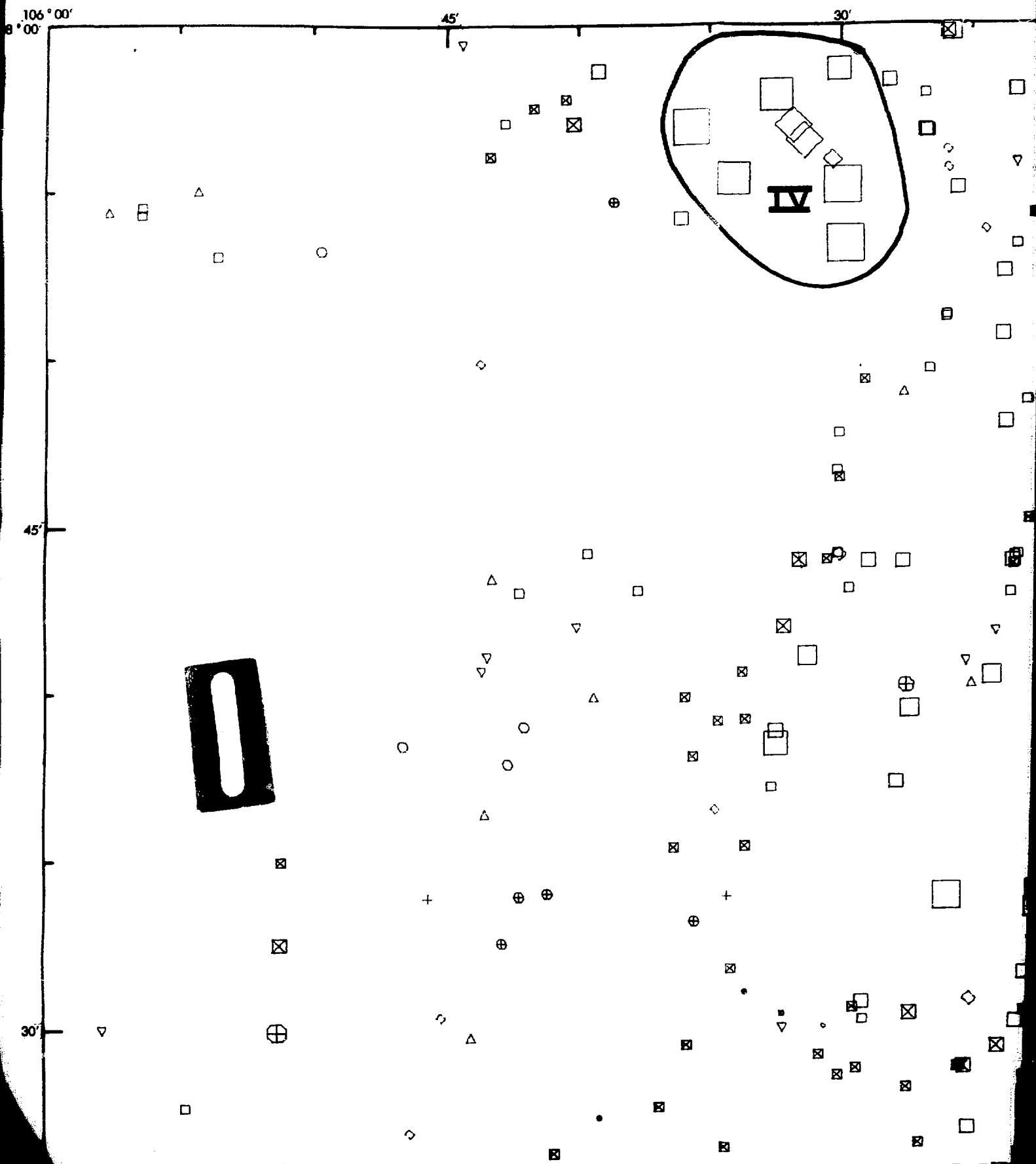
13

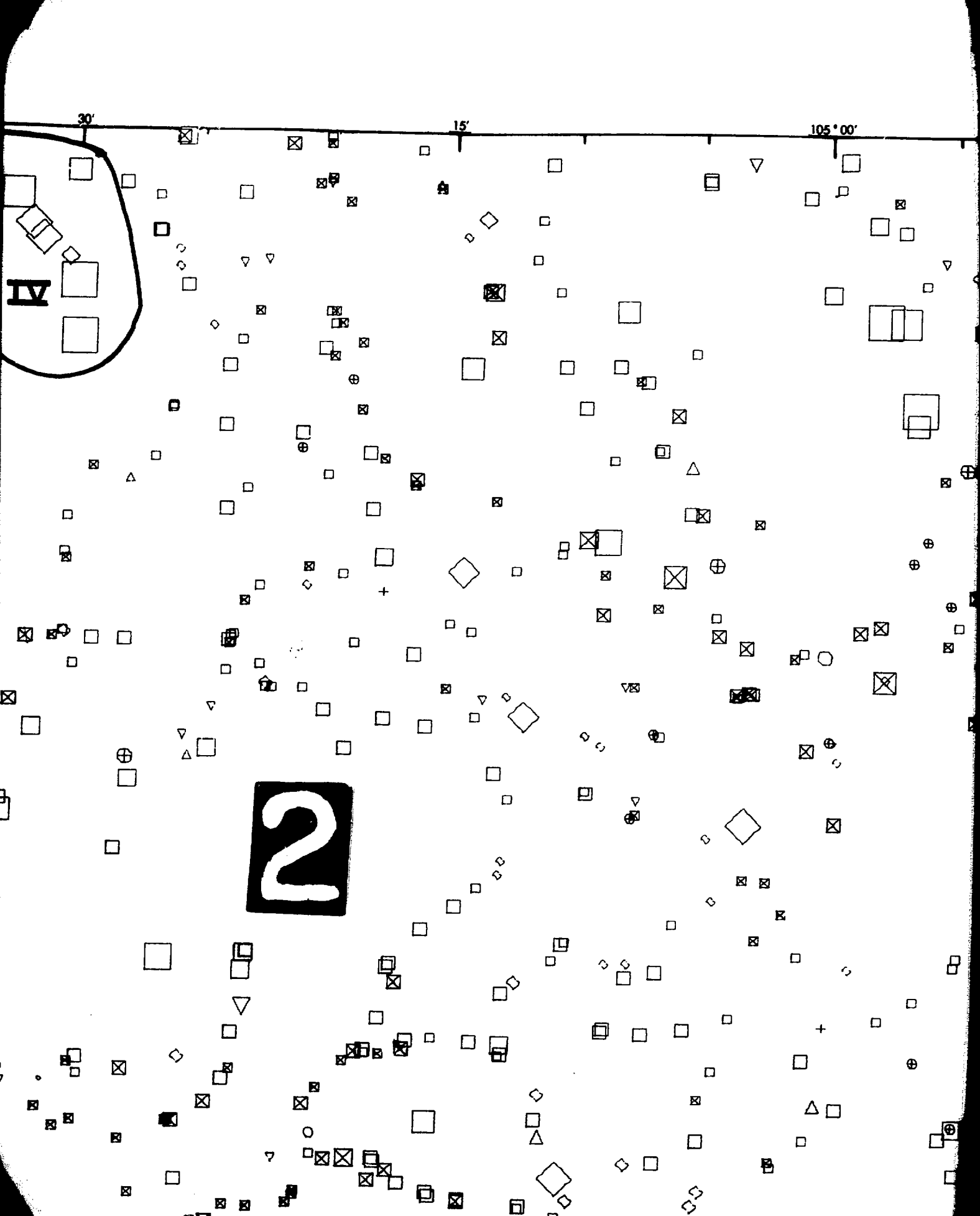


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LA-7345-MS





5°00'

45'

30'

