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URANIUM-BEARING WATER IN THE CROW CREEK AND MUSKRAT CREEK AREAS, FREMONT COUNTY, WYOMING

By John F. Murphy

Trace Elements Memorandum Report 489

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geology and Mineralogy

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Series A.

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John F. Murphy

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TEPCO, RPS, Washington (including master)	2
	47

CONTENTS

ILLUSTRATIONS

TABLES

URANIUM-BEARING WATER IN THE CROW CREEK AND MUSKRAT CREEK AREAS, FREMONT COUNTY, WYOMING

By John F. Murphy

ABSTRACT

Thirty-five water samples from various sources were collected from localities within the Wind River Basin, Wyoming. High uranium content of many of the samples suggests the possible presence of uranium minerals in two areas. Water samples from the Crow Creek area, in the northwestern part of the Wind River Basin, contain as much as 150 parts per billion uranium, and water from the lower Muskrat Creek area, in the central part of the Wind River Basin, contains as much as 340 parts per billion uranium. The uranium content of these samples is comparable to, and in many instances in excess of, the uranium content found in water samples taken from known mineralized localities in the Gas Hills and Crooks Gap areas.

INTRODUCTION

In the course of oil and gas investigations and general geologic reconnaissance in the Wind River Basin of central Wyoming, the writer collected water samples and made preliminary field tests of radioactivity in two areas where no uranium minerals have previously been reported. Some of the water samples contain more than normal amounts of uranium.

Results of previous studies by Denson, Zeller, and Stephens (1955) suggest that the uranium content of water can be a useful guide in prospecting for new areas containing uranium minerals. Most ground water contains less than 2 parts per billion uranium. However, water issuing from springs in areas of known uranium mineralization contains as much as 300 or more parts per billion uranium (Denson, and others, 1955). The uranium content of water sampled from mineralized localities within the Gas Hills (Zeller, and others, 1955) and Crooks Gap (Stephens and Bergin, 1955) areas (fig. 1) averages 98 and 124 parts per billion, respectively.

The Crow Creek area (fig. 1), from which five samples were collected, is a part of the Wind River Indian Reservation and lies about 10 miles north of Burris, Wyoming. Samples from this area were collected in June 1955, largely from springs, and the locations were plotted on enlarged aerial photographs at an approximate scale of 1:12,000.

The lower Muskrat Creek area (fig. 1) comprises about 175 square miles in the central part of the Wind River Basin, directly east of the Wind River Indian Reservation. Locations for the 30 samples taken from this area in June and July 1955 were plotted on topographic maps at a scale of 1:24,000. The water was collected from several types of sources including water wells, springs, seismic shot holes, and intermittent streams.

Pint polyethylene bottles were used in sampling the water at each locality. Seismic shot holes were sampled by lowering a bail, consisting of a weighted perforated pipe, into the hole and later transferring the water into a bottle. Hydrologic and geologic notations were made for each sample when data were available.

The acidity and uranium content of the samples were determined by the U. S. Geological Survey laboratories by the following chemists: J. McClure, J. Schuch, and Roberta Smith.

The only published geologic map available for the Crow Creek area is by Love (1939). Geologic investigations are currently being conducted in the area by the U. S. Geological Survey as a part of the Department of the

