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Uranium Concentrations in Natural Waters South Park, Colorado

by

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SOUTH PARK, COLORADO

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ABSTRACT

During the summer of 1975, 464 water samples from 149 locations in South Park, Colorado, were taken for the Los Alamos Scientific Laboratory in order to test the field sampling and analytical methodologies proposed for the NURE Hydrogeochemical and Stream Sediment Reconnaissance for uranium in the Rocky Mountain states and Alaska. The study showed, in the South Park area, that the analytical results do not vary significantly between samples which were untreated, filtered and acidified, filtered only, or acidified only. Furthermore, the analytical methods of fluorometry and delayed-neutron counting, as developed at the LASL for the reconnaissance work, provide fast, adequately precise, and complementary procedures for analyzing a broad range of uranium in natural waters. The data generated using this methodology do appear to identify uraniferous areas, and when applied using sound geochemical, geological, and hydrological principles, should prove a valuable tool in reconnaissance surveying to delineate new districts or areas of interest for uranium exploration.

I. INTRODUCTION

This report describes work done by the Los Alamos Scientific Laboratory (LASL) for the United States Energy Research and Development Administration (US ERDA). The ERDA Grand Junction Office (GJO) in Grand Junction, Colorado, is responsible for administering a nationwide Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) as part of their National Uranium Resource Evaluation (NURE) program. The LASL is responsible for completing the HSSR project throughout the states of New Mexico, Colorado, Wyoming, Montana, and Alaska.[1-4]

Between July 29 and August 28, 1975, Lucius-Pitkin Corporation (LPC), then under contract to the ERDA GJO, collected 464 water samples from 149 locations in the South Park area of Park County, Colorado (Figure 1). These samples were taken at the request of the LASL for use in planning future HSSR work in adjacent parts of Colorado. The sample locations were chosen by LPC personnel as part of a larger study they were carrying out in the area. However, the specific treatments given the water samples from each location were as directed by the LASL. These were aimed at testing the effects of suspended sediment as well as at determining any need for acidification to retain the uranium in solution. Field data and uranium concentrations for the samples from South Park are set forth in Appendixes A and B, and the parameters included there are defined and described in Appendix C.

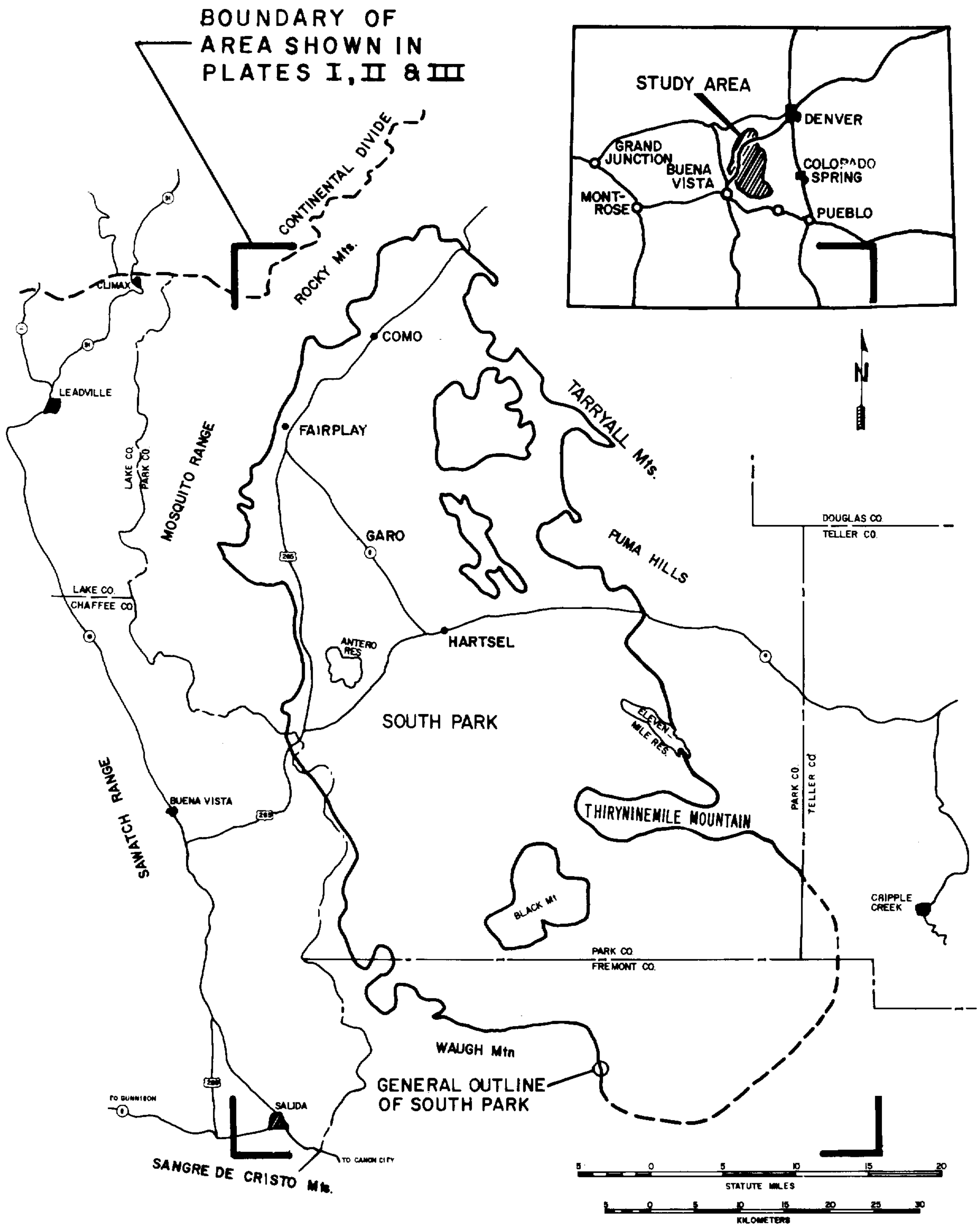

Figure I -

LOCATION MAP SHOWING
PHYSIOGRAPHY AND POLITICAL SUBDIVISIONS
SOUTH PARK AREA, COLORADO

II. LOCATION, PHYSIOGRAPHY, AND CLIMATE

The South Park area is located approximately 105 km southwest of Denver and 80 km west of Colorado Springs. It is a broad, north-trending, intermontane valley bounded by the Front Range on the east and the Mosquito Range on the west. The valley elevation ranges from 2600 m in the southeast to 3000 m in the northwest. The land surface is nearly flat and typically barren, except near the surrounding mountains.

Physiographically, the valley can be subdivided into three provinces: the low pediments in the north and west, the rolling Elkhorn Upland in the east, and the low volcanic hills in the southeast.[5] Black Mountain and Thirtyninemile Mountain of the Thirtyninemile volcanic center actually form the southeast rim of South Park.[6] However, for this study, the South Park area has been extended to the southwest into the headwaters of Badger Creek, and to the south and southeast past the volcanic centers of Thirtyninemile Mountain and Black Mountain to the headwaters of Currant Creek and West Fourmile Creek.

The climate of South Park is generally cool and dry. The surrounding mountains receive moderate snowfall in winter, and the valley receives much of its precipitation from summer thunderstorms. Table I lists climatic data from stations in the area.

III. GEOLOGY

An early account (1935) of the stratigraphy of the northeastern and east-central parts of the South Park area is provided by J. H. Johnson.[8] The most complete description of the geology of South Park is that by Stark and others, published in 1949.[5] Much of the summary reported here is based on their work. More recent studies, emphasizing the southern part of South Park, have been published by D. L. Sawatzky[9] and R. H. De Voto,[10] both in 1964. Epis and Chapin, in 1968 and 1974, have provided substantial detail about the stratigraphy of the Thirtyninemile volcanic center on the southern border of South Park.[6,11] The most recent geologic maps covering the South Park area are those of Epis and others,[12] and Bryant and Wobus,[13] both open-filed in 1975. V. R. Wilmarth, in a 1959 publication, reports on the geology of the Garo uranium-vanadium-copper deposit, north of center in South Park,[14] while the geology and ore deposits of the Tallahassee Creek district, south of the Park, are described by B. A. MacPherson in his 1959 report[15] and those of Badger Flats on the east side are dealt with in the 1969 work by C. C. Hawley.[16]

TABLE I

CLIMATIC DATA FROM STATIONS IN SOUTH PARK

		Mean Monthly Precipitation (cm)[5,7]												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Como	1886–94 1909–10	1.27	1.80	2.44	3.48	4.24	2.06	9.04	6.81	2.62	1.52	2.46	1.90	39.6
Hartsel	1909–30	0.53	0.58	0.94	1.83	2.21	2.84	8.74	5.59	2.69	1.27	0.81	0.71	28.8
Antero Reservoir	1975	0.56	1.19	0.58	1.19	1.17	2.97	2.72	1.96	2.29	0.38	1.73	0.33	17.1
		Average Temperature (Degrees Celsius)[7]												
Antero Reservoir	1975	-9.3	-10.6	-3.8	-0.3	5.2	9.2	14.3	12.4	8.2	3.7	-5.4	-7.1	1.4

The geology of the South Park area (as generalized from Refs. [12] and [13]) is shown on Plate I, in the pocket at rear. Included in the Explanation of Plate I is a condensed list of the geologic units exposed in the area, and these units are described in greater detail in Table II.

South Park is primarily a synclinal structure bordered on the east by the Elkhorn thrust fault which formed during Laramide time. Rocks underlying the area range in geologic age from Precambrian to Holocene, with only those of the Silurian and possibly the Triassic intervals missing. The Paleozoic sequence exposed in northwestern South Park is folded and faulted. The Mesozoic rocks of the Park are similar to the continental sedimentary sequence east of the Front Range. Together, the pre-Miocene sedimentary rock strata comprise the principal southward-plunging synclinal structure. On the south, the syncline is itself covered by Miocene and younger sedimentary and volcanic rocks.

The eastern limb of the structure is broken and covered by the Elkhorn thrust fault, which brings Precambrian crystalline rocks of the Front Range westward over the early Tertiary rocks of the syncline. Post-Eocene volcanic flows and pyroclastics, primarily from the Thirtyninemile volcanic center, interbedded with torrential and "lake bed" sediments, accumulated unconformably on the older rocks. The present topography of the Park is the result of pre-Pleistocene fluvial erosion which produced a series of generally south-sloping pediments or erosion surfaces. Uplift of the southern part of the area in Pliocene or later time deflected the pre-Pleistocene drainage to the northeast. Moraine and outwash, spread into the valley by Pleistocene glaciation of the Mosquito Range, have been only partially removed by recent stream erosion.

IV. URANIUM OCCURRENCES IN ROCKS OF THE AREA

South Park exhibits the tectonic history and many of the structural characteristics and relationships favorable to the occurrence of uranium as set forth by Osterwald in his study of the relation of tectonic elements in Precambrian rocks to uranium deposits in the Cordilleran Foreland.[17] Among these favorable features are: a) fractured and refractured Precambrian granitic cores and stocks, including pegmatites and greisen pipes, surrounded by Precambrian sedimentary metamorphics; b) the occurrence of carbonaceous shales and mudstones interbedded with arkosic sandstones, altered red beds and other continental sediments, with overlying tuffs and even some oil; c) highly sheared, fissured, flexured and en echelon faulted zones; and d) numerous regional and local surfaces of unconformity evidencing repeated deformations and cycles of erosion throughout geologic time. Such features, which can be seen and inferred from the map of Plate I and from Table II, provide the sources and the necessary host rocks for uranium ore, both in veins[18,19] and terrestrial sediments,[20] as well as a number of the recognized ore controls in sandstone uranium deposits at diverse localities.[21]

Indeed, uranium mineralization is reported in a remarkable number of the rock units exposed in, underlying, or surrounding South Park. The Schwartzwalder Mine, in adjacent Jefferson County, produces uranium from Tertiary ores containing pitchblende, torbernite, and autunite in the metasediments of the Precambrian Idaho Springs formation.[18] Uraninite in small amounts (mostly of the sooty pitchblende variety, all in ore deposits of Precambrian age) is reported from the Boomer, Redskin, and Black Prince Mines,[16] in the Badger Flats area of South Park as included on Plates I, II, and III. Part of the workings

TABLE II

TABLE OF GEOLOGIC UNITS RECOGNIZED IN SOUTH PARK[5,8,10-13]

Age		Formation	Thickness* (meters)	Description
Quaternary	Recent			Stream gravels, etc.
		Unconformity		
	Pleistocene	Wisconsin		Glacial, glacio-fluvial, and stream deposits.
		Unconformity		
		Illinoian (?)		Glacial, glacio-fluvial, and stream deposits.
		Unconformity		
		Pre-Illinoian		Glacial, glacio-fluvial, and stream deposits.
		Unconformity		
Tertiary	Pliocene (?)	Trump formation	0 - 150	Sand, gravel, and poorly consolidated conglomerate.
		Unconformity		
	Miocene (?)	Wagontongue formation	30 - 150	Coarse sandstone, sandy clay, and conglomerates. Largely reworked volcanics.
		Unconformity		
	Oligocene	Antero formation ("Lake beds")	610	Upper: conglomerate and arkose. Middle: tuff and silicified lacustrine algal limestone. Lower: conglomerate and mudstone.
		Thirtyninemile formation	0 - 270	Andesitic flow breccias, lahars.
		Unconformity		
		Tallahassee Creek conglomerate	0 - 350	Igneous and volcanic pebbles, cobbles, and boulders.
		Unconformity (?)		
		Wall Mountain tuff	0 - 180	Welded tuff.
		Unconformity		
	Eocene Paleocene	South Park formation	0 - 2400	Conglomerate, arkose, and tuff.
		Unconformity (?)		
Cretaceous		Laramie formation	0 - 110	Sandstone, shale, tuff, and coal.
		Unconformity (?)		
		Fox Hills sandstone	0 - 100	Sand and sandstone.
		Pierre shale	670 - 800	Shale, some sandy shale.
		Niobrara formation	150 - 160	Calcareous shale, limestone.
		Unconformity		
		Benton shale	125 - 140	Black shale with bentonite, calcareous shale.
		Dakota sandstone	75 - 90	Sandstone, some conglomerate and shale.
		Unconformity		
Jurassic		Morrison formation	75 - 100	Shale, calcareous and sandy shale, siltstone.
		Unconformity		
		Garo sandstone	0 - 120	Cross-bedded sandstone.
		Unconformity		
Permian		Maroon formation	0-2400	Red-beds, sandstone, and siltstone.
Pennsylvanian		Weber (?)	390 - 700	Shale with limestone, arkose above.
		Unconformity		
Pre-Pennsylvanian		Undifferentiated		Sandstones and limestones.
Precambrian		Redskin granite		Fine- to medium-grained, late phase of Pikes Peak granite.
		Pikes Peak granite		Coarse-grained granite with comagmatic minor plutons.
		Silver Plume (?) granite		Metaigneous granite of variable texture.
		Idaho Springs formation		Gneiss, biotite gneiss, and schist.

*Maximum thicknesses shown are not generally exposed in South Park.

of the Boomer Mine, where anomalous radioactivity was noted on the mine dump in the early 1950's, are in the Idaho Springs formation and the Silver Plume (?) granite. This mine, a beryllium producer from at least 1956 to 1965, is located along the Badger Flats fault between Sites 96 and 98 as shown on Plate II. At the Redskin and Black Prince Mines, the uranium mineralization is in greisen pipes in the Redskin granite stock,[16] about 1.6 to 1.8 km north of Site 100. Another local occurrence of radioactive mineralization in Precambrian rocks is that of the Micanite-Guffey area, which spreads across Currant Creek along and mostly north of the Fremont-Park County line (Plate II). Here, the uranium bearing mineral, euxenite, and radioactive ilmenite are reportedly found in small, zoned pegmatites.[22]

The Garo (or Shirley May) copper-vanadium-uranium deposit, in the Permian Maroon formation of South Park, is described by a number of workers,[19-23] but the most extensive account is that of Wilmarth.[14] Located on the northeast flank of the Garo anticline, about 1.6 km south of Garo and 1 km west of Site 91 on Plate II, the deposit reportedly has tyuyamunite and carnotite as fracture fillings and disseminations in three beds of complexly faulted, red to white to light buff, thin-bedded, medium- to coarse-grained sandstone, all situated within a stratigraphic interval of about 45 m. At this location the Maroon formation, an eastern equivalent of the Cutler formation,[21] includes a few thin beds of limestone as well as beds of red sandstone, conglomerate, and shale.[14] Abnormal radioactivity in some of the cherty limestone beds persists for several km to the northwest.[14] Additional occurrences of carnotite are reported in Permian, gray to brown, arkosic sandstone at the Perry De Lellis claim, and in sandstone of the Maroon (?) formation at the Armstrong location.[23] Both of these are in the southwest corner of Fremont County, southward from Badger Creek and off the map of Plate II.