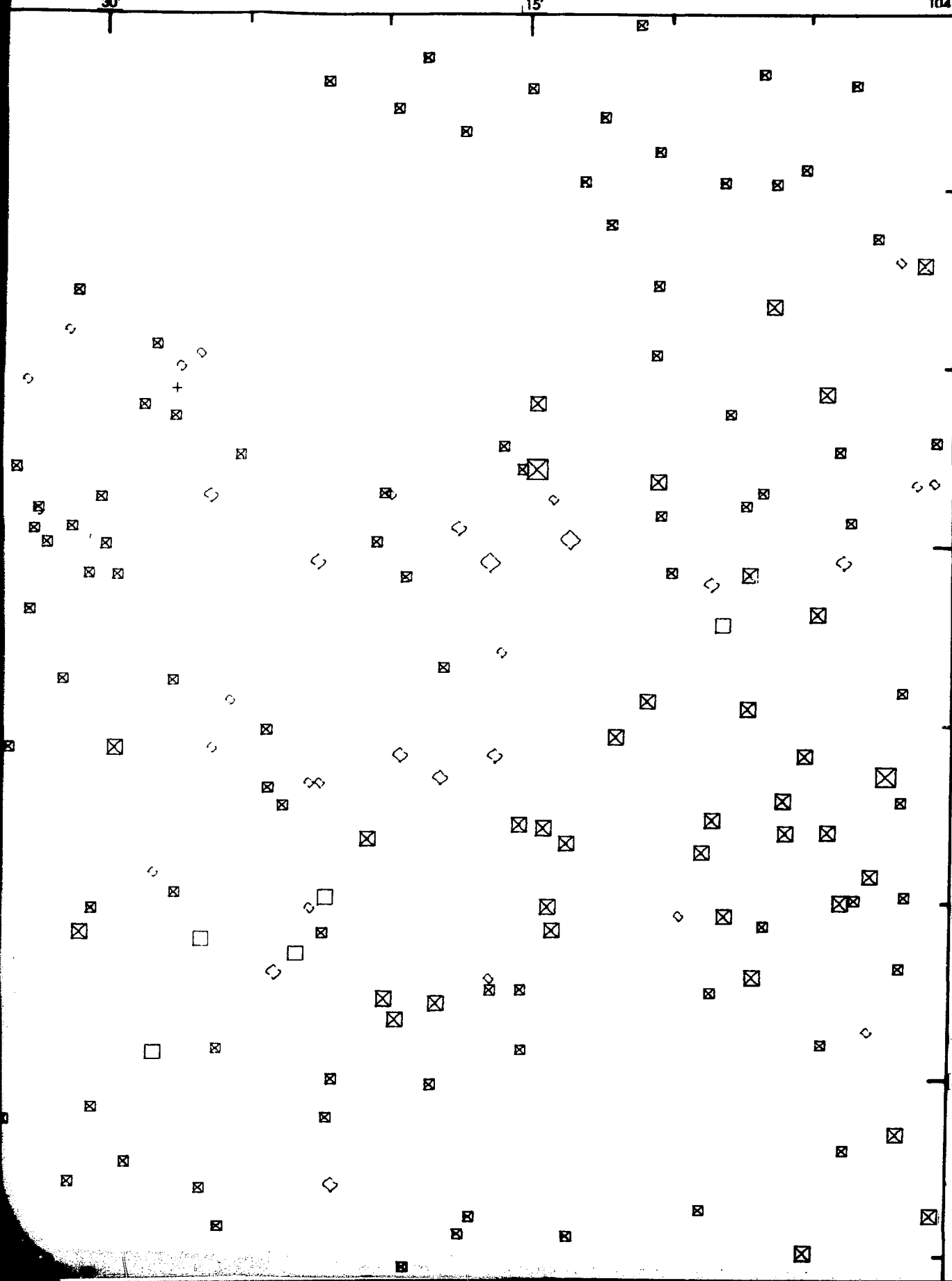
3

PLATE III

30'

15'

104° 00'
38° 00'