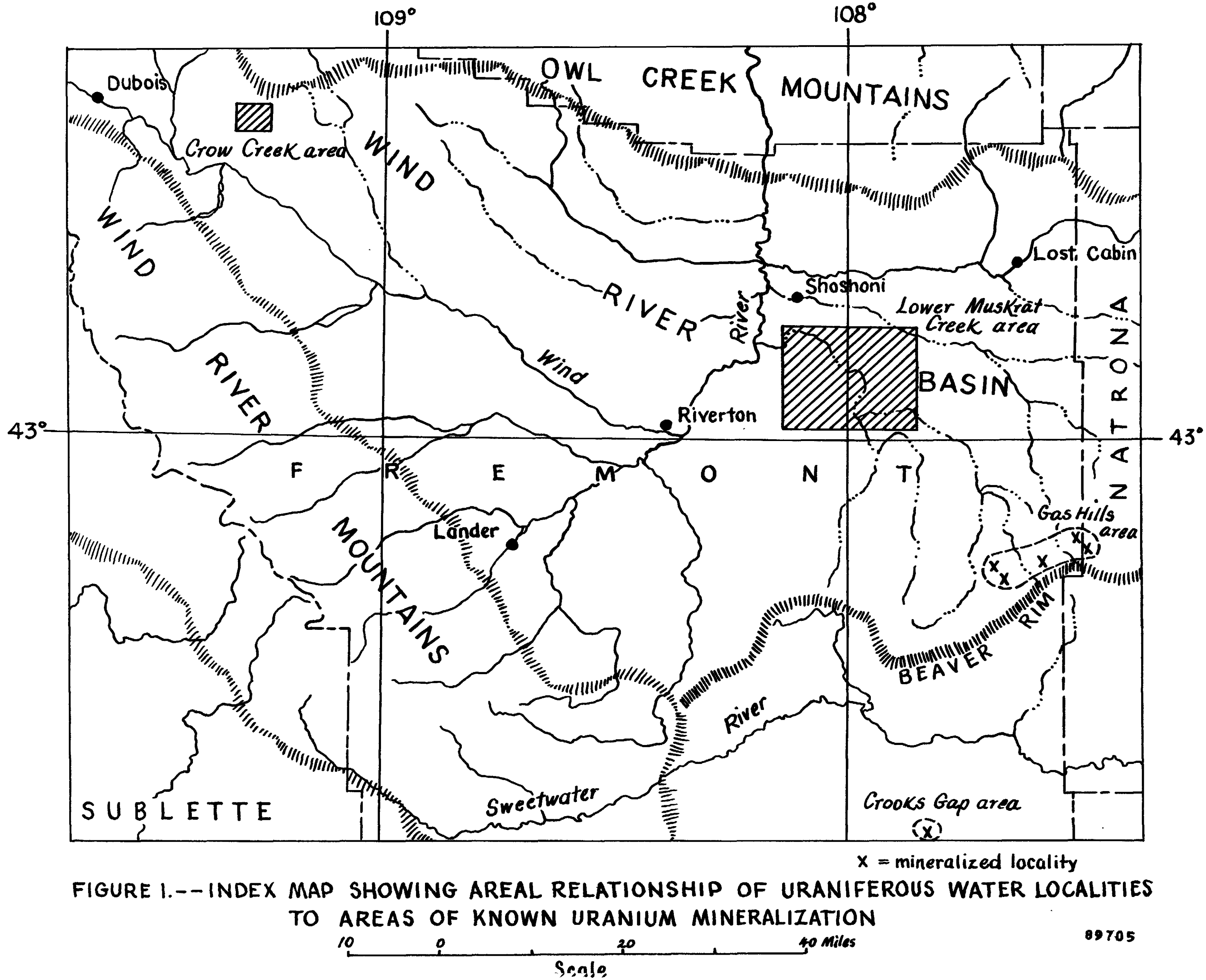

FIGURE 1.--INDEX MAP SHOWING AREAL RELATIONSHIP OF URANIFEROUS WATER LOCALITIES TO AREAS OF KNOWN URANIUM MINERALIZATION

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Interior program for the development of the Missouri River Basin, with the initial objective of evaluating fuel resources. No detailed geologic map is available for the lower Muskrat Creek area, but it lies directly south of the area mapped by Tourtelot (1953), directly east of an area mapped by Thompson and White (1954), and north of another area mapped by Thompson and White (1952). The lower Muskrat Creek area is completely covered by topographic maps at a scale of 1:24,000.

CROW CREEK AREA

Several uranium-bearing water samples were obtained from the Crow Creek area in the extreme northwestern part of the Wind River Basin, Wyoming. The samples, one of which contained 150 parts per billion uranium, represent the first suggestion of the possible presence of uranium minerals in this region. As shown on the generalized geologic map (fig. 2) the uraniferous water came from springs, two of which issue from a fault plane. The third spring, carrying 45 parts per billion uranium, occurs in the scar of a recent landslide. Detailed information on each sample is given in table 1.