Commercial uranium occurrences in the Jurassic Morrison formation outside the South Park area are well known and uranium is found in at least two deposits in the Cretaceous Dakota formation in Fremont County, within and adjacent to the South Park area. One of these is at the Colexco location, where carnotite and uranophane (?) are associated with iron and manganese concretions in black shale. The other is at the Jesus lode, where torbernite or metatorbernite is reported in sandstone.[23] The first-mentioned locality is about 13 km south-southeast of the junction of Park, Fremont, and Teller Counties, in the southeast corner of the map area of the Plates, while the other is off the map, approximately 20 km further southward and below Tallahassee Creek. The Cretaceous Pierre shale - which is carbonaceous in South Park and has produced oil from a well north of Hartzel[5] - is uraniferous.[24] Likewise, uranium bearing coal, in nearly vertical beds of a hogback of the Late Cretaceous Laramie formation, has long been known to come from the Old Leyden Coal Mine, in Jefferson County, northwest of Denver.[25] Coal with a grade from 0.1 to 0.7 percent U_3O_8 is reported to have come from the Leyden Mine, and the likely possibility of similar occurrences in the Laramie formation elsewhere is discussed by Boberg and Runnels.[24]

Three uranium deposits are reported in what is known as the Tallahassee Creek District of Fremont County.[15] This district covers about 100 sq km and is centered along Tallahassee Creek, above the southern boundary of the area included in Plates I, II, and III. While inside the map area, it extends only to within about 15 km due south of the southernmost site sampled upstream on Currant Creek (Site 55, Plate II). At the Mary L Mine, carbonaceous uranium ore is concentrated in flat-lying lenticular bodies within Eocene (?) arkosic sediments. At both the Sunshine and Dickson-Snooper Mines, the uranium ore (autinite at the former and uraninite at the latter) occurs in lenticular bodies of Oligocene-Miocene volcanic conglomerate. At each of these mines in the Tallahassee Creek District the lenticular ore deposits appear to be in paleostream channels or basins.[15] Although Finch indicates in his 1967 work that uranium deposits are unknown in the Eocene Denver (?) formation (recently mapped in the present area as the South Park formation[12,13]), he dates the host rock of the Mary L Mine simply as Tertiary.[23] He does, however, cite the occurrence of autinite in gray, fine-grained, tuffaceous sandstones of the Oligocene Antero formation. This is in a prospect located along the county line in southwest Park County, west of Agate Creek and Site 63. Outside of South Park, uranium deposits occur in the Miocene (?) Browns Park formation and the Pliocene (?) North Park formation in Colorado,[20] and uranium occurrences not mentioned above are reported from elsewhere in Park County as well as in the surrounding counties of Teller, Chaffee, Clear Creek, Jefferson, and Fremont.[19,22,23]

V. FIELD TREATMENTS GIVEN SAMPLES

In order to test the effects of suspended sediment and acidification, an untreated water sample, a filtered and acidified water sample, and a filtered-only water sample were collected from each sample site for this study. Also, to test the effect of acidifying without filtering, one out of ten of the untreated samples was split and one-half of it was acidified, while the remainder was left untreated. Standard 0.45-μ filters were used in all filtering, and 8 M reagent grade nitric acid was used for acidification to a pH of about 1, wherever it was done. All LASL samples were placed in polyethylene containers (30 or 130 mℓ in size) which were pre-washed in nitric acid, rinsed with distilled water, and capped before shipment to the field. The treatment given each sample is specified by the number under "Sample Type" in the Data Listings of Appendices A and B, as described in the Code and Numerical Key of Appendix C.

VI. ANALYTICAL METHODS

The water samples were analyzed for uranium by one of two methods, fluorometry or delayed-neutron counting. The fluorometric technique used at the LASL is presently the most economic one available there and was developed for maximum sensitivity. Samples were initially analyzed by fluorometry and those found to contain a uranium concentration in excess of ~10 ppb (the maximum that can be handled by this method at the LASL without recalibration) were analyzed by delayed-neutron counting. Additionally, 47 of the samples having uranium concentrations generally in the range that could be adequately determined by both methods were run by both to provide a basis for comparison.

Fluorometric Method

Here, after vigorous shaking of each sample by hand, 100-μℓ aliquots were transferred in duplicate, without separation or concentration of the uranium, onto pellets of 2 percent LiF and 98 percent NaF flux. These were then dried and fused. The fluoride pellets were transferred to a Galvanek-Morrison fluorometer for excitation with ultraviolet radiation and measurement of the reflected fluorescence. The sensitivity of this method was found to be about 0.2 ppb of uranium. The samples were run in sets which consisted of two to seven pairs of duplicate aliquots, two duplicate standards (duplicates at 4.9 ppb for calibration, and duplicates at 1.0 ppb as a quality control check), and two blanks. The analytical results were then calculated using a computer program which provides an independent least-squares calibration line for each set based on the duplicate standards and blanks included in that set. Fluorometry results are listed in Tables A-I and B-I of the Appendixes.

The samples utilized in this study provided an opportunity to determine the precision of the LASL fluorometric procedures. In each case where the fluorometric method was relied upon, duplicate analyses were made of each sample, as mentioned. For nine of these samples, either one or both of the results were measurable only as "less than 0.2 ppb." Because the exact uranium concentration in these nine samples was not determinable, they were omitted from the following statistical analysis. However, when calculating the average uranium concentrations obtained by fluorometry for the various samples as given in the Appendices, the nine individual values determinable only as less than 0.2 ppb were included, but arbitrarily as having a value of 0.1 ppb in each case. For each pair of the remaining results (where the uranium concentration was 0.2 ppb or greater) the arithmetic mean and variance were calculated. Because the precision of the analytical procedures is known to vary according to the concentration of solution being analyzed, the results of the above calculations were grouped according to uranium concentration. These groups, along with the resulting standard deviations and relative errors for each, are listed in Table III. Here it is seen that for

TABLE III

ANALYSIS OF ANALYTICAL PRECISION AND SAMPLE TREATMENT
SOUTH PARK, COLORADO, SAMPLES
HAVING URANIUM DETERMINATIONS MADE BY FLUOROMETRY

(1) INTERVAL (ppb U)	(2) FIELD TREATMENT	(3) SAMPLE COUNT	(4) STANDARD DEV (ppb)	(5) AVERAGE (ppb)	(6) RELATIVE ERROR (percent)
0.200 - 1.500	A	38	0.436	0.987	31.24
same	B	35	0.447	1.016	31.11
same	C	4	0.655	0.847	54.68
same	D	36	-0.430	1.093	27.82
0.200 - 1.500	all	113	0.447	1.025	30.84
1.505 - 3.000	A	44	0.573	2.144	18.90
same	B	50	0.684	2.200	21.98
same	C	2	0.492	2.430	14.32
same	D	46	0.657	2.292	20.27
1.505 - 3.000	all	142	0.640	2.216	20.42
3.005 - 4.500	A	29	0.671	3.759	12.62
same	B	26	0.776	3.694	14.85
same	C	7	1.180	3.549	23.51
same	D	23	1.025	3.747	19.34
3.005 - 4.500	all	85	0.858	3.627	16.73
4.505 - 6.000	A	10	0.789	5.160	10.81
same	B	16	0.392	5.219	5.31
same	C	2	1.829	4.805	26.92
same	D	11	0.822	5.035	11.54
4.505 - 6.000	all	39	0.765	5.131	10.54
6.005 - 9.090	A	10	1.048	6.835	10.84
same	B	5	1.251	7.347	12.04
same	C	0	0.000	0.000	0.00
same	D	10	0.397	7.082	3.96
6.005 - 9.090	all	25	0.903	7.036	9.08

the uranium concentration interval of 0.2 to 1.5 ppb there were 38 samples which received field treatment A (acidified and filtered), 35 given treatment B (no treatment), 4 which received treatment C (acidified but not filtered), and 36 given treatment D (filtered but not acidified). Hence, for the subgroup given treatment A, 38 variances, s^2, were calculated. A pooled estimate of the variance of a single fluorometric determination for each concentration range was then calculated from the average of the individual variances in each treatment subgroup, thusly

$$\hat{s}_p^2 = \frac{\sum s^2}{N} .$$

The square root of this is the best estimate of the standard deviation of a single determination in the given concentration range (e.g. - 0.436 ppb for concentrations of 0.2 to 1.5 ppb given treatment A). The fifth column in the table shows the average (arithmetic mean) of all the measurements in each subgroup. For the 38 samples which received treatment A and which had concentrations between 0.2 and 1.5 ppb, the average concentration was 0.987 ppb. The relative error for a single measurement in each subgroup is tabulated in column (6). It was calculated as

$$\text{Relative Error} = \frac{1}{\sqrt{2}} \times \frac{\text{Standard Deviation}}{\text{Average Concentration}} \times 100, \text{ in percent.}$$

The factor of $1/\sqrt{2}$ is required because the estimated standard deviation is derived from pairs of measurements.

The fifth line of each group of samples having the same concentration range shows the results derived when all measurement pairs in the group are averaged together regardless of field treatment. From this it can be seen that the relative error, or precision, of the LASL fluorometric analyses is approximately 30 percent for concentrations in the range 0.2 to 1.5, improving to about 10 percent in the 4.5 to 6.0 ppb range, and remaining at about 10 percent in the case of higher concentrations.

Delayed-Neutron Counting Method

The 41-mℓ reactor vials used to contain the water for irradiation and counting were injection molded of ethylene butene copolymer by the LASL Plastics Section. These vials contain no detectable uranium, and were stored in sealed cardboard boxes until shortly before use. Transfer of field water to the reactor vials was carried out in a chemistry laboratory, taking precautions against sample contamination. Prior to making the transfer, each of the vials and their caps were rinsed twice with distilled water. Each of the selected field samples was shaken vigorously, uncapped, and poured into a reactor vial until the latter was about 95 percent full, if sufficient sample existed. The reactor vial was then capped, numbered, and weighed with a digital balance, the tare weight being automatically subtracted. The net sample weight and number were then logged and the reactor vial containing the sample was placed in a plastic sample loader clip having a capacity of 25 such vials.

Delayed-neutron counting measurements are not carried out until the LASL Omega West Reactor (OWR) has been at full power for >1 hr, insuring a relatively constant neutron flux of 1.2×10^{13} n/cm^2 sec. Standard water samples, containing 7.5, 15, 75, and 150 ppb uranium, are assayed at the beginning of a data run to calibrate the counting system and to establish the system background count rate. At least one of these standards is remeasured every 2 hrs and at the end of the day's run.

An automatic loader, which accepts the sample loader clips, is used to feed the individual samples into the pneumatic rabbit system. Various timing cycles may be used. Sample movements are controlled by a master timer accurate to ± 0.03 sec. The cycle used for most samples is a reactor irradiation time of 60 sec, a delay of 30 sec, and a counting time of 60 sec. The counting is done with delayed-neutron detectors designed and built at the LASL specifically for the HSSR project.[26] The 30-sec delay is necessary to avoid background neutron counts from ^{17}N.

In the case of a 60-30-60 sec cycle, the net integrated neutron count is ~1000 for a 40-g sample containing 10 ppb uranium. Two scaler readings are recorded for each sample. The first scaler reading is the integrated detector count in the peak region of the pulse-height spectrum, and the second is the integrated count in a window of similar width below the peak (valley). If the peak/valley scaler ratio is less than 10, caused by γ-ray pileup in the counter, the sample is remeasured in a 3-mℓ vial in the 1.27-cm pneumatic system, which has greater γ-ray discrimination. None of the samples from South Park required this type of remeasurement.

The uranium assay (expressed in ppb) is calculated for each sample from the net neutron counts in the "peak" scaler reading. Using the 60-30-60 sec timing cycle, the lower limit of detection in the method utilized for determination by delayed-neutron counting is about 0.5 ppb uranium, and the precision at 10 ppb uranium is 4.5 percent. This precision is governed largely by the statistical uncertainty of 4.3 percent (1000 net counts above a 210 ± 25 count background). At higher uranium concentrations, better precision is of course obtained. Results obtained by delayed-neutron counting, excluding those from the 47 samples run simply for comparison with the values obtained by fluorometry, are given in Tables A-2 and B-2 of the Appendices.

VII. COMPARISON OF ANALYTICAL METHODS

As mentioned earlier, 47 water samples were selected to compare the results of fluorometry and delayed-neutron counting on the uranium determinations. Results of the repeat analyses by delayed-neutron counting are not included herein. However, using the nonparametric statistical "sign test,"[27] 24 out of the 47 results from the delayed-neutron counting were larger and 23 were less than those obtained by fluorometry. Hence no significant difference was indicated between the two methods by this test.

If it is assumed that the differences of the paired observations from fluorometry and delayed-neutron counting are normally distributed, the "t-test" for paired differences is also applicable.[27] When the uranium determinations from both of the two analytical methods were given this test, the results again showed no significant difference between data obtained on cuts of the same samples by the different methods.

VIII. EFFECT OF FIELD TREATMENT OF SAMPLES

The primary reason for requesting the collection of multiple samples was to determine the effect of different treatments on the detectable uranium

TABLE IV

RESULTS OF FRIEDMAN'S RANK STATISTICS FOR SAMPLE TREATMENT EFFECTS EXCLUDING ACIDIFICATION ONLY

Treatment		All Data	Streams	Springs	Wells
	Number of Sites	150*	104*	33	13
Filtered and Acidified	Sum of Ranks	284	202	63	18
Filtered Only	Sum of Ranks	313	218	68	27
No Treatment	Sum of Ranks	303	203	68	33
	T Value	3.02	1.59	0.41	8.77
	95% chi-Square Value	5.99	5.99	5.99	5.99

*While only 149 different locations are involved, data for a replicate set of stream samples carrying the LASL No. 100149 were included here.

in the water. Friedman's rank statistics test was used to analyze the data.[28] Because no significant difference was found between the two methods used for the uranium determinations, data from all the samples listed in Appendices A and B - except the 15 which were acidified only - were included in these tests. The average uranium determinations for each of the 3 treatments given samples from each of the sites, then, were ranked 1, 2, and 3 in order of increasing uranium concentration. The ranks for each different treatment were then summed for all sites. If there are no differences due to treatment, the sums for each treatment set will be nearly equal. Friedman's test statistic, T,[29] is calculated from the sums of the ranks. Because the number of sites is considerable, the distribution of this test statistic generally approaches the chi-square distribution, thus it is used to test the significance of the T values. The chance of obtaining a T value greater than the 95 percent chi-square value, if there is no treatment effect, is 5 percent. First, treatments from all sites were tested collectively. Then those from each individual source category (streams, springs, or wells) were treated separately. Table IV shows that the T values are less than the 95 percent chi-square values, or therefore not significant, for all except the well water samples. For the well samples, the number of sites is small enough that chi-square is possibly a poor approximation of T, and therefore the test result for this source category is inconclusive.

To provide another test for treatment differences which requires no chi-square approximation, the "k-sample sign test" can be used.[28] For this test, specific differences between measured uranium concentrations at each site are given a value of one if positive or zero if negative. The assigned values are then summed over all locations for all specific differences to obtain the maximum sum when all data are included. Then, each source category is examined in like manner. The results for the South Park data are shown in Table V. The critical value, also shown in Table V, is the value expected to be exceeded only 5 percent of the time if there are no differences due to treatments. As can be seen in Table V, in all cases the observed maximum sum is less than the critical value, therefore again indicating no significant differences due to the different sample treatments.

TABLE V

RESULTS OF k-SAMPLE SIGN TEST FOR SAMPLE TREATMENT EFFECTS EXCLUDING ACIDIFICATION ONLY

Treatment	All Data	Streams	Springs	Wells
Number of Sites	150*	104*	33	13
Maximum sum, S_{max}	84	58	18	11
Critical Value, S_c	90	65	24	12
None Significant				

*While only 149 different locations are involved, data for a replicate set of stream samples carrying the LASL No. 100149 were included here.

As mentioned, from each tenth sample site, an unfiltered but acidified sample was also collected so that four differently treated samples rather than three were available from 15 sites. In order to examine the effect of acidification only, both Friedman's rank statistics and the k-sample sign tests were applied to data from these sites only. These results are given in Table VI, where it is again seen that there is no significant difference between the sample treatments even when all four are considered.

Therefore, when it is taken into account that some of the water samples were acidified and filtered, some were filtered only, others were acidified only, and still others underwent no field treatment, no significant difference in results was found between either the two uranium determination methods used or among the four different treatments given the samples from South Park. For this reason, the following descriptions and discussions can be limited to the uranium concentrations as reported for the filtered and acidified samples only.

TABLE VI

FRIEDMAN'S RANK STATISTICS AND k-SAMPLE SIGN TEST FOR ALL SAMPLE TREATMENT EFFECTS

Friedman's Rank Statistics

Treatment		All Data	Streams Only
	Number of Sites	15	14
Filtered and Acidified	Sum of Ranks	42	40
Acidified Only	Sum of Ranks	38	37
Filtered Only	Sum of Ranks	32	29
No Treatment	Sum of Ranks	38	34
	T Value	2.04	2.83
	95% chi-Square Value	7.81	7.81

k-Sample Sign Test

	All Data	Streams Only
S_{max} = Maximum Sum of Differences	10	10
S_c = Critical Sum	13	13

IX. RELATIONSHIP OF MEASURED URANIUM IN WATER TO DRAINAGE AND GEOLOGY

While there are a number of excellent contributions on the subject of hydrogeochemical reconnaissance surveying for uranium,[24,30-36] among the most thorough, straightforward, practical, and concise are the 1968 report of A. Grimbert and R. Loriod of France,[30] the 1973 publication of H. Fauth of the Federal Republic of Germany,[31] and the 1975 paper of W. Dyck of Canada.[32] Some of the others, however, provide accounts of work in Colorado as well as background data perhaps more applicable to the South Park area.[24,33-35] Among these latter ones, that by Boberg and Runnells in 1971 deals with uranium in the South Platte River, Colorado,[24] although the nearest point along it sampled by them was near the town of Waterton, about 35 km downstream and north-northeast beyond the confluence of Tarryall Creek (as shown on Plate II), and outside the area reported upon here. Although they found the uranium concentrations in the South Platte River between Waterton and Sterling, Colorado, to range between 5 and 67 ppb, the three sample points near Waterton (as far upstream as they sampled) had only from 5 to 6 ppb. Their sampling was done in the winter of 1969-70, and their samples were filtered through an 8-μ membrane filter prior to analysis. At the three sites near Waterton, they found the total dissolved solids to fall between 233 and 238 parts per million (ppm), and the pH at the two of these sites for which it is given was 8.25 and 8.19.