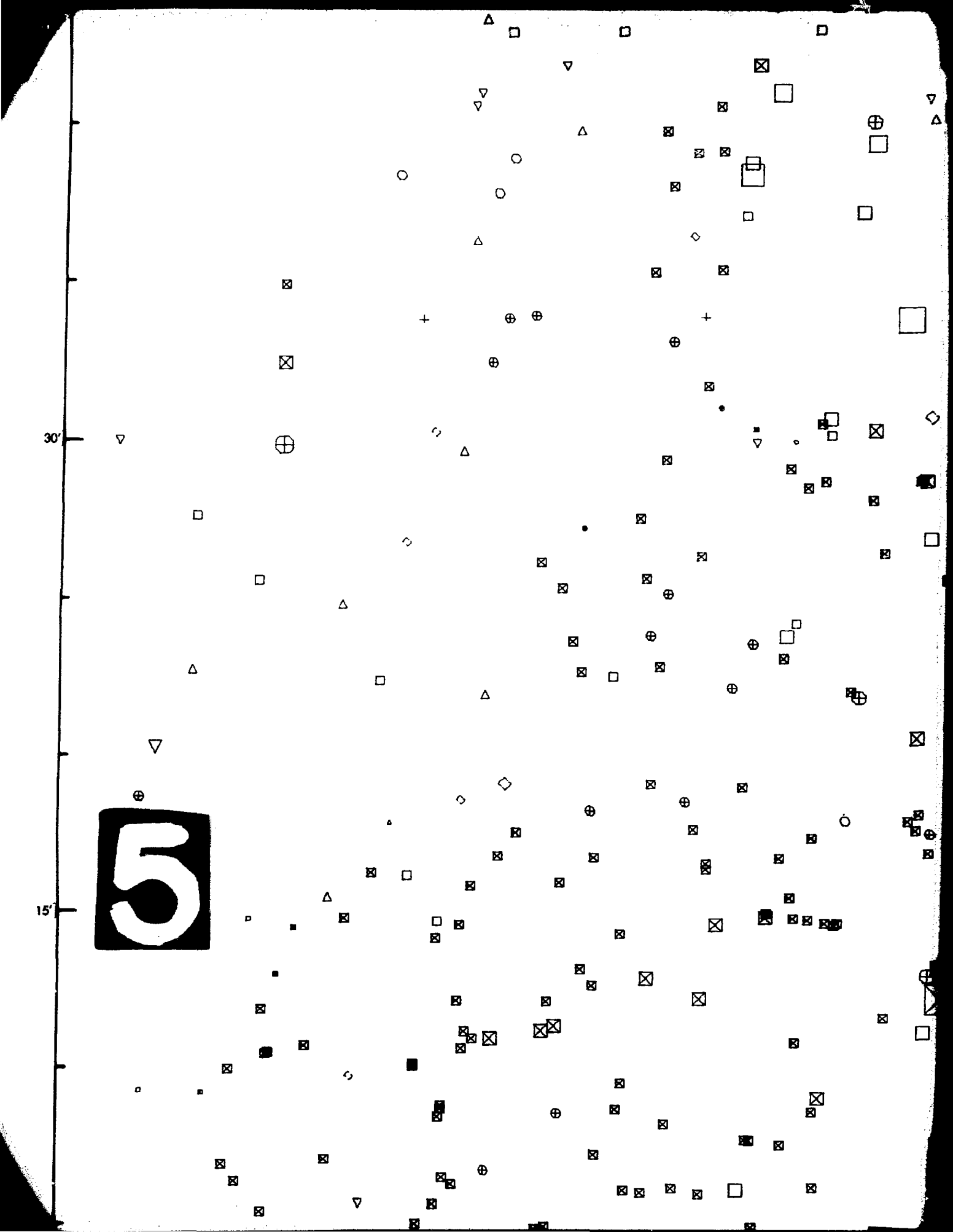


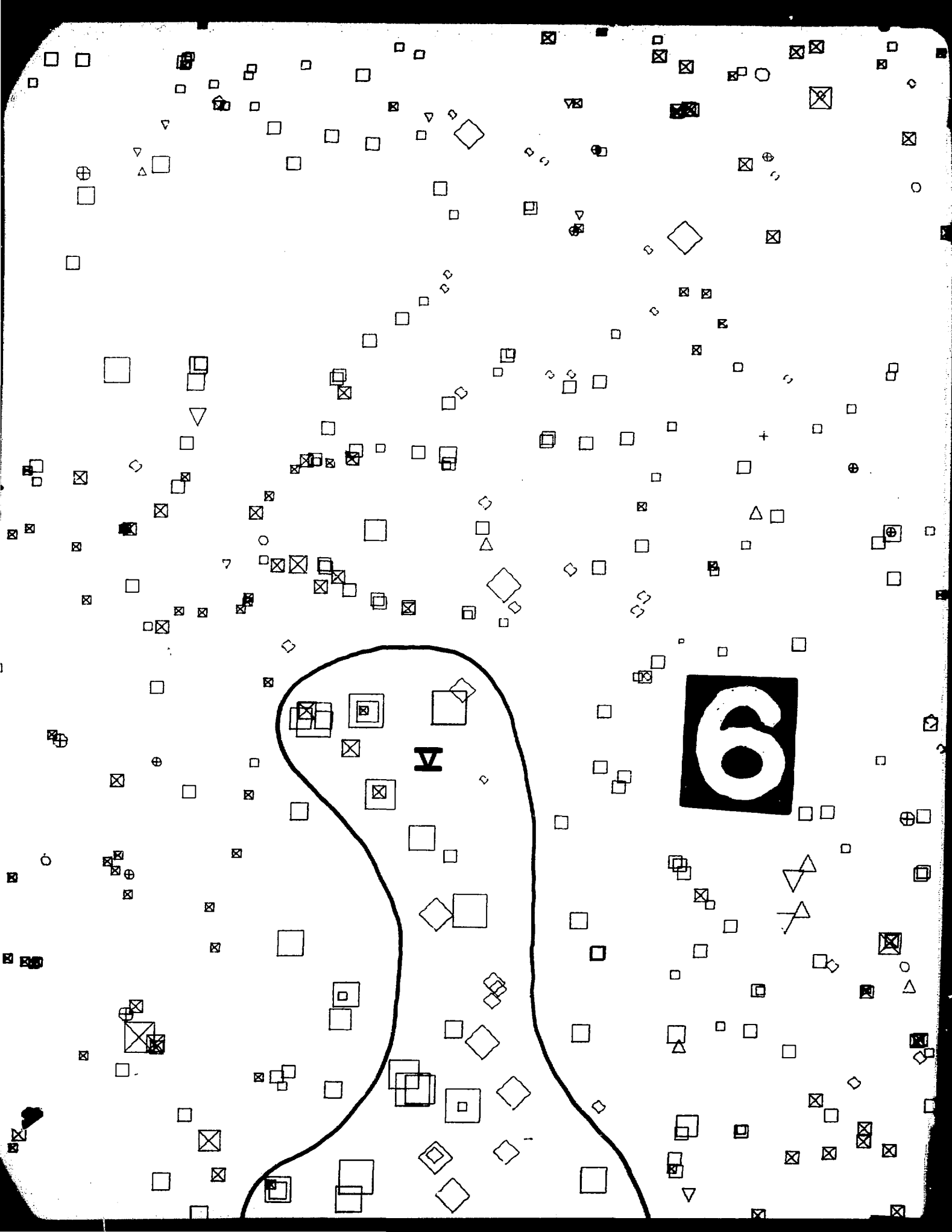
4

30'