The area shown on the map is completely covered by the Wind River formation of early Eocene age and Quaternary deposits. The Wind River formation in this part of the Wind River Basin consists of highly variegated red, gray-white, and purple siltstones, claystones, and coarse-grained sandstones. A few boulder conglomerate lenses composed largely of Paleozoic rock types are interspersed throughout the section. A northward dipping normal fault of unknown displacement transects the area in an east-west direction. On the south side of the fault, a tuffaceous member of the Wind River formation caps a high butte. This unit was mapped by

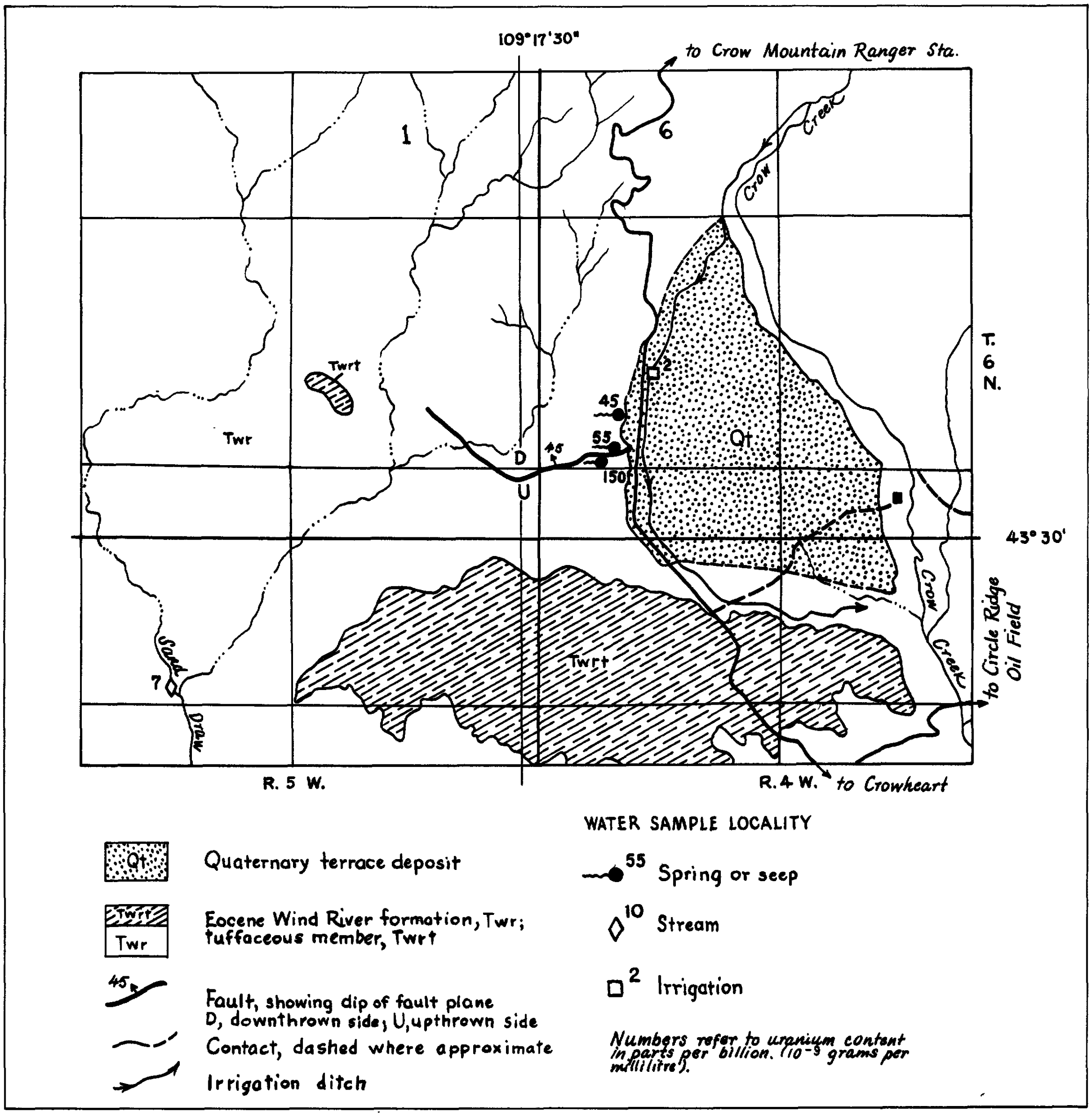

FIGURE 2.--MAP OF PART OF THE CROW CREEK AREA, FREMONT COUNTY, WYOMING, SHOWING LOCATION OF URANIFEROUS WATER SAMPLES

by

John F. Murphy

0 1 2 miles

APPROXIMATE SCALE

1955

Love (1939) as part of the Aycross formation of middle Eocene age and may include the basal part of that formation. All Eocene strata in the area dip very gently to the southwest.