Along with some other parameters, the water temperature, the specific conductance, and the pH (as measured in the field with pH paper) are given with the uranium concentrations for each of the South Park water samples in the listings of Appendices A and B, at rear. Except for portions of the South Platte River, and some of the ground waters, the total dissolved solids in the waters of the South Park study area (as approximated from the measured specific conductance) do not generally vary radically from those reported near Waterton. The pH measurements from the South Park area, however, are consistently lower in all cases, seldom reaching 6.5 or higher. Furthermore, the considerable number of pH measurements from Tarryall Creek are all recorded as 5.0, which is highly unlikely. Attempts to rectify or understand these consistently low pH values resulted in the conclusion, on the part of all concerned, that the pH paper used was probably old.

For the above reasons, all of the pH values recorded in the data listings of the Appendices are suspected of being low, and this is particularly true of those for the sites in the Tarryall Creek drainage area. While this has resulted in the general use of pH meters for field measurements in all more recent work conducted directly by the LASL, it is not likely to be of any great concern to the results of this study. This is supported by both H. Fauth and M. Dall'aglio, who, in discussing similar work involving at least 15 000 water samples from various locations around the world, with pH values from 5 to 9, have stated outright that careful study of their data showed no significant correlation between uranium concentrations and pH values.[36] This does not mean, however, that accurate pH values cannot be useful for other purposes.

Among the additional data included in the listings of the Appendices are observations concerning known or suspected local features near a sample site that may influence analytical results. These, for sites where they were apparent, are to be found under the heading of "Contaminants," where they are designated by code numbers. An explanation of the code is given in Appendix C. One such feature found to be fairly common in the vicinity of sample sites in the study area is agricultural development, indicated simply by the code number for "agriculture." The possible significance of this feature is related largely to the fact that some phosphate fertilizers may contain as much as 100 ppm uranium. And while the possibility that such a source of contamination might exist in almost any agricultural area cannot be totally dismissed, it is worthy of note that Boberg and Runnells found that only 341 metric tons were used in the entire state of Colorado during 1970. Furthermore, they concluded that the total amount could hardly be a significant contributor of uranium to the South Platte River alone.[24] It is unlikely that the quantity of phosphate fertilizer used in Colorado has increased manyfold over the last few years.

Nearly all of the works referred to in the first paragraph of this section give some definition of what the respective authors consider to constitute an anomalously high content or "anomaly threshold" for uranium in surface or ground water, and these definitions are set forth in Table VII. This, in turn, should aid the reader in the determination of any unreported areas of interest. Average values for natural waters cited in the literature are generally between 0.1 and 3.0 ppb uranium for freshwater streams, and about 0.5 to perhaps 10 ppb uranium for non-saline ground waters (see Table VII). These values are for thousands of analyses of samples taken in all kinds of geologic/hydrologic regimes, and do not necessarily reflect the expected background levels for any small geographic area. However, it is well recognized that the uranium concentrations in both surface and ground waters are generally higher in uraniferous areas, and the South Park area has long been considered to be in a uraniferous province.[17,19,37]

In the following subsections, the uranium concentrations measured in the water samples are related to both the drainage systems and local geology of the various drainage areas with the purpose of testing the general method of water sampling for correlations with reported occurrences of uranium. All of the interpretations are based entirely on published literature and field notes provided by the LPC samplers. Consequently, they should be viewed critically and with caution. At the present time all water samples being collected for the LASL elsewhere in Colorado are being filtered and acidified, and for the sake of consistency the analytical results referred to henceforth and shown on the overlays of Plates II and III in the rear pocket are for filtered and acidified samples only, as set forth in Appendix A. Note that all of the site numbers referred to below and given on Plate II relate to the LASL Sample Numbers in the data listings of the Appendices, but with 100 000 subtracted from each of the numbers as given in the listings. Since there was no significant difference found between the various treatments of the South Park water samples, the relationships shown will generally apply to all samples regardless of treatment.

The uranium concentrations of stream waters from 103 locations in the South Park study area range from <0.2 to 8.9 ppb and average 2.5 ppb. Ground water values were considerably higher, with samples from 46 locations ranging from a low of 0.2 ppb uranium up to 292 ppb uranium for a spring sample taken northeast of Hartsel. The actual uranium concentrations determined in the waters from streams, springs, and wells within the area are shown with the drainage system on the overlay of Plate II, while the relative values are shown as a graphic computer plot on the overlay of Plate III.

Tarryall Creek Drainage Area

Tarryall Creek flows from the northwest corner of the study area toward the southeast, where it joins the South Platte River near the intersection

TABLE VII

SOME OBSERVATIONS AND DEFINITIONS CONCERNING URANIUM CONCENTRATIONS IN NATURAL WATERS

Ref. No.	R No.	Definition of Anomalous Uranium Content of Water, or "Anomaly Threshold" in Hydrogeochemical Reconnaissance for Uranium	Remarks
30	21	"... you must stop worrying about hunting for the anomaly threshold, which has nothing to do with reality."	The form, extent and homogeneity of an anomalous zone, as well as relations to geology, topography, vegetation, climate and weather are all important. Considers 0.1 to 10 ppb normal for U in water, with ground waters usually higher than surface.
	22	"The fact is that there is no ideal dividing line between normal background content and truly abnormal content. ... the higher a content, the greater the probability that it is affected by the presence of a mineral concentration."	
31	215	"... method is a relatively sensitive and certain way to indicate uranium enrichments."	Reports on work in Black Forest; mentions extensive work elsewhere. Avoids equating absolute U content in water with workable deposits. Considers water sampling good, first of all, as a relatively certain negative indicator, when used for U over broad areas.
	216	"In all cases, only a qualitative, and not quantitative, evaluation of the general results is possible since, as a rule, there is no relation between the height of the uranium water anomaly and the size or degree of enrichment of the corresponding uranium deposit."	
32	42	"... criteria ... which will help in deciding on the significance of radioactive anomalies in groundwater: ... A threefold or greater increase in the content compared to the background of a region. ..."	Reports work in Canada, some in lakes. Deals with Rn, Ra, He, and U. Says high radioactivity in springs at base of mountains can be misleading, as can hot springs.
33	790	"The threshold of anomaly (a rough guide to waters requiring further investigation) is about 1.0 ppb U, or 10 times the regional background in the western United States generally. In the tuffaceous rocks of the Great Plains it is about 2 ppb in surface waters and 5 ppb in ground waters. In the Colorado Plateau, it is about 4 ppb in surface waters and at least 5 ppb in ground waters. ... Surface waters in most uraniferous areas ordinarily contain from 1 to 10 ppb U. ... Ground waters in most uraniferous areas ordinarily contain from 1 to about 120 ppb U."	Reports work in Colorado, other western states, and elsewhere in U.S. Describes effects of climate, seasons, geology, recent mining activity, etc. Indicates U fluctuations in ground waters to ordinarily be much less than in streams. States that waters with as little as 4.8 ppb U are known from mines that produced U, while non-producers are known with waters having 100 ppb.
34	753	"Most ground water contains less than 2 ppb uranium and water from volcanic and tuffaceous sediments considered favorable for uranium deposits may contain 10 to 250 ppb. ... measurement ... in streams indicates that the uranium ... decreases downstream by dilution and ... large streams traversing uraniferous areas commonly contain 1 to 10 ppb. The threshold of significance is 3 to 10 times background, depending upon geological factors." On Colorado Plateau, "... streams have a back-	States that sampling of both ground water and surface streams shows favorable U formations and districts can be outlined by method, and that sampling of ground water and measurement of U content has indicated areas favorable for U that have subsequently been found to contain commercial deposits.
	754	ground of about 0.5 to 3.0 ppb and a threshold of significance of about 4 ppb in the major streams. Anomalies in or near uraniferous areas range from 5 to 12 ppb for streams free of contamination."	
35	153	Reporting on ground waters collected by regions, "... from most major and some minor aquifers throughout the United States from 1953 to 1957," they state, "The uranium ... concentrations ... were reasonably consistent with log-normal frequency distributions." They later say, "The anomaly threshold is that value lying two standard deviations above the median of a smoothed log-normal frequency curve fitted to the data. Statistically, it represents the lower limit of values ... likely to have come from a different population than did the bulk of samples making up the frequency distribution."	Indicate that ratios of U to dissolved solids content of water are useful. For 84 ground waters from the Rocky Mountain Cretaceous-Cenozoic Orogenic Belt (a region straddling the Colorado Plateau and spreading beyond it to the north and south), a range of <0.1 - 37 ppb U, a median of 1.6 ppb, and an "anomaly threshold" of 28 ppb are given.

of the Park, Jefferson, and Teller County lines (Plate II). The drainage encompasses roughly one-third of the South Park area, but includes over one-half of all the surface water locations sampled.

The average uranium concentration in the 53 surface waters sampled in the area is 1.48 ppb, and the samples range from <0.2 ppb at Site 127 to 3.95 ppb at Site 130. Ground water samples were taken from a total of nine springs, two near the drainage divide in the headwaters of Ruby Gulch and seven in the Badger Flats area near the terminus of Tarryall Creek. The average uranium concentration in the waters of the nine springs sampled is 41.59 ppb, and the values range from 5.94 ppb at Site 35 to 106 ppb at Site 108.

In general, the uranium concentrations in the ground waters of the area are somewhat higher than in the surface waters, as might be anticipated from some of the references cited in Table VII (e.g. - Refs. [27] and [30]). For this reason, ground waters must be treated separately in any evaluation or correlation to known uranium occurrences. There are no well water samples from within the Tarryall Creek drainage area.

In the extreme northwest, Tarryall Creek crosses a small area of Paleozoic sedimentary rocks before entering a region mapped as Quaternary alluvial deposits (overlay Plate I with Plate II). At the junction of Park Gulch, the creek flows across Precambrian granites and metamorphics, following generally along their contact to its confluence with the South Platte River. The only uranium mineralization found to be reported within the Tarryall Creek drainage area is in the Badger Flats District mentioned above and described in Section IV of this report.

Surface Waters of the Tarryall Creek Drainage System. In general, the uranium concentrations in surface waters sampled along Tarryall Creek show only minor variation. Taken in conjunction with the measured temperature, pH (all of which are low and questionable, as mentioned), specific conductance, and field notes available, there appear to be only a few locations worthy of interest. Water from Site 130, upstream on Tarryall Creek from the confluence of Ruby Gulch, has a uranium concentration of 4.0 ppb, or about three times the concentration of samples taken immediately upstream (at Site 131, 1.3 ppb) and downstream (at Site 129, 1.1 ppb). Site 130, like several others along Tarryall Creek, is located on or near the contact between the Precambrian granites and metamorphics, but there is no apparent relationship between the contact and the uranium concentration at this site. A ranch is located upstream, but no contamination from this source is specifically recorded.

The slightly higher uranium concentrations in waters from Sites 100, 101, and 102, downstream in the Badger Flats area, may be a reflection of the mineralization reported to the west.[13] However, these concentrations (2.9 ppb, 2.3 ppb, and 1.8 ppb, respectively) are not markedly different from locations farther upstream, so any direct correlation would be tenuous at best.

Ground Waters in the Tarryall Creek Drainage Area. Two springs were sampled in the upper reaches of Ruby Gulch. One, at Site 34, apparently emanates from Precambrian granitics (undifferentiated plutonics and metamorphics), while the other, at Site 35, is located within the Tertiary Antero formation (see Plates in rear pocket).

The uranium concentration measured in the water from Site 34, 13 ppb, is comparable to the uranium concentrations found in other spring waters originating in the Precambrian bedrock in this general area. It would not be unusual if these granitic rocks were slightly mineralized due to the active geochemical nature of circulating ground waters along faults and fissures where springs might discharge. Additional information about the subsurface environment at Site 34 would be required before an adequate evaluation could be made of the measured uranium concentration.

The uranium concentration measured in the water from Site 35 was 5.9 ppb. This concentration generally compares to the uranium measured in other ground water samples mapped within the Antero formation in the South Park area (see Plates I and II).

The group of springs located in the Badger Flats District, where uranium has been reported,[16] all have waters with relatively high uranium concentrations (Sites 94-99 and Site 108). All of these springs emanate from the Precambrian granites known to contain radioactive minerals in greisen pipes, stocks, and fault zones, as described in Section IV. On the basis of the reported mineralization, and the analytical results, it appears quite reasonable to conclude that the uranium concentrations measured in these spring waters are a reflection of the uranium in the Badger Flats District.

South Platte Drainage Area

The Platte River drainage system in South Park includes nearly all of the streams in the central part of the area covered (Plate II). The average uranium concentration of the 35 surface waters sampled within it is 3.3 ppb, and the values range from a low of 0.9 ppb to a high of 6.5 ppb. Again, the uranium levels in the ground waters are generally higher than those in the streams. Samples from 16 springs in the drainage area average 22.61 ppb uranium and range between 0.21 and 292 ppb (with the maximum being from a warm spring, and the only one above 15.7 ppb), while those from 11 wells have an average value of 5.5 ppb and a range of from 0.29 to 17.4 ppb.

Within this drainage area, uranium is known to occur in the Maroon formation south of Garo,[14] and in the Antero (?) formation[23] south of Antero Reservoir and west of Site 63. The Pierre shale, which is exposed in a narrow band trending northwest, generally along Trout Creek, is known to be uraniferous in at least some localities.[24] Additionally, other formations exposed within this drainage are known to be uraniferous elsewhere (see Section IV).

Surface Waters of the South Platte Drainage System. While the number and spacing of sample locations on tributaries of the South Platte may be too few or too far apart to allow a positive correlation between uranium concentrations in the surface waters and the known uranium occurrences, there is some evidence to imply such a correlation in the vicinity of the Garo deposit.[14] Site 91, southeast of Garo and just below the confluence of the Middle Fork and Trout Creek, has a uranium concentration of 5.1 ppb, which is three times as great as that found for a sample taken upstream at Garo (Site 88), and twice the concentration at the next location sampled downstream (Site 92). Although it is possible that the higher uranium concentration at Site 91 is due to a contribution from Trout Creek, which drains across the Pierre shale for much of its length, or due to some extraneous cause, it is likewise possible that the higher concentration is a result of contribution from the uraniferous Maroon formation. The Maroon sandstones are the host rocks for the small uranium deposits mined in the early 1950's about 1.6 km west of Site 91. The surface drainage in the vicinity of the Garo Mine is generally to the south, toward Fourmile Creek. However, the mineralized beds dip to the northeast and are cut by many north-trending faults;[14] thus it is conceivable that some ground water could migrate from the uraniferous area into the Middle Fork near Site 91.

Additional evidence for a correlation between surface water and the Garo deposit may exist at Site 78, on Fourmile Creek, just upstream from its junction with the South Fork. Site 78 is the only location sampled on Fourmile Creek. However, it is only about 9 km downstream from the Garo deposit and does show a higher than average uranium concentration, at 6.5 ppb. In fact, this is the highest uranium concentration in any surface water sample taken from the Platte River drainage system in South Park. Downstream, at the confluence of the South Fork, the uranium concentration at Site 69 decreases to 4.0 ppb, which may be attributed to dilution by less uraniferous South Fork water.

Surface waters sampled near the headwater of Agate Creek, but below a spring feeding the drainage at Site 44, are all slightly above the average uranium concentrations seen in the portion of the Platte River system taken under study. It is probable that the spring water from Site 44, which has a uranium concentration of 5.0 ppb, is being reflected in the concentrations at Sites 40 through 43 (4.2, 4.66, 4.3, and 3.81 ppb). Above the spring, Sites 60 and 68 have lower uranium concentrations, at 2.7 and 3.3 ppb, respectively.

The uranium concentrations seen elsewhere in the Platte River drainage fluctuate irregularly, but are generally close to the average concentration for the entire system. One exception is Site 90, which has a uranium concentration of 6.1 ppb. This site is located just downstream from the town of Fairplay on the Middle Fork of the South Platte River. The higher than average uranium concentration at this site might be related to known fissure-type uranium occurrences further upstream to the northwest,[19] though this cannot be verified on the basis of available data.

<u>Ground Waters in the South Platte Drainage Area</u>. The range of uranium concentrations in springs within the South Platte drainage system is 0.21 ppb at Site 87 in lower Chase Gulch to 292 ppb at Site 33 in the headwaters of the Gulch. Of the 16 springs sampled within the Platte River drainage area, only Site 33 had a uranium concentration higher than 15.7 ppb. This site is mapped near the contact of undivided Precambrian igneous and metamorphic rocks and the South Park formation (Plate I).

The measure of water temperature at Site 33 was 14°C, which indicates a moderately warm spring, thus the uranium concentration might be suspected of being misleading (see Remarks for Ref. [32], Table VII). In addition, the location is described in the data listings of the Appendices as being in the vicinity of agricultural activity, thus subject to possible contamination from fertilizers. As indicated earlier, many phosphate fertilizers are slightly uraniferous, although there is no specific report to indicate they were used in this area. A more detailed evaluation using the temperature, pH, and total dissolved solids (as approximated from the conductance), plus a field inspection of the site, would probably aid in determining if the measured uranium concentration at this site in fact represents a truly significant anomaly.

Approximately 5 km southeast of Site 33 is Site 1, which has a measured uranium concentration of 14.8 ppb. This spring is also within the area generally mapped as Precambrian igneous and metamorphics, and is downstream from Site 33. Although considerably lower in dissolved uranium, the comments directed at Site 33 might also be pertinent for this location. The water temperature, pH, and specific conductance are all lower at Site 1 (see Table A-II, Appendix A), although the pH may be questioned and should be rechecked.