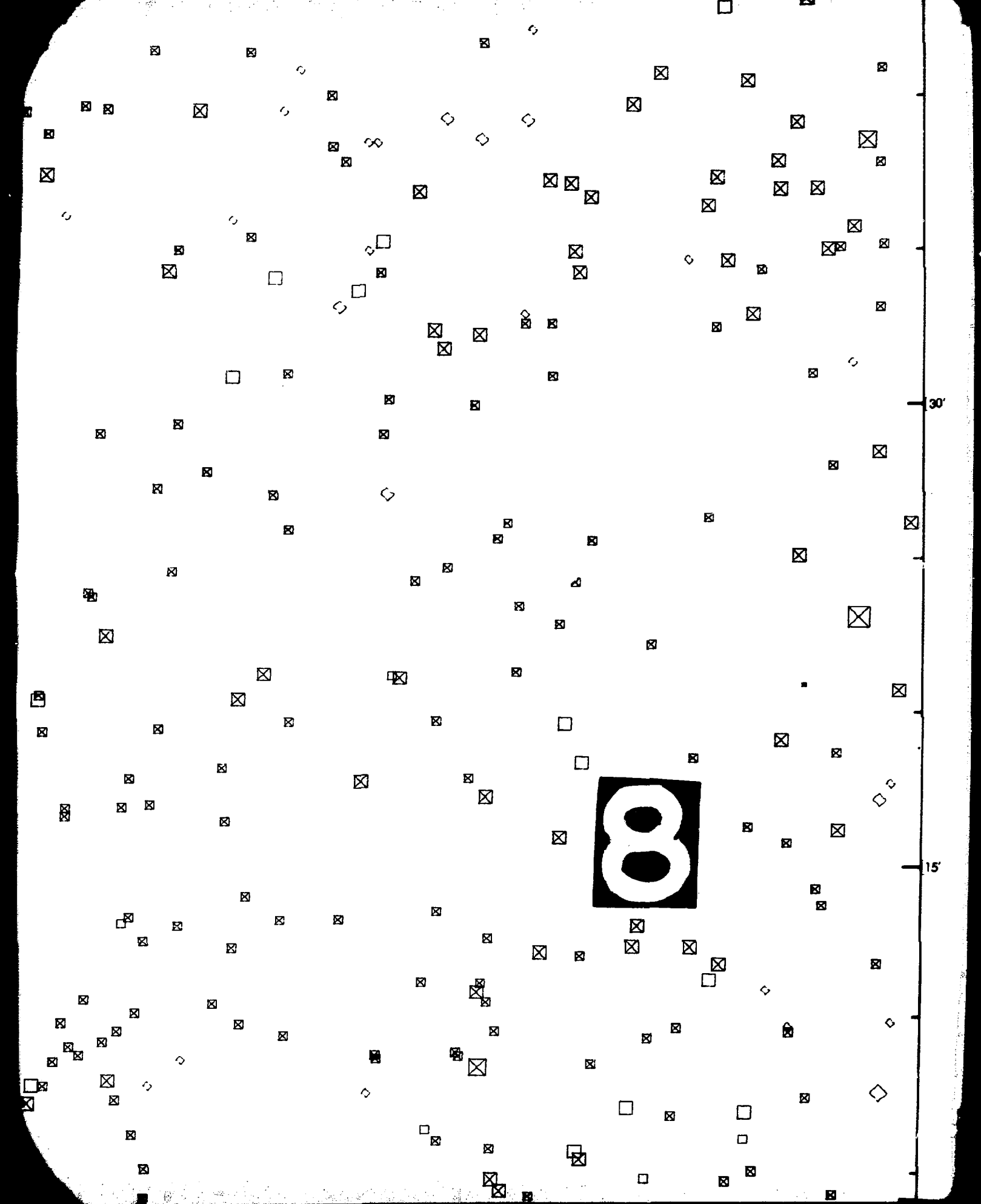
15'