Northeast of Site 33, on an unnamed intermittent stream channel, a spring at Site 13 has a measured uranium concentration of 15.6 ppb. This site is shown within the Tertiary South Park formation of Plate I, which is described briefly in Table II. Here also there is an unconfirmed possibility of agricultural contamination. The water temperature measured 7°C, the pH 5.0 (questionable), and the specific conductance 600 μmhos/cm. The cause of the somewhat higher uranium concentration in this spring water, relative to that in other springs nearby, is uncertain, but it may be related to the volcanic tuffs within the South Park formation (see Refs. [33,34], Table VII).

Eleven wells were sampled within the Platte River drainage in central South Park. Uranium concentrations ranged from 0.29 ppb at Site 15 to 17.4 ppb at Site 63, southeast of Antero Reservoir. No information was provided as to the well depths, water depths, or producing aquifers; therefore, the following comments are made without benefit of these pertinent data.

Only the well water sampled at Site 63 had a uranium concentration in excess of 10 ppb, which is considered by some to be the lower level of significance for ground water in volcanic and tuffaceous areas favorable for uranium mineralization (Ref. [34], Table VII). The surface geology at this site is mapped on Plate I as Miocene fluvial material (Wagontongue formation) composed largely of volcanic sand, ash, and pebbles. The Wagontongue formation unconformably overlies the Oligocene Antero formation described in Table II. Uranium mineralization is known to occur in the Antero formation several km southwest of Site 63, although the extent of mineralization is unknown.[23] It is possible that the measured uranium concentration at Site 63 (17.4 ppb) is a reflection of this nearby mineralization. The uranium concentration in a well water sample from Site 62 (8.7 ppb), which is located northeast of Site 63 and is seen to be drilled in the Antero formation on Plate I, might also be reflecting mineralization elsewhere in that lacustrine deposit. The well at Site 62 is separated from Site 63 by the Agate Creek drainage, but if the Antero formation dips to the east or northeast as would be expected of sediment deposited on the west limb of a north-trending syncline,[5] it appears possible that ground water could migrate from the mineralized area toward these two wells.

West Fourmile Creek Drainage Area

This area is located in extreme southeastern Park County and its drainage is to the southeast into Teller County (Plate II). Fourmile Creek drains a region of Tertiary volcanics, while its tributaries entering from the north flow over Precambrian granites (Plate I). Within this area there are four stream sample locations and four springs which were sampled.

Surface Waters of the West Fourmile Creek Drainage System. The average uranium concentration of the four stream samples analyzed from this system is 2.88 ppb, and they range from 1.1 to 4.92 ppb. The four samples show a somewhat marked variation, with those from Sites 24 and 26 having uranium concentrations of 1.1 and 1.25 ppb, respectively, while those from Sites 25 and 47 have values of 4.23 and 4.92 ppb. Site 25 (4.2 ppb) is located between Sites 24 (1.1 ppb) and 26 (1.2 ppb). Each of these three locations is within the area mapped as Tertiary volcanics. The temperature, pH, and specific conductance of all are nearly the same, although the pH (if accurate) and specific conductance do decrease slightly downstream. Two tributaries enter West Fourmile Creek between Sites 24 and 25, one from the northwest and the other from the southwest. The southwest tributary may extend into an area of known mineralization, the Micanite-Guffey pegmatite area,[22] although this was not verified and appears doubtful on the basis of available geologic and hydrologic information. All three locations are in an agricultural area, though no information is available concerning the local use of phosphate fertilizers.

The stream sample from Site 47 shows an increase to 4.9 ppb uranium. This site is shown as being within a small exposure of Tallahassee Creek conglomerate, which is composed largely of tuffaceous material. Similar conglomeratic beds some 35 km to the southwest, in the Tallahassee Creek area, are known to contain uranium mineralization.[15] However, no specific reports were found of uranium mineralization in the region of the West Fourmile Creek drainage area that was sampled.

Ground Waters in the West Fourmile Creek Drainage Area. Of the four springs sampled in the area of the West Fourmile Creek drainage system, only the one at Site 22 showed a uranium concentration greater than 1.9 ppb. This site is located some 5 km north of stream Site 47, in Teller County. The site is in an area shown on Plate I as undifferentiated Precambrian granites and related rocks. The measured physical and chemical parameters at Site 22 are not greatly different from those at the three other springs in the area of the West Fourmile drainage system, and no specific reports of uranium mineralization in this area were found. However, the Lady Stith uraniferous fluorite-bearing veins are in the general vicinity,[19] and similar rocks in the Badger Flats area, some 25 to 30 km to the northwest, are known to possess some uranium mineralization in fault zones and greisen pipes.[16]

Currant Creek Drainage Area

The Currant Creek area is in southcentral Park County and its drainage is generally to the southeast into Fremont County (Plate II). Headwater tributaries in the north and west drain a region of Tertiary volcanics in the Thirtyninemile volcanic field. Except in the northernmost reaches, the main channel of Currant Creek flows across an area of Precambrian granites, schists, and gneisses (Plate I). It tends to follow the course of a fault along the eastern edge of a northwest-trending graben.[6]

An area of abnormally high radioactivity is reported in the Currant Creek drainage system north of the Fremont-Park County line, in the Micanite-Guffey area.[22] This area is shown on Plate I as having Precambrian granite and related rocks exposed. Some additional information concerning it has been provided in Section IV.

Surface Waters of the Currant Creek Drainage System. Eight locations were sampled along the main channel of Currant Creek. The average uranium concentration for the samples from these eight locations is 4.9 ppb, and their values range from 2.69 to 8.88 ppb. In general, the uranium concentrations tend to increase downstream. However, the increased levels at Sites 54 and 55 are probably a result of uranium introduced by spring water entering from Site 32. The more general increase in uranium in the creek water may simply be a reflection of the bedrock mineralization in the area.

Ground Waters in the Currant Creek Drainage Area. Four springs were sampled within the Currant Creek drainage area. Three are in the volcanic rocks in the northwest, and one is in Precambrian granitics north of Site 54. The uranium concentrations in samples from these springs range from 0.71 ppb at Site 30 to 32.8 ppb at Site 32 on Currant Creek. Of the three springs in the volcanic area, only that of Site 109, with water having a uranium concentration of 7.1 ppb (as compared to 0.7 ppb at Site 30 and 1.5 ppb at Site 31), seems to warrant attention. The water temperature at Site 109 (10°C) is from 2 to 4°C higher than at the other two springs, and the pH (6.0 - if it can be relied upon) is 0.5 pH units higher. The specific conductance at Site 109 is 320 μmhos/cm, 45 μmhos/cm higher than at Site 30, but the same as at Site 31. On the basis of these data and the other available information about the area, it is not evident why the uranium concentration is higher (though not necessarily anomalous) at Site 109.

Site 32 must be treated separately, since it is in a different geologic area, is apparently the only spring in that area, and possesses some unusual characteristics. Known locally as Yellow Soda Spring, it is in, or very near, the Micanite-Guffey mineralized area.[22] In fact, a mine (of which nothing more is known) is noted in the data listings as a possible source of contamination at this location. The Yellow Soda Spring apparently emanates from Tertiary volcanics near their contact with Precambrian metamorphics and is situated on a northwest-trending graben fault.[6] The water temperature is recorded as 13°C, making it another moderately warm spring. The pH of 7.2 measured at the site is higher than that for any other water of any type sampled in South Park, and the specific conductance at 8000 mhos/cm is also considerably higher than for any other water sampled. The uranium concentration of 32.8 ppb at Site 32, while apparently high for the particular drainage area, should be evaluated on the basis of both the geochemical parameters provided (along with their remeasurement as a check) and a more detailed examination of the geology, mineralization, and hydrology near the site than is possible from any of the literature found to be available.

Badger Creek Drainage Area

The Badger Creek area is located in the southwest corner of Park County and the drainage is southward into northwestern Fremont County (Plate II). Within this drainage area samples were taken from three stream locations and two wells. Badger Creek and its tributaries drain an assortment of geologic formations including Tertiary lake beds in the north, Precambrian granites in the west, Tertiary volcanics in the east, and several Paleozoic units along the main stream (Plate I). The closest reported uranium mineralization occurs to the northwest, in the tuffaceous sandstones of the Antero (?) formation as mentioned earlier.[20]

Surface Waters of the Badger Creek Drainage System. The average uranium concentration of the three stream samples is 5.16 ppb and they range from 4.41 to 6.59 ppb, increasing downstream. It is worthy of note that the uranium concentrations at sites on Agate Creek, which drains roughly equivalent geologic units to the north, are quite comparable. The temperature and pH vary slightly from location to location. However, the specific conductance increases downstream from 320 μmhos/cm at Site 66 to 440 μmhos/cm at Site 64.

Ground Waters in the Badger Creek Drainage Area. Two well water samples were taken in the Badger Creek drainage area. One, at Site 45, had a measured uranium concentration of 1.5 ppb and is shown on Plate I as being located within the Tertiary Antero lake beds. The other, at Site 67, has a uranium concentration of 4.0 ppb, and is shown within the Wagontongue formation near its contact with the Antero formation. Both wells provide stock water from windmills, but it is unknown if the samples were taken while they were pumping or were from adjacent holding tanks. Site 45 is described as subject to metallic contamination. The water temperature and specific conductance at Site 67 are slightly higher than at Site 45, while the recorded pH is the same. The difference in the uranium concentrations of these well waters, although perhaps not significant, cannot be explained on the basis of available data.

X. SUMMARY AND CONCLUSIONS

During the summer of 1975, 464 samples of natural waters were collected from 149 locations in South Park, Colorado. These samples, taken at the request of the LASL, were acquired specifically to test the effects of various sample treatments on the levels of uranium, to assess the newly developed LASL analytical methods for uranium in waters, and to generally evaluate the method of water sampling as a tool for delineating areas of possible interest for further uranium exploration by the private sector.

South Park, located in southcentral Colorado, is a high, north-trending, intermountain basin, formed by diastrophism during Laramide time. Exposed bedrock in the Park ranges in age from Precambrian to Cenozoic and includes an extensive volcanic sequence in the south. The Park is generally described as being in an uraniferous province, and radioactive mineralization is known to occur at least at four localities in the report area as well as at several others just outside the area boundaries.

The sensitivity of the LASL fluorometric analysis was found to be 0.2 ppb uranium, and the precision ranged from about 30 percent in the low ppb range to about 10 percent above 4.5 ppb uranium. Samples above or near 10 ppb uranium were run by delayed-neutron counting after activation in a reactor-generated neutron flux. The sensitivity of this method, as used, was found to be 0.5 ppb uranium. The precision at 10 ppb is about 4.5 percent and improves at higher concentrations.

Water samples collected were of three distinct types: surface stream waters, spring waters, and well waters. Multiple samples taken from each location were treated in three or four different ways: given no treatment; filtered and acidified; filtered only; or acidified only (this was done at only one out of every ten locations). No significant variance was evident between the samples given different treatments, and the filtered and acidified values were therefore used for evaluation to be consistent with ongoing LASL HSSR work. The analytical results for all treatments are included in the Appendices.

Using the field and analytical methodology designed by the LASL, a definite correlation is seen between the uranium concentrations in ground waters and the reported uranium mineralization in the Badger Flats area of east-central Park County. More subtle or suspected correlations show up in the ground waters of the Micanite-Guffey mineralized area, reported near the Park and Fremont County line, and an unnamed prospect in the Antero formation, reported south of Antero Reservoir. The single area where uranium concentrations in surface waters appear to subtly reflect reported uranium mineralization is that of the Garo deposit. Here, higher than average uranium concentrations are found at two different stream sites, on two different drainages, both apparently downstream from the deposit. In addition to these less definite correlations, there were a few higher than average uranium concentrations which could not be explained on the basis of available information.

The results of the study show the method of water sampling, in general, and the LASL procedures for both field treatment of samples and laboratory analysis, in particular, to provide viable tools for locating areas possessing higher than normal uranium mineralization.

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APPENDIX A

LISTINGS OF FIELD DATA AND URANIUM CONCENTRATIONS

FOR

FILTERED AND ACIDIFIED WATER SAMPLES

FROM

SOUTH PARK, COLORADO

TABLE A-I

SAMPLES ANALYZED BY FLUOROMETRY

and

TABLE A-II

SAMPLES ANALYZED BY DELAYED-NEUTRON COUNTING

(See Appendix C for codes to listings)

TABLE A-1

FILTERED AND ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
							TIME SAMPLED																											SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	DATE	HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (μmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	
08	39.1202	105.7125	2	06	000	100002	07/29/75	11		9.0	-	-	6.2	750		-	-	-	-	3	-	1	-	-	-	-	-	-	1	-	-	-	-	4.92
08	39.1863	105.7941	2	06	000	100003	07/29/75	12		8.0	-	-	6.2	160		-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	3.71
08	39.2161	105.8275	2	08	000	100004	07/29/75	-		6.0	-	-	6.0	1175		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.80
08	39.3588	105.9516	2	07	000	100005	07/29/75	11		10.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.79
08	39.3552	105.9358	2	07	000	100006	08/09/75	12		10.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50
08	39.3391	105.9111	2	07	000	100007	09/08/75	12		10.0	-	-	5.0	145		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.02
08	39.3247	105.8552	2	07	000	100008	08/09/75	-		15.0	-	-	5.0	205		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	0.73
08	39.3247	105.8488	2	07	000	100009	08/09/75	14		16.0	-	-	5.0	205		-	-	-	-	-	-	2	-	-	-	-	-	-	3	-	-	-	-	0.60
08	39.2805	105.7886	2	07	000	100010	08/09/75	15		16.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	0.72
08	39.2819	105.7858	2	07	000	100011	08/09/75	15		16.0	-	-	5.0	225		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	0.47
08	39.1369	105.7766	2	06	000	100012	08/10/75	10		7.0	-	-	5.0	725		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3.63
08	39.1686	105.8205	2	06	000	100014	08/10/75	11		9.0	-	-	5.0	580		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	2.38
08	39.1480	105.8186	2	08	000	100015	08/10/75	-		9.0	-	-	6.4	2200		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0.29
08	39.2038	105.8788	2	06	000	100016	08/10/75	-		7.0	-	-	6.2	530		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.43
08	39.2327	105.8825	2	06	000	100017	08/10/75	14		8.0	-	-	6.2	265		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.05
08	39.0894	105.7355	2	08	000	100018	08/10/75	15		6.0	-	-	6.2	1200		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	5.62
08	38.9494	105.3033	2	07	000	100019	08/11/75	12		15.0	-	-	6.0	400		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1.40
08	38.9550	105.3200	2	07	000	100020	08/11/75	12		19.0	-	-	6.2	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.17
08	38.9094	105.2791	2	08	000	100021	08/11/75	13		10.0	-	-	6.0	380		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	3.22
08	38.8560	105.2705	2	06	000	100022	08/11/75	13		8.0	-	-	6.0	400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.16
08	38.8272	105.4888	2	06	000	100023	08/12/75	12		8.0	-	-	6.2	300		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.95
08	38.7908	105.4827	2	07	000	100024	08/12/75	13		18.0	-	-	6.4	480		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1.10
08	38.7847	105.4300	2	07	000	100025	08/12/75	13		21.0	-	-	6.2	460		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4.23
08	38.7727	105.3597	2	07	000	100026	08/12/75	-		20.0	-	-	6.0	440		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1.25
08	38.8244	105.3888	2	06	000	100027	08/12/75	13		9.0	-	-	5.5	370		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.54
08	38.8416	105.3630	2	06	000	100028	08/12/75	14		8.0	-	-	5.5	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.89
08	39.8841	105.7969	2	06	000	100029	08/13/75	10		8.0	-	-	6.2	725		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3.99
08	38.8063	105.6777	2	06	000	100030	08/13/75	15		8.0	-	-	5.5	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.71
08	38.8183	105.6772	2	06	000	100031	08/13/75	15		6.0	-	-	5.5	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.45
08	39.1786	105.7369	2	06	000	100015	08/20/75	12		6.0	-	-	6.0	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.94
08	39.1644	105.7700	2	08	000	100036	08/20/75	14		5.0	-	-	6.2	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.16
08	38.9402	105.8105	2	08	000	100037	08/20/75	11		6.0	-	-	6.0	700		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	6.85
08	38.8691	105.7827	2	08	000	100038	08/20/75	12		7.0	-	-	6.2	800		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	6.40
08	38.8480	105.7716	2	08	000	100039	08/20/75	12		6.0	-	-	5.8	440		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2.33
08	38.8461	105.8211	2	07	000	100040	08/20/75	14		17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.21
08	38.8419	105.8161	2	07	000	100041	08/20/75	14		17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.66
08	38.8383	105.8155	2	07	000	100042	08/20/75	14		15.0	-	-	6.2	650		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.30
08	38.8352	105.8138	2	07	000	100043	08/20/75	15		14.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.81
08	38.8347	105.8080	2	06	000	100044	08/20/75	15		8.0	-	-	6.2	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.97
08	38.7977	105.8013	2	08	000	100045	08/20/75	16		12.0	-	-	6.2	290		-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	1.54
08	38.9919	105.7559	2	03	000	100046	08/20/75	16		8.0	-	-	6.0	1400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1.99
08	38.7794	105.2877	2	07	000	100047	08/21/75	16		20.0	-	-	6.4	600		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.92
08	38.8091	105.6097	2	07	000	100048	08/21/75	11		16.0	-	-	6.4	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.69
08	38.8044	105.6047	2	07	000	100049	08/21/75	11		16.0	-	-	6.4	470		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.73
08	38.7865	105.5844	2	07	000	100050	08/21/75	-		18.0	-	-	6.2	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.75
08	38.7675	105.5647	2	07	000	100051	08/21/75	12		20.0	-	-	6.2	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.11
08	38.7511	105.5497	2	07	000	100052	08/21/75	12		21.0	-	-	6.4	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3.70
08	38.7391	105.5433	2	07	000	100053	08/21/75	12		22.0	-	-	6.3	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	5.16
08	38.7291	105.5233	2	07	000	100054	08/21/75	-		21.0	-	-	6.4	630		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.88
08	38.7219	105.5169	2	07	000	100055	08/21/75	13		22.0	-	-	6.4	625		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.18
08	38.9102	105.7208	2	07	000	100056	08/21/75	14		20.0	-	-	6.4	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.90