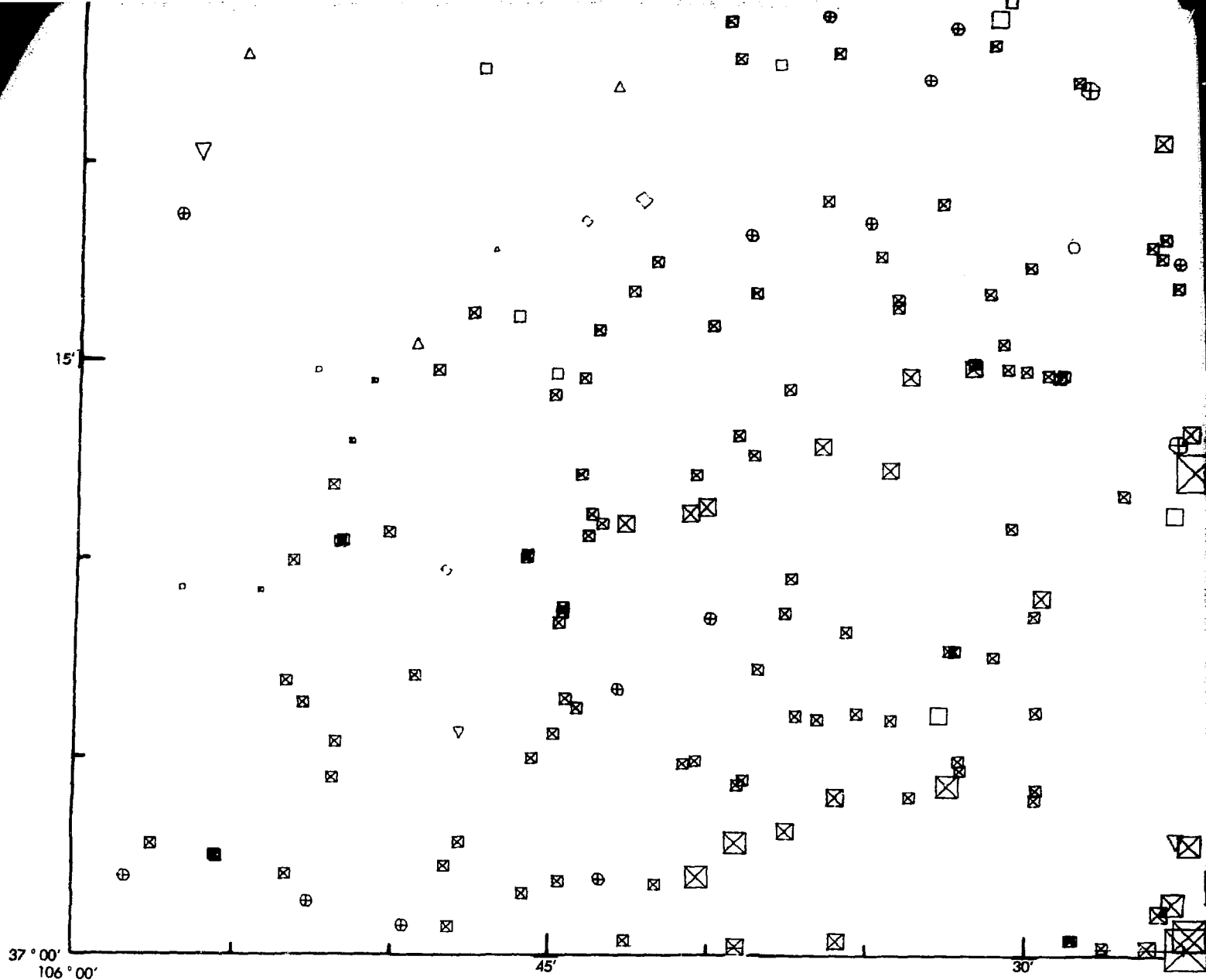
5





7





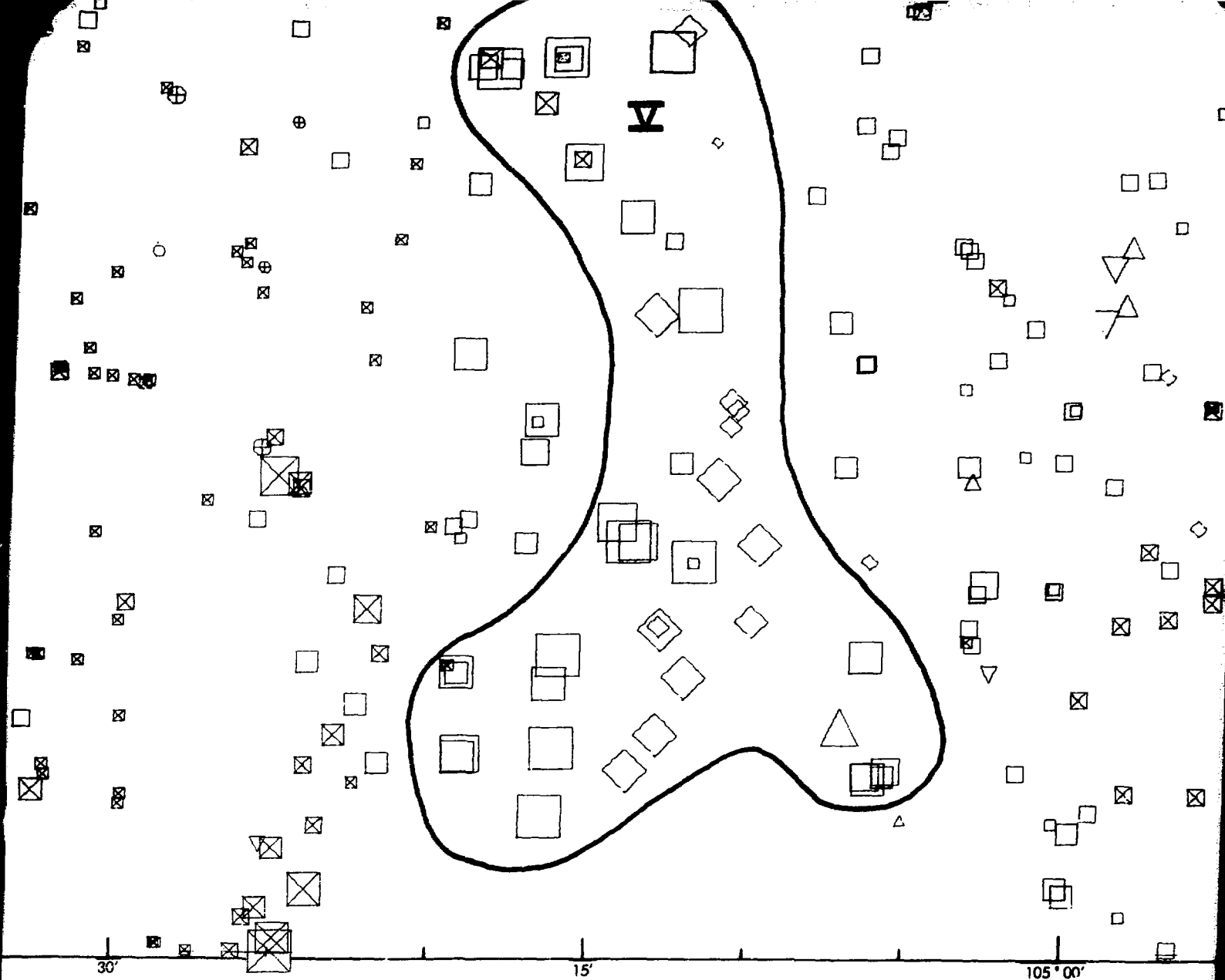
LEGEND

SYMBOLS

-  Wet Spring
-  Wet Stream
-  Wet Natural Lake or Pond
-  Wet Artificial Lake or Pond
-  Dry Stream
-  Dry Natural Lake or Pond
-  Dry Artificial Lake or Pond
-  Other Sediment (Dry Spring)

CONCENTRATIONS (ppm)

								0.0 -
								2.1 -
								4.1 -
								6.1 -
								8.1 -
								10.1 -
								12.1 -
								>

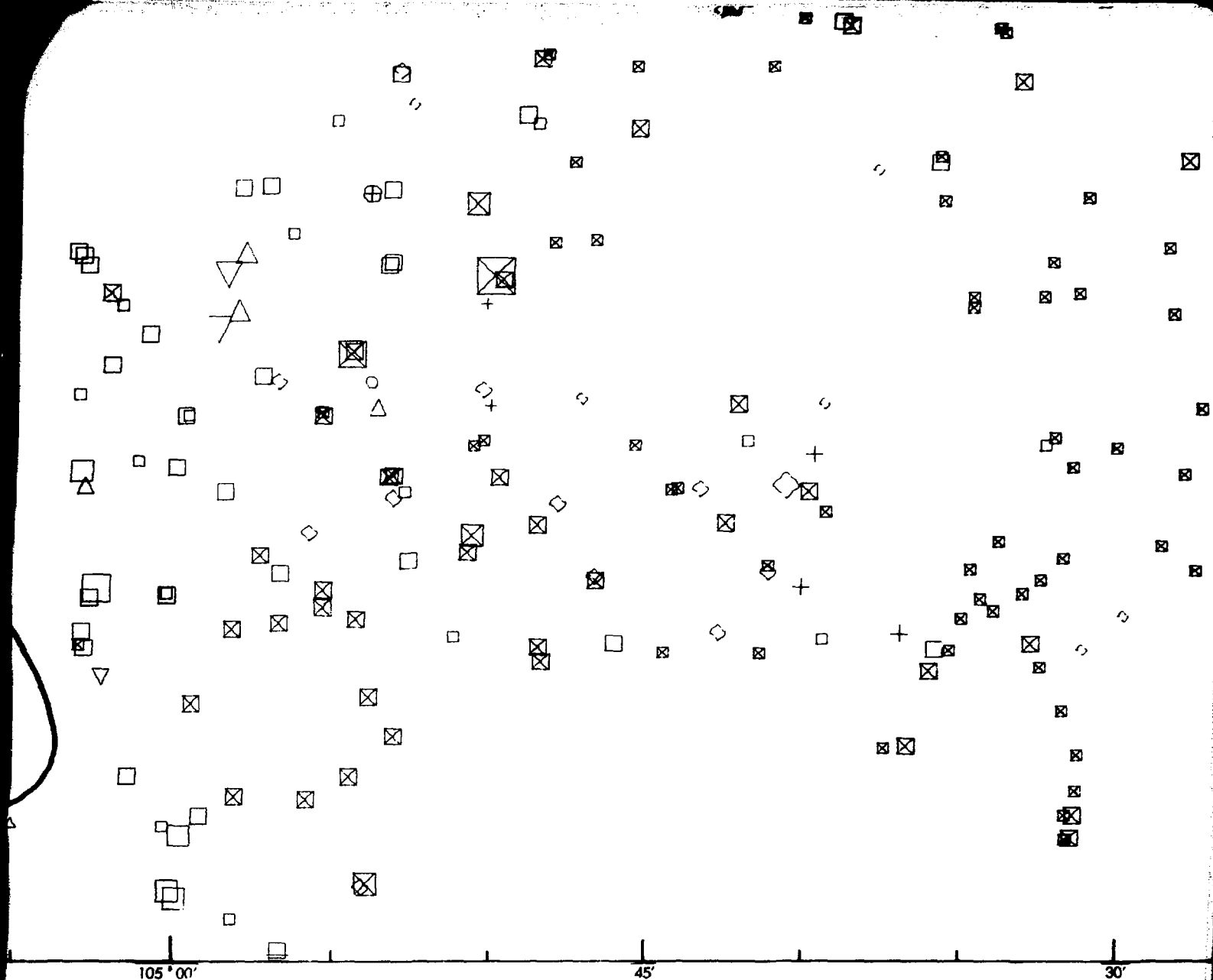


NS (ppm)