TABLE A-I (continued)

FILTERED AND ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

State	Latitude	Longitude	ERDA Lab	Sample Type	Replicate	LASL Sample Number	Date	Hour	Air Temperature	Water Temperature	Comments	Special Measurements	pH	Specific Conductance (µmhos/cm)	Scintillometer (µU ppm)	Rock Type	Rock Color	Sediment Type	Sediment Color	Water Flow	Water Level	Water Color	Stream Channel	Vegetation Type	Vegetation Density	Relief	Weather	Ownership	Contaminants	Well Type	Well Diameter (inches)	Well Depth (feet)	Water Depth (feet)	U Concentration: Sample types 1-10, 21-30 are water in ppb / Sample types 11-20, 31-40 are sediment in ppm
08	38.9172	105.7213	2	07	000	100057	08/21/75	15		18.0			6.4	580															3					3.00
08	38.9255	105.7216	2	07	000	100058	08/21/75	15		17.0			6.2	650															3					1.57
08	38.9311	105.7175	2	07	000	100059	08/21/75			25.0			6.2	610															3					2.23
08	38.8263	105.7738	2	07	000	100060	08/21/75	16		21.0			6.2	460																				2.66
08	39.0038	105.7786	2	06	000	100061	08/21/75	10		10.0			6.2	2800																				1.72
08	38.6966	105.8283	2	07	000	100064	08/21/75	14		23.0			6.2	440																				6.59
08	38.7141	105.8488	2	07	000	100065	08/21/75	15		23.0			6.0	400																				4.49
08	38.7397	105.6502	2	07	000	100066	08/21/75	15		24.0			6.4	320																				4.41
08	38.7752	105.7955	2	08	000	100067	08/21/75	15		15.0			6.2	330																1				3.95
08	38.8150	105.7702	2	07	000	100068	08/21/75	16		25.0			6.4	580																				3.31
08	39.0244	105.8133	2	07	000	100069	08/22/75	10		15.0			6.0	1075																				3.95
08	39.0222	105.8305	2	07	000	100070	08/22/75	11		15.0			6.2	1325																				4.00
08	39.0255	105.8469	2	07	000	100071	08/22/75	11		16.0			6.2	1300																				3.76
08	39.0150	105.8561	2	07	000	100072	08/22/75	12		16.0			6.4	1300																				4.23
08	39.0194	105.7930	2	07	000	100073	08/22/75	14		18.0			6.2	1100																				2.96
08	39.0161	105.7766	2	07	000	100074	08/22/75	13		17.0			6.2	1100																				3.30
08	39.0136	105.7619	2	07	000	100075	08/22/75	15		18.0			6.4	1100																				2.24
08	38.9700	105.6133	2	07	000	100076	08/22/75	16		19.0			6.2	700																				2.79
08	38.9677	105.5819	2	07	000	100077	08/22/75	16		19.0			6.4	680																				3.73
08	39.0241	105.6177	2	07	000	100078	08/22/75	11		12.0			6.8	480																				6.54
08	39.0483	105.8397	2	06	000	100079	08/22/75	10		9.0			5.0	440																				6.59
08	38.9958	105.8786	2	07	000	100080	08/22/75	11		17.0			6.2	1350																				3.89
08	38.9994	105.8536	2	07	000	100081	08/22/75	11		15.0			6.0	1125																				3.19
08	39.0213	105.8019	2	07	000	100082	08/22/75	13		17.0			6.2	1100																				3.64
08	38.9927	105.6825	2	07	000	100083	08/22/75	15		17.0			6.2	400																				2.70
08	39.0055	105.7080	2	07	000	100084	08/22/75	15		17.0			5.0	700																				3.87
08	39.0196	105.7555	2	07	000	100085	08/22/75	15		17.6			6.0	300																				2.10
08	39.0180	105.7933	2	06	000	100086	08/22/75	13		50.0			6.8	4000																				0.30
08	39.0236	105.6308	2	06	000	100087	08/22/75	16		16.0			6.5	6500																				0.21
08	39.1094	105.8908	2	07	000	100088	08/23/75	11		10.0			6.0	260																				1.65
08	39.1672	105.9441	2	07	000	100089	08/23/75	11		10.0			6.0	240																				2.43
08	39.2194	105.9938	2	07	000	100090	08/23/75			11.0			6.2	200															2					6.09
08	39.0927	105.8650	2	07	000	100091	08/23/75	15		16.0			6.2	275																				5.12
08	39.0630	105.8225	2	07	000	100092	08/23/75	15		16.0			6.0	290																				2.45
08	39.0913	105.4238	2	07	000	100100	08/25/75	11		15.0			5.0	250																				2.91
08	39.0852	105.4197	2	07	000	100101	08/24/75	13		17.0			5.0	250																				2.31
08	39.0805	105.4158	2	07	000	100102	08/24/75	13		17.0			5.0	250																				1.85
08	39.1383	105.4605	2	07	000	100103	08/24/75	14		17.0			5.0	220																				1.99
08	39.1438	105.4680	2	07	000	100104	08/24/75	15		18.0			5.0	240																				1.54
08	39.1475	105.4713	2	07	000	100105	08/24/75	15		18.0			5.0	240																				1.65
08	39.1525	105.4772	2	07	000	100106	08/24/75	15		18.0			5.0	240																				2.57
08	39.1616	105.4886	2	07	000	100107	08/24/75	15		18.0			5.0	240																				1.60
08	38.8183	105.6944	2	06	000	100109	08/24/75	13		10.0			6.0	320																				7.07
08	39.1658	105.4950	2	07	000	100110	08/25/75	9		11.0			5.0	240																				1.34
08	39.1690	105.5033	2	07	000	100111	08/25/75	9		11.0			5.0	240																				2.21
08	39.1677	105.5077	2	07	000	100112	08/25/75	10		11.0			5.0	190																				1.83
08	39.1705	105.5130	2	07	000	100113	08/25/75	10		12.0			5.0	200																				1.62
08	39.1750	105.5188	2	07	000	100114	08/25/75	10		12.0			5.0	240																				1.81
08	39.1830	105.5283	2	07	000	100115	08/25/75	11		12.0			5.0	240																				2.52
08	39.1891	105.5419	2	07	000	100116	08/25/75	11		13.0			5.0	245																				1.13
08	39.1972	105.5497	2	07	000	100117	08/25/75	11		14.0			5.0	240																				1.39

TABLE A-I (continued)

FILTERED AND ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	TIME SAMPLED DATE	TIME SAMPLED HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (µmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	39.1983	105.5533	2	07	000	100118	08/25/75	11		14.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.47
08	39.2022	105.5605	2	07	000	100119	08/25/75	12		14.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.35
08	39.2066	105.5658	2	07	000	100120	08/25/75	13		16.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.18
08	39.2097	105.5700	2	07	000	100121	08/25/75	13		17.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.69
08	39.2141	105.5797	2	07	000	100122	08/25/75	13		17.0	-	-	5.0	340		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.05
08	39.2161	105.5855	2	07	000	100123	08/25/75	13		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.96
08	39.2180	105.5933	2	07	000	100124	08/25/75	14		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.75
08	39.2219	105.6019	2	07	000	100125	08/25/75	14		16.0	-	-	5.0	225		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.26
08	39.0661	105.6988	2	06	000	100126	08/26/75	12		14.0	-	-	7.0	7000		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1.37
08	39.2425	105.6400	2	07	000	100127	08/26/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16
08	39.2490	105.6463	2	07	000	100128	08/26/75	10		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.50
08	39.2422	105.6502	2	07	000	100129	08/26/75	11		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.12
08	39.2643	105.6686	2	07	000	100130	08/26/75	12		13.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.95
08	39.2694	105.6744	2	07	000	100131	08/26/75	12		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.31
08	39.2763	105.6841	2	07	000	100132	08/26/75	13		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.71
08	39.2797	105.6897	2	07	000	100133	08/26/75	13		15.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.47
08	39.2869	105.6955	2	07	000	100134	08/26/75	14		16.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.25
08	39.2900	105.6977	2	07	000	100135	08/26/75	14		17.0	-	-	5.0	60		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.99
08	39.2891	105.6988	2	07	000	100136	08/27/75	10		11.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.41
08	39.2947	105.7055	2	07	000	100137	08/27/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.32
08	39.2958	105.7125	2	07	000	100138	08/27/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.76
08	39.2947	105.7277	2	07	000	100139	08/27/75	11		13.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.90
08	39.2958	105.7286	2	07	000	100140	08/17/75	11		12.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.07
08	39.2988	105.7339	2	07	000	100141	08/27/75	11		13.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.17
08	39.2980	105.7422	2	07	000	100142	08/27/75	12		13.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.61
08	39.3058	105.7494	2	07	000	100143	08/27/75	12		14.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.68
08	39.3133	105.7522	2	07	000	100144	08/27/75	12		14.0	-	-	5.0	125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.86
08	39.3248	105.7597	2	07	000	100145	08/27/75	14		15.0	-	-	5.0	120		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.86
08	39.3244	105.7680	2	07	000	100146	08/27/75	13		15.0	-	-	5.0	105		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.80
08	39.3277	105.7694	2	07	000	100147	08/27/75	13		16.0	-	-	5.0	140		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.94
08	39.3286	105.7683	2	07	000	100148	08/27/75	13		15.0	-	-	5.0	95		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.42
08	39.0191	105.3566	2	07	000	100149	08/28/75	17		14.0	-	-	6.0	900		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.06
08	39.0191	105.3566	2	07	001	100149	08/28/75	17		14.0	-	-	6.0	900		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.06

TABLE A-II

FILTERED AND ACIDIFIED SAMPLES ANALYZED BY DELAYED-NEUTRON COUNTING

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	TIME SAMPLED: DATE	TIME SAMPLED: HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (µmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	39.0961	105.6788	2	06	000	100001	07/29/75	12		8.0	-	-	5.5	650		-	-	-	-	2	-	-	-	-	-	-	-	-	9	-	-	-	-	14.80
08	39.1480	105.7886	2	06	000	100013	08/10/75	10		7.0	-	-	5.0	600		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	15.70
08	38.7380	105.5297	2	06	000	100032	08/13/75	15		13.0	-	-	7.2	6000		-	-	-	3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	32.80
08	39.1188	105.7358	2	06	000	100033	08/20/75	11		14.0	-	-	6.4	850		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	292.00
08	39.1838	105.7594	2	06	000	100034	08/20/75	12		9.0	-	-	6.2	260		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.00
08	38.9558	105.8363	2	08	000	100062	08/21/75	11		9.0	-	-	6.0	540		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	8.70
08	38.9458	105.8555	2	08	000	100063	08/21/75	11		8.0	-	-	6.0	390		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	17.40
08	39.0291	105.7733	2	07	000	100093	08/23/75	16		19.0	-	-	6.2	290		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.00
08	39.0305	105.4450	2	06	000	100094	08/24/75	9		11.0	-	-	5.0	940		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	103.00
08	39.0522	105.4683	2	06	000	100095	08/24/75	10		9.0	-	-	5.0	750		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.60
08	39.0790	105.4483	2	06	000	100096	08/24/75	10		9.0	-	-	5.0	410		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51.50
08	39.0600	105.4391	2	06	000	100097	08/25/75	10		8.0	-	-	5.0	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.20
08	39.0800	105.4530	2	06	000	100098	08/24/75	11		8.0	-	-	5.0	350		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.30
08	39.0888	105.4897	2	06	000	100099	08/24/75	11		9.0	-	-	5.0	350		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29.80
08	39.0786	105.4269	2	06	000	100108	08/24/75	12		19.0	-	-	5.8	650		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106.00

APPENDIX B

LISTINGS OF FIELD DATA AND URANIUM CONCENTRATIONS

FOR

WATER SAMPLES TREATED BY METHODS OTHER THAN COMBINED FILTRATION AND ACIDIFICATION

FROM

SOUTH PARK, COLORADO

TABLE B-I

SAMPLES ANALYZED BY FLUOROMETRY

and

TABLE B-II

SAMPLES ANALYZED BY DELAYED-NEUTRON COUNTING

(See Appendix C for codes to listings)

TABLE B-1

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA	TIME SAMPLED																											U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	DATE	HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (µmhos/cm)	SCINTILLOMETER (40 ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	39.1202	105.7125	2	01	000	100002	07/29/75	11		9.0			6.2	750						3		1							1					6.79
08	39.1202	105.7125	2	21	000	100002	07/29/75	11		9.0			6.2	750						3		1							1					4.25
08	39.1863	105.7941	2	01	000	100003	07/29/75	12		8.0			6.2	160															9					3.49
08	39.1863	105.7941	2	21	000	100003	07/29/75	12		8.0			6.2	160															9					5.56
08	39.2161	105.8275	2	03	000	100004	07/29/75			6.0			6.0	1175																				2.60
08	39.2161	105.8275	2	23	000	100004	07/29/75			6.0			6.0	1175																				4.08
08	39.3588	105.9516	2	02	000	100005	07/29/75	11		10.0			5.0	125																				1.98
08	39.3588	105.9516	2	22	000	100005	07/29/75	11		10.0			5.0	125																				2.51
08	39.3552	105.9358	2	02	000	100006	08/09/75	12		10.0			5.0	125																				1.18
08	39.3552	105.9358	2	22	000	100006	08/09/75	12		10.0			5.0	125																				2.05
08	39.3391	105.9111	2	02	000	100007	09/08/75	12		10.0			5.0	145																				0.45
08	39.3391	105.9111	2	22	000	100007	09/08/75	12		10.0			5.0	145																				1.33
08	39.3247	105.8552	2	02	000	100008	08/09/75			15.0			5.0	205															3					0.88
08	39.3247	105.8552	2	22	000	100008	08/09/75			15.0			5.0	205															3					0.06
08	39.3247	105.8488	2	02	000	100009	08/09/75	14		16.0			5.0	205								2							3					0.56
08	39.3247	105.8488	2	22	000	100009	08/09/75	14		16.0			5.0	205								2							3					0.59
08	39.2805	105.7886	2	02	000	100010	08/09/75	15		16.0			5.0	220															3					0.78
08	39.2805	105.7886	2	22	000	100010	08/09/75	15		16.0			5.0	220															3					0.59
08	39.2805	105.7886	2	27	000	100010	08/09/75	15		16.0			5.0	220															3					0.69
08	39.2819	105.7858	2	02	000	100011	08/09/75	15		16.0			5.0	225															3					0.47
08	39.2819	105.7858	2	22	000	100011	08/09/75	15		16.0			5.0	225															3					1.40
08	39.1369	105.7766	2	01	000	100012	08/10/75	10		7.0			5.0	725															3					3.32
08	39.1369	105.7766	2	21	000	100012	08/10/75	10		7.0			5.0	725															3					4.27
08	39.1686	105.8205	2	01	000	100014	08/10/75	11		9.0			5.0	580															3					2.65
08	39.1686	105.8205	2	21	000	100014	08/10/75	11		9.0			5.0	580															3					3.03
08	39.1480	105.8186	2	03	000	100015	08/10/75			9.0			6.4	2200																1				0.48
08	39.1480	105.8186	2	23	000	100015	08/10/75			9.0			6.4	2200																1				0.90
08	39.2038	105.8788	2	01	000	100016	08/10/75			7.0			6.2	530																				2.81
08	39.2038	105.8788	2	21	000	100016	08/10/75			7.0			6.2	530																				3.00
08	39.2327	105.8825	2	01	000	100017	08/10/75	14		8.0			6.2	265																				1.22
08	39.2327	105.8825	2	21	000	100017	08/10/75	14		8.0			6.2	265																				0.81
08	39.0894	105.7355	2	03	000	100018	08/10/75	15		6.0			6.2	1200																1				5.93
08	39.0894	105.7355	2	23	000	100018	08/10/75	15		6.0			6.2	1200																1				8.10
08	38.9494	105.3033	2	02	000	100019	08/11/75	12		15.0			6.0	400															3					1.16
08	38.9494	105.3033	2	22	000	100019	08/11/75	12		15.0			6.0	400															3					2.01
08	38.9550	105.3200	2	02	000	100020	08/11/75	12		19.0			6.2	500																				2.52
08	38.9550	105.3200	2	22	000	100020	08/11/75	12		19.0			6.2	500																				2.93
08	38.9550	105.3200	2	27	000	100020	08/11/75	12		19.0			6.2	500																				3.16
08	39.9094	105.2791	2	03	000	100021	08/11/75	13		10.0			6.0	380																1				3.96
08	38.9094	105.2791	2	23	000	100021	08/11/75	13		10.0			6.0	380																1				5.50
08	38.8500	105.2705	2	01	000	100022	08/11/75	13		8.0			6.0	400																				2.93
08	38.8500	105.2705	2	21	000	100022	08/11/75	13		8.0			6.0	400																				2.81
08	38.8272	105.4888	2	01	000	100023	08/12/75	12		8.0			6.2	300																				1.75
08	38.8272	105.4888	2	21	000	100023	08/12/75	12		8.0			6.2	300																				0.10
08	38.7908	105.4827	2	02	000	100024	08/12/75	13		18.0			6.4	480															3					1.18
08	38.7908	105.4927	2	22	000	100024	08/12/75	13		18.0			6.4	480															3					1.47
08	38.7827	105.4300	2	02	000	100025	08/12/75	13		21.0			6.2	460															3					1.04
08	38.7827	105.4300	2	22	000	100025	08/12/75	13		21.0			6.2	460															3					1.03
08	38.7727	105.3597	2	02	000	100026	08/12/75			20.0			6.0	440															3					1.74
08	38.7727	105.3597	2	22	000	100026	08/12/75			20.0			6.0	440															3					1.36
08	38.8244	105.3888	2	01	000	100027	08/12/75	13		9.0			5.5	370																				1.36

TABLE B-1 (continued)

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	TIME SAMPLED DATE	TIME SAMPLED HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (μmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	38.8244	105.3888	2	21	000	100027	08/12/75	13	-	9.0	-	-	5.5	370		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.96
08	38.8416	105.3630	2	01	000	100028	08/12/75	14	-	8.0	-	-	5.5	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.85
08	38.8416	105.3530	2	21	000	100028	08/12/75	14	-	8.0	-	-	5.5	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.36
08	38.8841	105.7969	2	01	000	100029	08/13/75	10	-	8.0	-	-	6.2	725		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	5.54
08	38.8841	105.7969	2	21	000	100029	08/13/75	10	-	8.0	-	-	6.2	725		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4.92
08	38.8063	105.6777	2	01	000	100030	08/13/75	15	-	8.0	-	-	5.5	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.22
08	38.8063	105.6777	2	21	000	100030	08/13/75	15	-	8.0	-	-	5.5	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.79
08	38.8063	105.6777	2	26	000	100030	08/13/75	15	-	8.0	-	-	5.5	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.57
08	38.8183	105.6772	2	01	000	100031	08/13/75	15	-	6.0	-	-	5.5	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.08
08	38.8183	105.6772	2	21	000	100031	08/13/75	15	-	6.0	-	-	5.5	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.01
08	39.1786	105.7369	2	01	000	100035	08/20/75	12	-	6.0	-	-	6.0	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.38
08	39.1786	105.7369	2	21	000	100035	08/20/75	12	-	6.0	-	-	6.0	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.31
08	39.1644	105.7700	2	03	000	100036	08/20/75	14	-	5.0	-	-	6.2	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.06
08	39.1644	105.7700	2	23	000	100036	08/20/75	14	-	5.0	-	-	6.2	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.50
08	38.9402	105.8105	2	03	000	100037	08/20/75	11	-	6.0	-	-	6.0	700		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	9.09
08	38.9402	105.8105	2	23	000	100037	08/20/75	11	-	6.0	-	-	6.0	700		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	7.52
08	38.8691	105.7827	2	03	000	100038	08/20/75	12	-	7.0	-	-	6.2	800		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4.85
08	38.8691	105.7827	2	23	000	100038	08/20/75	12	-	7.0	-	-	6.2	800		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	5.03
08	38.8490	105.7716	2	03	000	100039	08/20/75	12	-	6.0	-	-	5.8	440		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2.61
08	38.8480	105.7716	2	23	000	100039	08/20/75	12	-	6.0	-	-	5.8	440		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2.95
08	38.8461	105.8211	2	02	000	100040	08/20/75	14	-	17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.74
08	38.8461	105.8211	2	22	000	100040	08/20/75	14	-	17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.58
08	38.8461	105.8211	2	27	000	100040	08/20/75	14	-	17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.75
08	38.8419	105.8161	2	02	000	100041	08/20/75	14	-	17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.22
08	38.8419	105.8161	2	22	000	100041	08/20/75	14	-	17.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.57
08	38.8383	105.8155	2	02	000	100042	08/20/75	14	-	15.0	-	-	6.2	650		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.77
08	38.8383	105.8155	2	22	000	100042	08/20/75	14	-	15.0	-	-	6.2	650		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.22
08	38.8352	105.8138	2	02	000	100043	08/20/75	15	-	14.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.42
08	38.8352	105.8138	2	22	000	100043	08/20/75	15	-	14.0	-	-	6.2	640		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.12
08	38.8347	105.8080	2	01	000	100044	08/20/75	15	-	8.0	-	-	6.2	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.01
08	38.8347	105.8080	2	21	000	100044	08/20/75	15	-	8.0	-	-	6.2	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.59
08	38.7977	105.8013	2	03	000	100045	08/20/75	16	-	12.0	-	-	6.2	290		-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	2.20
08	38.7977	105.8013	2	23	000	100045	08/20/75	16	-	12.0	-	-	6.2	290		-	-	-	-	-	-	-	-	-	-	-	-	-	9	1	-	-	-	3.00
08	38.9919	105.7558	2	03	000	100046	08/20/75	16	-	8.0	-	-	6.0	1400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1.78
08	38.9919	105.7558	2	23	000	100046	08/20/75	16	-	8.0	-	-	6.0	1400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2.30
08	38.7744	105.2877	2	02	000	100047	08/21/75	16	-	20.0	-	-	6.4	600		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.40
08	38.7744	105.2077	2	22	000	100047	08/21/75	16	-	20.0	-	-	6.4	600		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.87
08	38.9091	105.6097	2	02	000	100048	08/21/75	11	-	16.0	-	-	6.4	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.90
08	38.8091	105.6097	2	22	000	100048	08/21/75	11	-	16.0	-	-	6.4	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.32
08	38.8044	105.5047	2	02	000	100049	08/21/75	11	-	16.0	-	-	6.4	470		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.03
08	38.8044	105.6047	2	22	000	100049	08/21/75	11	-	16.0	-	-	6.[illegible]	470		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.16
08	38.7866	105.5844	2	02	000	100050	08/21/75	-	-	18.0	-	-	6.2	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.66
08	38.7866	105.5844	2	22	000	100050	08/21/75	-	-	18.0	-	-	6.2	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.90
08	38.7866	105.5844	2	27	000	100050	08/21/75	-	-	18.0	-	-	6.2	480		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.72
08	38.7675	105.5647	2	02	000	100051	08/21/75	12	-	20.0	-	-	6.2	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.64
08	38.7675	105.5647	2	22	000	100051	08/21/75	12	-	20.0	-	-	6.2	500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.11
08	38.7511	105.5497	2	02	000	100052	08/21/75	12	-	21.0	-	-	6.4	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	5.35
08	38.7511	105.5497	2	22	000	100052	08/21/75	12	-	21.0	-	-	6.4	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4.31
08	38.7391	105.5433	2	02	000	100053	08/21/75	12	-	22.0	-	-	6.3	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4.61
08	38.7391	105.5433	2	22	000	100053	08/21/75	12	-	22.0	-	-	6.3	520		-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4.94
08	38.7291	105.5233	2	02	000	100054	08/21/75	-	-	21.0	-	-	6.4	630		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.53

TABLE B-I (continued)

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	TIME SAMPLED: DATE	TIME SAMPLED: HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (μmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	38,7291	105.5233	2	22	000	100054	08/21/75			21.0			6.4	630																				7.35
08	38,7219	105.5169	2	02	000	100055	08/21/75	13		22.0			6.4	625																				5.82
08	38,7219	105.5169	2	22	000	100055	08/21/75	13		22.0			6.4	625																				7.80
08	38,9102	105.7208	2	02	000	100056	08/21/75	14		20.0			6.4	640																				3.83
08	38,9102	105.7208	2	22	000	100056	08/21/75	14		20.0			6.4	640																				4.24
08	38,9172	105.7213	2	02	000	100057	08/21/75	15		18.0			6.4	580															3					3.04
08	38,9172	105.7213	2	22	000	100057	08/21/75	15		18.0			6.4	580															3					4.13
08	38,9255	105.7216	2	02	000	100058	08/21/75	15		17.0			6.2	650															3					2.62
08	38,9255	105.7216	2	22	000	100058	08/21/75	15		17.0			6.2	650															3					4.17
08	38,9311	105.7175	2	02	000	100059	08/21/75			25.0			6.2	610															3					3.25
08	38,9311	105.7175	2	22	000	100059	08/21/75			25.0			6.2	610															3					2.92
08	38,8263	105.7738	2	02	000	100060	08/21/75	16		21.0			6.2	460																				3.43
08	38,8263	105.7738	2	22	000	100060	08/21/75	16		21.0			6.2	460																				3.98
08	38,8263	105.7738	2	27	000	100060	08/21/75	16		21.0			6.2	460																				3.47
08	39,0038	105.7786	2	01	000	100061	08/21/75	10		10.0			6.2	2800																				2.11
08	39,0038	105.7786	2	21	000	100061	08/21/75	10		10.0			6.2	2800																				1.44
08	38,6966	105.8283	2	02	000	100064	08/21/75	14		23.0			6.2	440																				5.95
08	38,6966	105.8283	2	22	000	100064	08/21/75	14		23.0			6.2	440																				4.58
08	38,7141	105.8458	2	02	000	100065	08/21/75	15		23.0			6.0	400																				6.54
08	38,7141	105.8458	2	22	000	100065	08/21/75	15		23.0			6.0	400																				2.62
08	38,7397	105.8502	2	02	000	100066	08/21/75	15		24.0			6.4	320																				4.59
08	38,7397	105.8502	2	22	000	100066	08/21/75	15		24.0			6.4	320																				3.63
08	38,7752	105.7955	2	03	100	100067	08/21/75	15		15.0			6.2	330																1				5.13
08	38,7752	105.7955	2	23	000	100067	08/21/75	15		15.0			6.2	330																1				3.53
08	30,8150	105.7702	2	02	000	100068	08/21/75	16		25.0			6.4	580																				4.00
08	38,8150	105.7702	2	22	000	100068	08/21/75	16		25.0			6.4	580																				2.59
08	39,0244	105.8133	2	02	000	100069	08/22/75	10		15.0			6.0	1075																				4.15
08	39,0244	105.8133	2	22	000	100069	08/22/75	10		15.0			6.0	1075																				6.49
08	39,0222	105.8305	2	02	000	100070	08/22/75	11		15.0			6.2	1325																				3.95
08	39,0222	105.8305	2	22	000	100070	08/22/75	11		15.0			6.2	1325																				1.45
08	39,0222	105.8305	2	27	000	100070	08/22/75	11		15.0			6.2	1325																				3.55
08	39,0225	105.8469	2	02	000	100071	08/22/75	11		16.0			6.2	1300																				5.23
08	39,0225	105.8469	2	22	000	100071	08/22/75	11		16.0			6.2	1300																				1.40
08	39,0150	105.8561	2	02	000	100072	08/22/75	12		16.0			6.4	1300																				2.96
08	39,0150	105.8561	2	22	000	100072	08/22/75	12		16.0			6.4	1300																				1.74
08	39,0194	105.7930	2	02	000	100073	08/22/75	14		18.0			6.2	1100																				2.88
08	39,0194	105.7930	2	22	000	100073	08/22/75	14		18.0			6.2	1100																				2.06
08	39,0161	105.7766	2	02	000	100074	08/22/75	13		17.0			6.2	1100																				2.92
08	39,0161	105.7766	2	22	000	100074	08/22/75	13		17.0			6.2	1100																				3.64
08	39,0136	105.7619	2	02	000	100075	08/22/75	15		18.0			6.4	1100																				3.64
08	39,0136	105.7619	2	22	000	100075	08/22/75	15		18.0			6.4	1100																				1.48
08	38,9700	105.6133	2	02	000	100076	08/22/75	16		19.0			6.2	700																				3.88
08	38,9700	105.6133	2	22	000	100076	08/22/75	16		19.0			6.2	700																				1.24
08	38,9677	105.5819	2	02	000	100077	08/22/75	16		19.0			6.4	680																				2.94
08	38,9677	105.5819	2	22	000	100077	08/22/75	16		19.0			6.4	680																				1.56
08	39,0241	105.8177	2	02	000	100078	08/22/75	11		12.0			6.8	480																				3.93
08	39,0241	105.8177	2	22	000	100078	08/22/75	11		12.0			6.8	480																				2.26
08	39,0483	105.8397	2	01	000	100079	08/22/75	10		9.0			5.0	440																				6.77
08	39,0483	105.8397	2	21	000	100079	08/22/75	10		9.0			5.0	440																				6.33
08	38,9958	105.8786	2	02	000	100080	08/22/75	11		17.0			6.2	1350																				3.69
08	38,9958	105.8786	2	22	000	100080	08/22/75	11		17.0			6.2	1350																				3.90

TABLE B-1 (continued)

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	TIME SAMPLED DATE	TIME SAMPLED HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (µmhos/cm)	SCINTILLOMETER (U ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	38.9958	105.8786	2	27	000	100080	08/22/75	11		17.0	-	-	6.2	1350		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.80
08	38.9994	105.8636	2	02	000	100081	08/22/75	11		15.0	-	-	6.0	1125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.53
08	38.9994	105.8636	2	22	000	100081	08/22/75	11		15.0	-	-	6.0	1125		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.97
08	39.0213	105.8019	2	02	000	100082	08/22/75	13		17.0	-	-	6.2	1100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.53
08	39.0213	105.8019	2	22	000	100082	08/22/75	13		14.0	-	-	6.2	1100		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.08
08	38.9927	105.6825	2	02	000	100083	08/22/75	15		17.0	-	-	6.2	400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.34
08	38.9927	105.6825	2	22	000	100083	08/22/75	15		17.0	-	-	6.2	400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.13
08	39.0025	105.7080	2	02	000	100084	08/22/75	15		17.0	-	-	5.0	700		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.97
08	39.0025	105.7080	2	22	000	100084	08/22/75	15		17.0	-	-	5.0	700		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.30
08	39.0186	105.7555	2	02	000	100085	08/22/75	15		17.0	-	-	6.0	300		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.40
08	39.0186	105.7555	2	22	000	100085	08/22/75	15		17.0	-	-	6.0	300		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.14
08	39.0180	105.7933	2	01	000	100086	08/22/75	13		50.0	-	-	6.8	4000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.98
08	39.0180	105.7933	2	21	000	100086	08/22/75	13		50.0	-	-	6.8	4000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10
08	39.0236	105.6308	2	01	000	100087	08/22/75	16		16.0	-	-	6.5	6500		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.97
08	39.1094	105.8908	2	02	000	100089	08/23/75	11		10.0	-	-	6.0	260		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.23
08	39.1094	105.8908	2	22	000	100089	08/23/75	11		10.0	-	-	6.0	260		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.51
08	39.1672	105.9441	2	22	000	100089	08/23/75	11		10.0	-	-	6.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.96
08	39.2194	105.9938	2	22	000	100090	08/23/75	-		11.0	-	-	6.	200		-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1.88
08	39.2194	105.9938	2	27	000	100090	08/23/75	-		11.0	-	-	6.2	200		-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	4.85
08	39.0927	105.8650	2	02	000	100091	08/23/75	15		16.0	-	-	6.2	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.79
08	39.0927	105.8650	2	22	000	100091	08/23/75	15		16.0	-	-	6.2	275		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.88
08	39.0630	105.8225	2	02	000	100092	08/23/75	15		16.0	-	-	6.0	290		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.47
08	39.0630	105.8225	2	22	000	100092	08/23/75	15		16.0	-	-	6.0	290		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.84
08	39.0291	105.7733	2	22	000	100093	08/23/75	16		19.0	-	-	6.2	290		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.29
08	39.0522	105.4683	2	21	000	100095	08/24/75	10		9.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.54
08	39.0913	105.4238	2	02	000	100100	08/25/75	11		15.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.61
08	39.0913	105.4238	2	22	000	100100	08/25/75	11		15.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.80
08	39.0913	105.4238	2	27	000	100100	08/25/75	11		15.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.03
08	39.0852	105.4197	2	02	000	100101	08/24/75	13		17.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.87
08	39.0852	105.4197	2	22	000	100101	08/24/75	13		17.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.58
08	39.0805	105.4158	2	02	000	100102	08/24/75	13		17.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.89
08	39.0805	105.4158	2	22	000	100102	08/24/75	13		17.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82
08	39.1383	105.4605	2	02	000	100103	08/24/75	14		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.77
08	39.1383	105.4605	2	22	000	100103	08/24/75	14		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.74
08	39.1438	105.4680	2	02	000	100104	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.69
08	39.1438	105.4680	2	22	000	100104	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.92
08	39.1475	105.4713	2	02	000	100105	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.50
08	38.1475	105.4713	2	22	000	100105	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.27
08	39.1525	105.4772	2	02	000	100106	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.32
08	39.1525	105.4772	2	22	000	100106	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.87
08	39.1616	105.4886	2	02	000	100107	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.37
08	39.1616	105.4886	2	22	000	100107	08/24/75	15		18.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.95
08	38.8183	105.6944	2	01	000	100109	08/24/75	13		10.0	-	-	6.0	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73
08	38.8183	105.6944	2	21	000	100109	08/24/75	13		10.0	-	-	6.0	320		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.93
08	39.1658	105.4950	2	02	000	100110	08/25/75	9		11.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.90
08	39.1658	105.4950	2	22	000	100110	08/25/75	9		11.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.32
08	39.1658	105.4950	2	27	000	100110	08/25/75	9		11.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.06
08	39.1680	105.5033	2	02	000	100111	08/25/75	9		11.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.28
08	39.1680	105.5033	2	22	000	100111	08/25/75	9		11.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.93
08	39.1677	105.5077	2	02	000	100112	08/25/75	10		11.0	-	-	5.0	190		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.28
08	39.1677	105.5077	2	22	000	100112	08/25/75	10		11.0	-	-	5.0	190		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.88

TABLE B-I (continued)