○	⊕	+	0.0 - 2.0
○	⊕	+	2.1 - 4.0
○	⊕	+	4.1 - 6.0
○	⊕	+	6.1 - 8.0
○	⊕	+	8.1 - 10.0
○	⊕	+	10.1 - 12.0
○	⊕	+	12.1 - 14.0
○	⊕	+	> 14.0

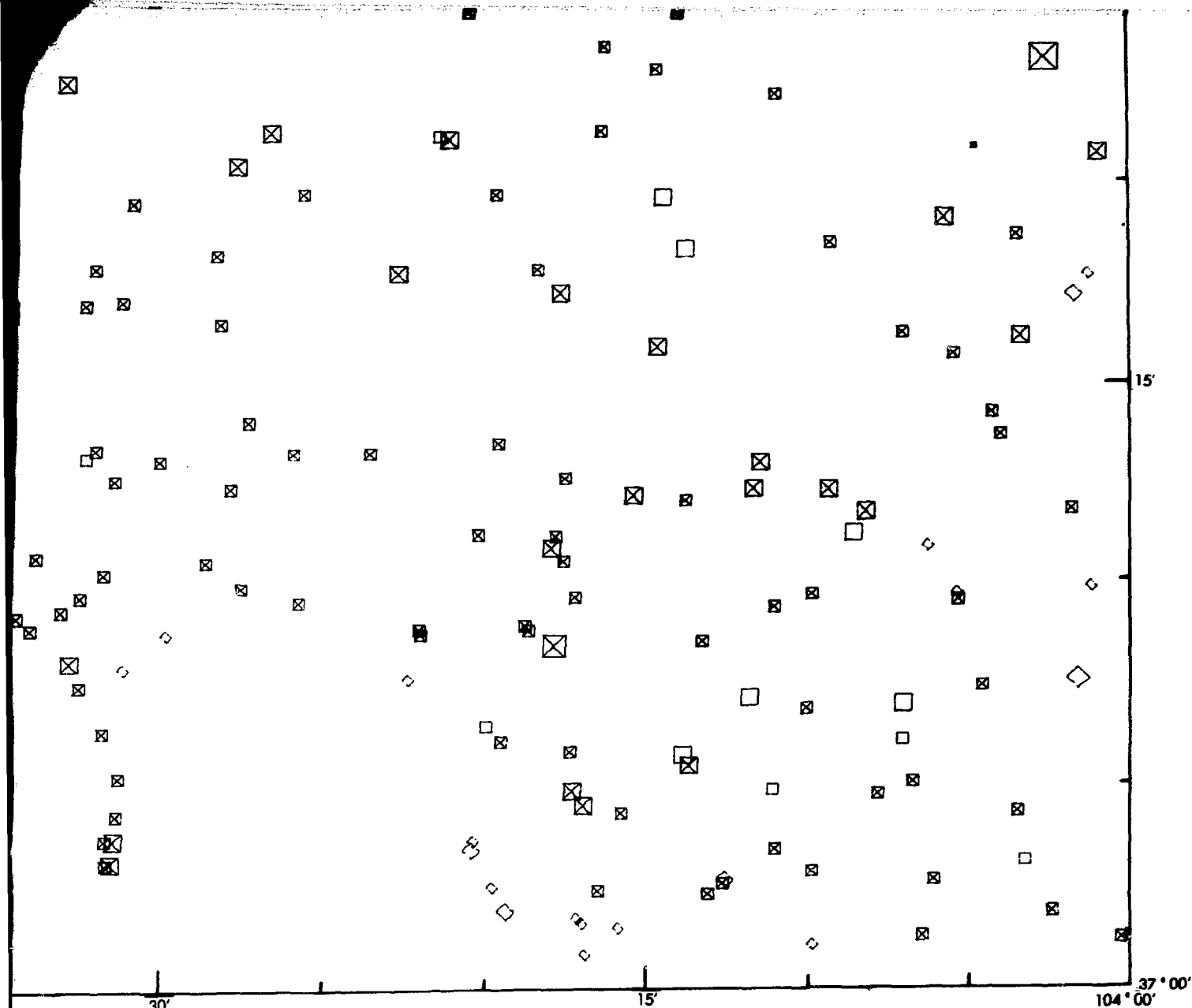
URANIUM CONCENTRATIONS (
OVERLAY TO
TRINIDAD NTMS QUADRAN

10



CONCENTRATIONS (ppm) IN SEDIMENTS
OVERLAY TO THE
QUADRANGLE, COLORADO





Anomalous Sample Cluster



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