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA	TIME SAMPLED																												U CONCENTRATION
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	DATE	HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (μmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)		SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	39.1705	105.5130	2	02	000	100113	08/25/75	10		12.0	-	-	5.0	200		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.24
08	39.1705	105.5130	2	22	000	100113	08/25/75	10		12.0	-	-	5.0	200		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.43
08	39.1750	105.5188	2	02	000	100114	08/25/75	10		12.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.62
08	39.1750	105.5188	2	22	000	100114	08/25/75	10		12.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.71
08	39.1830	105.5283	2	02	000	100115	08/25/75	11		12.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.95
08	39.1830	105.5283	2	22	000	100115	08/25/75	11		12.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.86
08	39.1891	105.5419	2	02	000	100116	08/25/75	11		13.0	-	-	5.0	245		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.66
08	39.1891	105.5419	2	22	000	100116	08/25/75	11		13.0	-	-	5.0	245		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.72
08	39.1972	105.5497	2	02	000	100117	08/25/75	11		14.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.64
08	39.1972	105.5497	2	22	000	100117	08/25/75	11		14.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.48
08	39.1983	105.5533	2	02	000	100118	08/25/75	11		14.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.97
08	39.1983	105.5533	2	22	000	100118	08/25/75	11		14.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.10
08	39.2022	105.5605	2	02	000	100119	08/25/75	12		14.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.14
08	39.2022	105.5605	2	22	000	100119	08/25/75	12		14.0	-	-	5.0	250		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.79
08	39.2066	105.5658	2	02	000	100120	08/25/75	13		16.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.73
08	39.2066	105.5658	2	22	000	100120	08/25/75	13		16.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.94
08	39.2066	105.5658	2	27	000	100120	08/25/75	13		16.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.33
08	39.2097	105.5700	2	02	000	100121	08/25/75	13		17.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.87
08	39.2097	105.5700	2	22	000	100121	08/25/75	13		17.0	-	-	5.0	240		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.02
08	39.2141	105.5797	2	02	000	100122	08/25/75	13		17.0	-	-	5.0	340		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.64
08	39.2141	105.5797	2	22	000	100122	08/25/75	13		17.0	-	-	5.0	340		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.49
08	39.2161	105.5855	2	02	000	100123	08/25/75	13		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.75
08	39.2161	105.5855	2	22	000	100123	08/25/75	13		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.76
08	39.2180	105.5933	2	02	000	100124	08/25/75	14		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.59
08	39.2180	105.5933	2	22	000	100124	08/25/75	14		17.0	-	-	5.0	220		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.01
08	39.2219	105.6019	2	02	000	100125	08/25/75	14		16.0	-	-	5.0	225		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.98
08	39.2219	105.6019	2	22	000	100125	08/25/75	14		16.0	-	-	5.0	225		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67
08	39.0661	105.6988	2	01	000	100126	08/26/75	12		14.0	-	-	7.0	7000		-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1.46
08	39.2425	105.6400	2	02	000	100127	08/26/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.63
08	39.2425	105.6400	2	22	000	100127	08/26/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.30
08	39.2400	105.6463	2	02	000	100128	08/26/75	10		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.38
08	39.2400	105.6463	2	22	000	100128	08/26/75	10		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.02
08	39.2422	105.6502	2	02	000	100129	08/26/75	11		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.61
08	39.2422	105.6502	2	22	000	100129	08/26/75	11		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.06
08	39.2633	105.6686	2	02	000	100130	08/26/75	12		13.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.59
08	39.2633	105.6686	2	22	000	100130	08/26/75	12		13.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.32
08	39.2633	105.6686	2	27	000	100130	08/26/75	12		13.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.43
08	39.2694	105.6744	2	02	000	100131	08/26/75	12		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.75
08	39.2694	105.6744	2	22	000	100131	08/26/75	12		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73
08	39.2763	105.6841	2	02	000	100132	08/26/75	13		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.34
08	39.2763	105.6841	2	22	000	100132	08/26/75	13		14.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.20
08	39.2797	105.6897	2	02	000	100133	08/26/75	13		15.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.90
08	39.2797	105.6897	2	22	000	100133	08/26/75	13		15.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.06
08	39.2869	105.6955	2	02	000	100134	08/26/75	14		16.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.19
08	39.2869	105.6955	2	22	000	100134	08/26/75	14		16.0	-	-	5.0	150		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.50
08	39.2900	105.6977	2	02	000	100135	08/26/75	14		17.0	-	-	5.0	60		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.29
08	39.2900	105.6977	2	22	000	100135	08/26/75	14		17.0	-	-	5.0	60		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.34
08	39.2891	105.6988	2	02	000	100136	08/27/75	10		11.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.37
08	39.2891	105.6988	2	22	000	100136	08/27/75	10		11.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.95
08	39.2947	105.7055	2	02	000	100137	08/27/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.20
08	39.2947	105.7055	2	22	000	100137	08/27/75	10		12.0	-	-	5.0	160		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.56

TABLE B-I (continued)

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY FLUOROMETRY

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
							TIME SAMPLED																											SAMPLE TYPES 11-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	DATE	HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (µmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	
08	39.2958	105.7125	2	02	000	100138	08/27/75	10		12.0	-	-	5.0	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.71
08	39.2958	105.7125	2	22	000	100138	08/27/75	10		12.0	-	-	5.0	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.55
08	39.2947	105.7277	2	02	000	100139	08/27/75	11		13.0	-	-	5.0	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.86
08	39.2947	105.7277	2	22	000	100139	08/27/75	11		13.0	-	-	5.0	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.04
08	39.2958	105.7286	2	02	000	100140	08/17/75	11		12.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.50
08	39.2958	105.7286	2	22	000	100140	08/17/75	11		12.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.05
08	39.2958	105.7286	2	27	000	100140	08/17/75	11		12.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.78
08	39.2988	105.7338	2	02	000	100141	08/27/75	11		13.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.74
08	39.2988	105.7338	2	22	000	100141	08/27/75	11		13.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.01
08	39.2980	105.7422	2	02	000	100142	08/27/75	12		13.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.73
08	39.2980	105.7422	2	22	000	100142	08/27/75	12		13.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.98
08	39.3058	105.7494	2	02	000	100143	08/27/75	12		14.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.26
08	39.3058	105.7494	2	22	000	100143	08/27/75	12		14.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.23
08	39.3133	105.7522	2	02	000	100144	08/27/75	12		14.0	-	-	5.0	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.99
08	39.3208	105.[illegible]597	2	02	000	100145	08/27/75	14		15.0	-	-	5.0	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16
08	39.3244	105.7680	2	02	000	100146	08/27/75	13		15.0	-	-	5.0	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.03
08	39.3277	105.7694	2	02	000	100147	08/27/75	13		16.0	-	-	5.0	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.91
08	39.3286	105.7683	2	02	000	100148	08/27/75	13		15.0	-	-	5.0	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.32
08	39.0191	105.3566	2	02	000	100149	08/28/75	17		14.0	-	-	6.0	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.41
08	39.0191	105.3566	2	02	001	100149	08/28/75	17		14.0	-	-	6.0	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.75
08	39.0191	105.3566	2	22	000	100149	08/28/75	17		14.0	-	-	6.0	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.32
08	39.0191	105.3566	2	22	001	100149	08/28/75	17		14.0	-	-	6.0	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.47
08	39.0191	105.3566	2	27	000	100149	08/28/75	17		14.0	-	-	6.0	900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.27

TABLE B-II

UNTREATED, FILTERED OR ACIDIFIED SAMPLES ANALYZED BY DELAYED-NEUTRON COUNTING

LASL Uranium Hydrogeochemical and Stream Sediment Reconnaissance Data Listing

ERDA SAMPLE NUMBER						LASL SAMPLE NUMBER AND FIELD DATA																												U CONCENTRATION
							TIME SAMPLED																											
STATE	LATITUDE	LONGITUDE	ERDA LAB	SAMPLE TYPE	REPLICATE	LASL SAMPLE NUMBER	DATE	HOUR	AIR TEMPERATURE	WATER TEMPERATURE	COMMENTS	SPECIAL MEASUREMENTS	pH	SPECIFIC CONDUCTANCE (μmhos/cm)	SCINTILLOMETER (eU ppm)	ROCK TYPE	ROCK COLOR	SEDIMENT TYPE	SEDIMENT COLOR	WATER FLOW	WATER LEVEL	WATER COLOR	STREAM CHANNEL	VEGETATION TYPE	VEGETATION DENSITY	RELIEF	WEATHER	OWNERSHIP	CONTAMINANTS	WELL TYPE	WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	WATER DEPTH (FEET)	SAMPLE TYPES 1-10, 21-30 ARE WATER in ppb / SAMPLE TYPES 11-20, 31-40 ARE SEDIMENT in ppm
08	39.0961	105.6788	2	01	000	100001	07/29/75	12		8.0			5.5	650						2									9					15.10
08	39.0961	105.6788	2	21	000	100001	07/29/75	12		8.0			5.5	650						2									9					15.10
08	39.1480	105.7886	2	01	000	100013	08/10/75	10		7.0			5.0	600															3					15.60
08	39.1480	105.7886	2	21	000	100013	08/10/75	10		7.0			5.0	600															3					16.40
08	38.7380	105.5297	2	01	000	100032	08/13/75	15		13.0			7.2	8000					3										2					27.80
08	38.7380	105.5297	2	21	000	100032	08/13/75	15		13.0			7.2	8000					3										2					45.10
08	39.1188	105.7358	2	01	000	100033	08/20/75	11		14.0			6.4	850															3					296.00
08	39.1188	105.7358	2	21	000	100033	08/20/75	11		14.0			6.4	850															3					316.00
08	39.1838	105.7594	2	01	000	100034	08/20/75	12		9.0			6.2	260																				12.60
08	39.1838	105.7594	2	21	000	100034	08/20/75	12		9.0			6.2	260																				13.90
08	38.9558	105.8363	2	03	000	100062	08/21/75	11		9.0			6.0	540																1				9.20
08	38.9458	105.8555	2	03	000	100063	08/21/75	11		8.0			6.0	390																1				18.60
08	38.9458	105.8555	2	23	000	100063	08/21/75	11		8.0			6.0	390																1				17.80
08	39.0236	105.6308	2	21	000	100087	08/22/75	16		16.0			6.5	6500																				0.70
08	39.1672	105.9441	2	02	000	100089	08/23/75	11		10.0			6.0	240																				2.10
08	39.2194	105.9938	2	02	000	100090	08/23/75			11.0			6.2	200															2					1.60
08	39.0291	105.7733	2	02	000	100093	08/23/75	16		19.0			6.2	290																				1.80
08	39.0305	105.4450	2	01	000	100094	08/24/75	9		11.0			5.0	940																				98.40
08	39.0305	105.4450	2	21	000	100094	08/24/75	9		11.0			5.0	940																				76.90
08	39.0522	105.4683	2	01	000	100095	08/24/75	10		9.0			5.0	250																				10.00
08	39.0700	105.4483	2	01	000	100096	08/24/75	10		9.0			5.0	410																				52.90
08	39.0700	105.4483	2	21	000	100096	08/24/75	10		9.0			5.0	410																				51.30
08	39.0600	105.4391	2	01	000	100097	08/25/75	10		8.0			5.0	480																				32.00
08	39.0600	105.4391	2	21	000	100097	08/25/75	10		8.0			5.0	480																				32.60
08	39.0800	105.4530	2	01	000	100098	08/24/75	11		8.0			5.0	350																				25.10
08	39.0800	105.4530	2	21	000	100098	08/24/75	11		8.0			5.0	350																				26.30
08	39.0888	105.4897	2	01	000	100099	08/24/75	11		9.0			5.0	350																				30.60
08	39.0888	105.4897	2	21	000	100099	08/24/75	11		9.0			5.0	350																				31.60
08	39.0786	105.4269	2	01	000	100108	08/24/75	12		19.0			5.8	650																				108.00
08	39.0786	105.4269	2	21	000	100108	08/24/75	12		19.0			5.8	650																				112.00
08	39.0661	105.6988	2	21	000	100126	08/26/75	12		14.0			7.0	7000															3					0.60
08	39.3133	105.7522	2	22	000	100144	08/27/75	12		14.0			5.0	125																				0.90
08	39.3208	105.7597	2	22	000	100145	08/27/75	14		15.0			5.0	120																				0.50
08	39.3244	105.7680	2	22	000	100146	08/27/75	13		15.0			5.0	105																				0.30
08	39.3277	105.7694	2	22	000	100147	08/27/75	13		16.0			5.0	140																				0.70
08	39.3286	105.7683	2	22	000	100148	08/27/75	13		15.0			5.0	95																				1.00

APPENDIX C

CODE TO DATA LISTINGS AND SAMPLE TYPES USED

BY

THE LOS ALAMOS SCIENTIFIC LABORATORY

IN THE

NURE HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE SURVEY

ITEM C-I

EXPLANATION OF CODE USED IN LASL HSSR DATA LISTINGS

and

ITEM C-II

NUMERICAL KEY TO SAMPLE TYPES TAKEN IN THE LASL HSSR SURVEY

APPENDIX ITEM C-I

EXPLANATION OF CODE USED

IN

OPEN-FILE LISTINGS OF HSSR SURVEY DATA

PROVIDED BY

THE LOS ALAMOS SCIENTIFIC LABORATORY

ERDA 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	New Mexico = 35
Colorado = 08	Wyoming = 56
Montana = 30	

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

ERDA LAB: An Energy Research and Development Administration (ERDA) one-digit identifier designating the national laboratory responsible for taking the sample and the data shown in the listing, as well as providing the analysis giving the uranium and other elemental concentrations, if any. The LASL is designated by the Number 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 "Numerical Key and Specifications for Sample Types Taken by the LASL" (Appendix Item C-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 NUMBER AND FIELD DATA

LASL SAMPLE NUMBER: A unique six-digit number permanently assigned by the LASL to every location sampled in each state. 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 the various states as follows.

Location Numbers		State
from 000 001 through 099 999	=	New Mexico
from 100 001 through 199 999	=	Colorado
from 200 001 through 299 999	=	Wyoming
from 300 001 through 399 999	=	Montana
from 400 001 through and above	=	Alaska

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 military (24-hour) clock.

AIR TEMPERATURE: The temperature that was measured in the shade at the time of sampling, to the nearest whole degree Celsius (°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: A "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 by the LASL.

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 μmho/cm, that was measured in the water at the sample location at the time of sampling.

SCINTILLOMETER: The equivalent uranium (eU), in parts per million (ppm), as measured on a flat ground surface within ten meters 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

VEGETATION TYPE: The single digit in this column provides a subjective evaluation of the dominant plant type in the vicinity of the sample location according to the key 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 according to the key 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 according to the key 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 by the key below.

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

OWNERSHIP: The single digit here gives a broad classification of administrative responsibility or general ownership of the land at the sample location according to the key 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 according to the key below.

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

WELL TYPE: The single digit in this column provides a general description of the type of water well from which the sample was taken (if, in fact, it was a well sample) according to the key 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: The one or two digits (if any) in this column give the measured or estimated inside diameter, in inches, of the casing of the well from which the sample (if taken from a well) came.

WELL DEPTH: The one, two, or three digits (if any) in this column give the total drilled depth from the surface, in feet, of the well from which the sample (if taken from a well) came.

WATER DEPTH: The one, two, or three digits in this column give the depth, in feet, from the surface to the standing water in the well, if known (if the sample was taken from a well).

URANIUM CONCENTRATION: The value given in this column is the analytically derived value of the uranium concentration found in the water sample in parts per billion (ppb), or in the sediment sample in parts per million (ppm). Sample Type Nos. 1 through 10 and 21 through 30 are water samples, with their uranium concentrations given in ppb, while Sample Type Nos. 11 through 20 and 31 through 40 are sediment samples, with their uranium concentration given in ppm.

APPENDIX ITEM C-II

NUMERICAL KEY AND SPECIFICATIONS
FOR SAMPLE TYPES TO BE TAKEN BY
THE LOS ALAMOS SCIENTIFIC LABORATORY (LASL)
IN
THE NATIONAL URANIUM RESOURCE EVALUATION (NURE)
HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE (HSSR) SURVEY

The two-digit number assigned each sample type in these specifications will designate three distinct properties of all samples taken by the LASL in the NURE HSSR project. These properties are:

(A) The general sample source (i.e. - spring or stream or dry stream, etc.);

(B) The sample medium (i.e. - water or sediment, etc.); and

(C) The treatment given the sample in the field or laboratory prior to its analysis by the LASL.

The express purpose of this numerical key and the accompanying specifications is to provide the ERDA Grand Junction Office (and ultimately the public) with the necessary tie between each individual suite of field and laboratory data and the specific type, or form of sample, to which they relate. In short, it is proposed to use this key and these specifications to define the various sample types to be collected by the LASL in the ERDA Hydrogeochemical and Stream Sediment Reconnaissance survey for uranium. These key numbers will be inserted in the appropriate columns of the specially formatted ERDA sample numbering system to positively identify the sample type for all LASL sample data submitted to the Grand Junction Office. It is anticipated that other laboratories will wish to expand this key both by adding other sample types and additional numbered specifications.

KEY		SOURCE / MEDIUM / TREATMENT
01	-	Spring water sample untreated
02	-	Stream water sample untreated
03	-	Well water sample untreated
04	-	Natural pond water sample untreated
05	-	Artificial pond water sample untreated
06	-	Spring water sample filtered through a 0.45 micron membrane filter and acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
07	-	Stream water sample filtered through a 0.45 micron membrane filter and acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)

KEY	SOURCE / MEDIUM / TREATMENT
08 -	Well water sample filtered through a 0.45 micron membrane filter and acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
09 -	Natural pond water sample filtered through a 0.45 micron membrane filter and acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
10 -	Artificial pond water sample filtered through a 0.45 micron membrane filter and acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
11 -	Wet spring sediment sample dried at ≤ 100°C and sieved to -100 mesh through stainless steel sieves
12 -	Wet stream sediment sample dried at ≤ 100°C and sieved to -100 mesh through stainless steel sieves
13 -	Wet natural pond sediment sample dried at ≤ 100°C and sieved to -100 mesh through stainless steel sieves
14 -	Wet artificial pond sediment sample dried at ≤ 100°C and sieved to -100 mesh through stainless steel sieves
15 -	Dry stream sediment sample dried at ≤ 100°C (if necessary) and sieved to -100 mesh through stainless steel sieves
16 -	Wet spring sediment sample dried at ≤ 100°C and sieved to -230 mesh through stainless steel sieves
17 -	Wet stream sediment sample dried at ≤ 100°C and sieved to -230 mesh through stainless steel sieves
18 -	Wet natural pond sediment sample dried at ≤ 100°C and sieved to -230 mesh through stainless steel sieves
19 -	Wet artificial pond sediment sample dried at ≤ 100°C and sieved to -230 mesh through stainless steel sieves
20 -	Dry stream sediment sample dried at ≤ 100°C (if necessary) and sieved to -230 mesh through stainless steel sieves
21 -	Spring water sample filtered through a 0.45 micron membrane filter
22 -	Stream water sample filtered through a 0.45 micron membrane filter
23 -	Well water sample filtered through a 0.45 micron membrane filter
24 -	Natural pond water sample filtered through a 0.45 micron membrane filter
25 -	Artificial pond water sample filtered through a 0.45 micron membrane filter
26 -	Spring water sample acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
27 -	Stream water sample acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
28 -	Well water sample acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)

KEY	SOURCE / MEDIUM / TREATMENT
29 -	Natural pond water sample acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
30 -	Artificial pond water sample acidified to a pH of ≤ 1 with reagent grade nitric acid (HNO_3)
31 -	Wet spring sediment sample dried at ≤ 100°C and sieved to +40 mesh through stainless steel sieves
32 -	Wet stream sediment sample dried at ≤ 100°C and sieved to +40 mesh through stainless steel sieves
33 -	Wet natural pond sediment sample dried at ≤ 100°C and sieved to +40 mesh through stainless steel sieves
34 -	Wet artificial pond sediment sample dried at ≤ 100°C and sieved to +40 mesh through stainless steel sieves
35 -	Dry stream sediment sample dried at ≤ 100°C (if necessary) and sieved to +40 mesh through stainless steel sieves
36 -	Wet spring sediment sample dried at ≤ 100°C and sieved to -80 mesh through stainless steel sieves
37 -	Wet stream sediment sample dried at ≤ 100°C and sieved to -80 mesh through stainless steel sieves
38 -	Wet natural pond sediment sample dried at ≤ 100°C and sieved to -80 mesh through stainless steel sieves
39 -	Wet artificial pond sediment sample dried at ≤ 100°C and sieved to -80 mesh through stainless steel sieves
40 -	Dry stream sediment sample dried at ≤ 100°C (if necessary) and sieved to -80 mesh through stainless steel sieves
98 -	Other water
99 -	Other sediment

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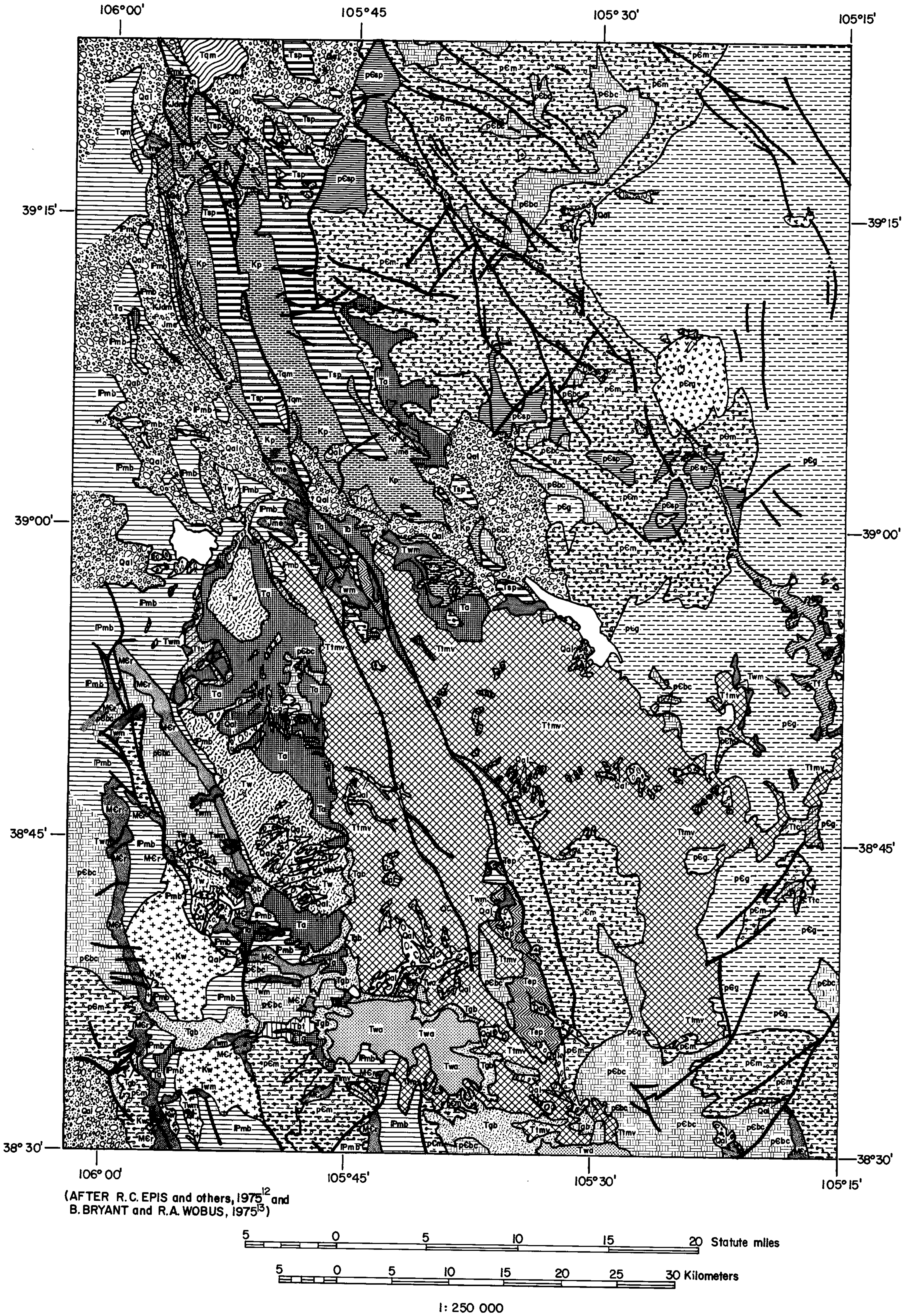

EXPLANATION

CENOZOIC

- Qal – Fan deposits and alluvium of Holocene age. Gravel, loess, alluvium and glacial deposits of Pleistocene age.
- Tw - Wagontongue formation (Miocene)
- Tbt - Siliceous tuff and basalt (Miocene)
- Twa - Andesite, rhyolite, latite and conglomerate of Waugh Mountain, Big Baldy Mountain and Fear Creek (Miocene)
- Ta - Antero formation (Oligocene)
- Ttc - Tallahassee Creek conglomerate (Oligocene)
- Tf - Florissant lake beds (Oligocene)
- Twm - Wall Mountain tuff (Oligocene)
- Ttmv - Thirtynlnemile andesite, rhyolite, diorite, basalt, trachyte and tuff (Oligocene)
- Tgb - Tuffs and andesite of Gribbles Park, Buffalo Peaks and Badger Creek (Oligocene)
- Tqm – Andesite, monzonite and rhyodacite (Eocene)
- Tep - Echo Park alluvium (Eocene)
- Tsp - South Park formation (Eocene? and Paleocene)

MESOZOIC

- Kp - Pierre shale (Upper Cretaceous)
- Kn - Niobrara formation and Benton group (Cretaceous)
- Kw - Whitehorn granodiorite (Cretaceous)
- KJdm - Dakota sandstone group - Includes some Morrison formation and Benton group (Lower Cretaceous and Upper Jurassic)
- Jme - Morrison formation (Upper Jurassic)

PALEOZOIC

- IPmb - Fountain, Maroon, Minturn and Beldon formations undifferentiated (Permian and Pennsylvanian)
- M€r - Undivided Mississippian, Devonian, Ordovician and Cambrian

PRECAMBRIAN (>1.0 billion)

- p€g - Granitic intrusive rocks of Pikes Peak age
- p€rg – Granite and porphyritic granite of the Redskin Stock
- p€sp - Quartz monzonite of Silver Plume age

PRECAMBRIAN (>1.7 billion)

- p€bc - Granodiorite, quartz diorite and pegmatites of Boulder Creek age
- p€m - Granitic and metamorphic rocks of Boulder Creek age

Contact

Fault — Dashed where approximate

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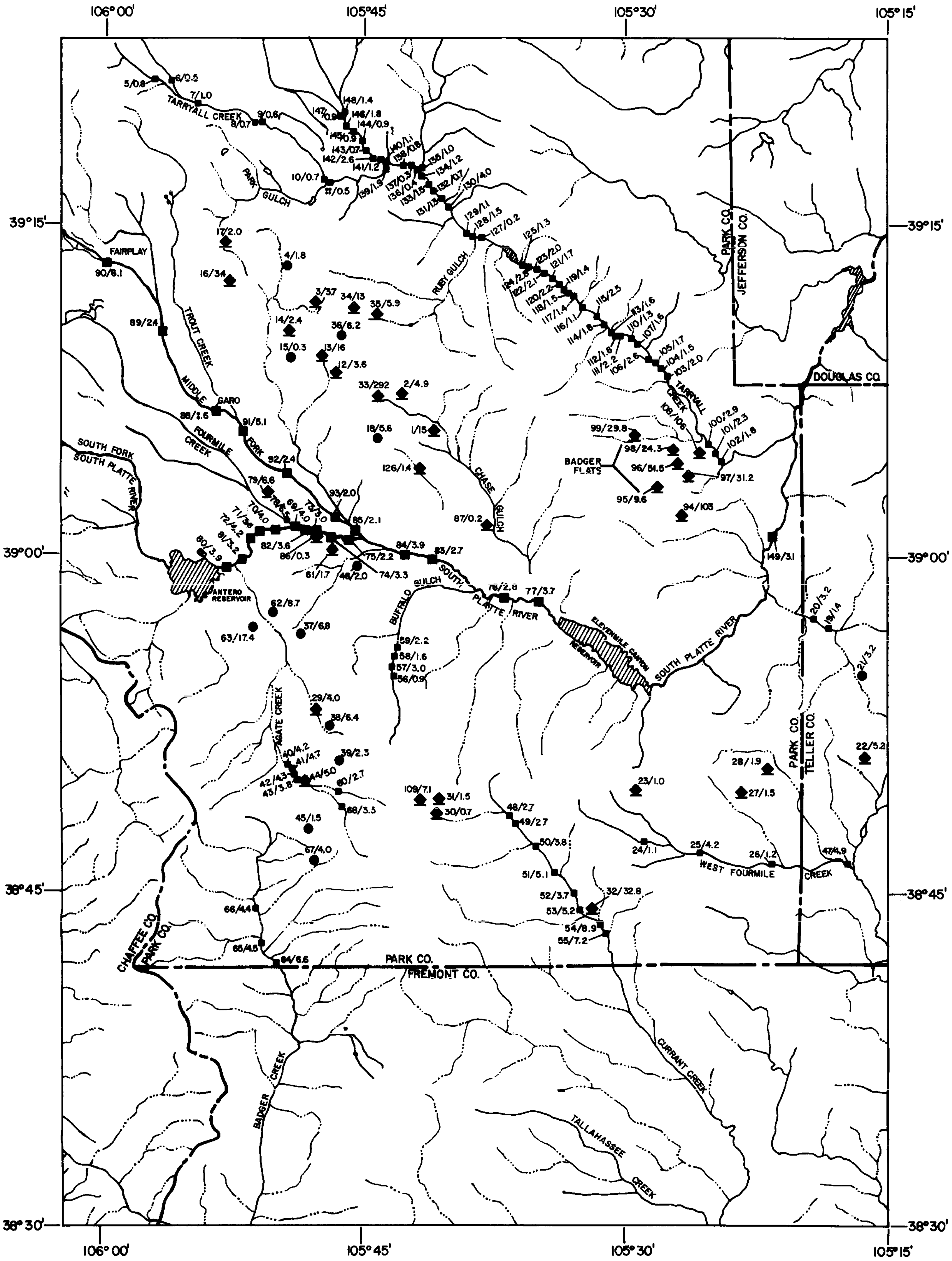
PLATE I.

GENERALIZED GEOLOGY, SOUTH PARK, COLORADO



EXPLANATION

SITE NO./U CONCENTRATION ppb*

65/4.6

- ● WELLS
- ■ LARGE STREAMS
- ▪ SMALL STREAMS
- ♠ SPRINGS

5 0 5 10 15 20 Statute miles

5 0 5 10 15 20 25 30 Kilometers

1:250 000

*URANIUM CONCENTRATIONS SHOWN ARE FOR FILTERED AND ACIDIFIED WATER SAMPLES

N

PLATE II

WATER SAMPLE LOCATIONS SOUTH PARK, COLORADO

OVERLAY TO GENERALIZED GEOLOGIC MAP

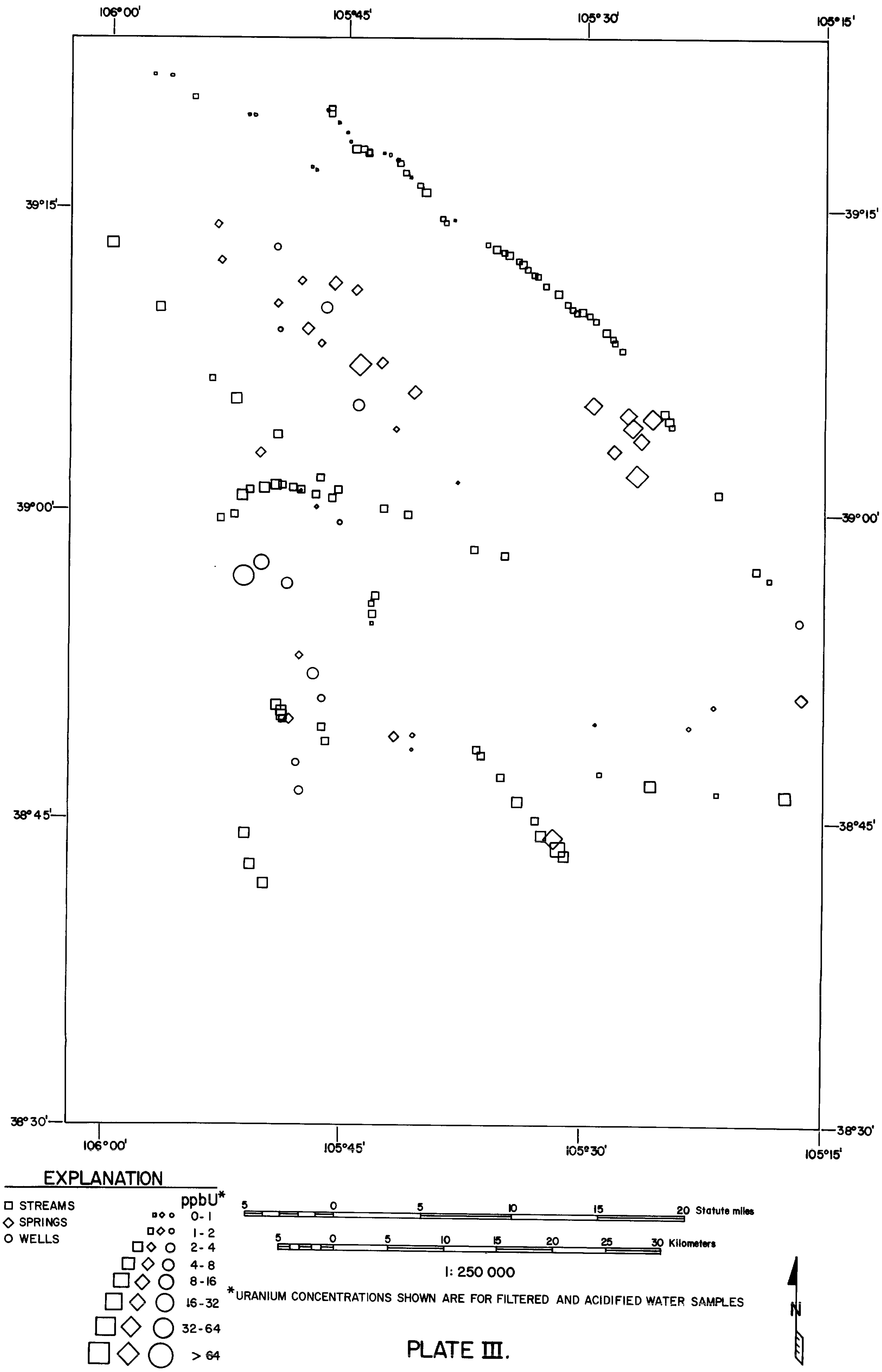


PLATE III.

GRAPHIC PLOT OF URANIUM CONCENTRATIONS IN WATER SOUTH PARK, COLORADO

OVERLAY TO GENERALIZED GEOLOGIC MAP