Table 1.--Water sample data of Crow Creek area, Fremont County, Wyoming

Serial no.	Location, Sec., T. R. (Wind Riv. Mer.)	Source of sample	Flow	Lithology of aquifer	Uranium (ppb)	pH
230200	SW sec. 7, 6N-4W	irrigation ditch	variable	alluvium	2	7.2
230201	SW sec. 7, 6N-4W	spring	½ gpm	sandy shale	150	8.0
230202	SW sec. 7, 6N-4W	spring	would fill a ½" pipe	sandy shale	55	8.1
230203	SW sec. 7, 6N-4W	spring	would fill 3/4" pipe	sandy shale	45	7.7
230204	SESW sec. 14, 6N-5W	stream	intermittent	alluvium	7	8.1

A Quaternary terrace deposit about five feet thick caps a bench cut by Crow Creek. The deposit is made up mostly of gravel composed of cobble-sized andesite and basalt fragments derived from upper Eocene and Oligocene volcanic conglomerates in the Absaroka Mountains to the north.

The springs are fed in part by irrigation water from a ditch which is cut into the terrace deposit. Testimony from local ranchers indicates that the springs are perennial, although their flow is reduced during nonirrigation periods. The irrigation water, which is derived from Crow Creek, was sampled in order to determine whether or not it was contributing the uranium in the spring water. The irrigation water contains only 2 parts per billion uranium and, as such, can be dismissed as a possible source. Inasmuch as the irrigation water does, in part, contribute to the flow of the springs, it can probably be considered that the original concentration of uranium in the spring water has been somewhat diluted by the addition of the irrigation water.

An alternate hypothesis to explain the source of the uranium is the possibility that the irrigation water percolating through the volcanic cobbles of the terrace deposit may have dissolved the uranium from the volcanic rocks and carried it in solution to the adjacent springs. The following lines of evidence cast some doubt on this possibility:

1. A water sample collected late in the irrigating season in 1954 contained 22 parts per billion uranium. This sample was taken from the same spring which, early in June 1955, before the irrigating season, contained 55 parts per billion uranium. These data suggest dilution by continued irrigation.
2. The most highly uraniferous water sample (150 parts per billion uranium) was collected about 80 feet below the elevation of the irrigation ditch and 40 to 50 feet below the elevations of the samples which contained 45 and 55 parts per billion uranium. Since the lowest spring was farthest away from the irrigation ditch, it received less water from the ditch than did the two nearer ones. This also suggests dilution of the spring waters by the downward movement of irrigation waters.

No significant radioactivity could be detected at the surface in the general area. The background count was 0.011 mr/hr 1/ and the highest reading was 0.022 mr/hr which was obtained on a carbonaceous shale bed exposed about 10 feet above the northernmost spring.

1/ Milliroentgen per hour.

The writer believes that the uranium is taken into solution at depth by ground water and brought to the surface hydrostatically along the fault plane. Subsurface investigation by drilling may not be warranted, but it is probably the most economical method by which further exploration can be done.

LOWER MUSKRAT CREEK AREA

The lower Muskrat Creek area is located about 15 miles southeast of Shoshoni, Wyoming, and about 23 miles northwest of the Gas Hills area--the closest area of known uranium mineralization. A total of 30 water samples were collected from Quaternary alluvium and from the Wind River formation of early Eocene age. The water came from water wells, springs, seismic shot holes, and intermittent streams. Chemical analyses show that one sample contains 340 parts per billion uranium. Eight other samples have a uranium content in the range from 40 to 170 parts per billion. Figure 3 shows the location and source of each sample, as well as the parts per billion uranium contained in each.

The area has very little relief and is drained by Muskrat Creek and its tributaries. Essentially flat-lying strata of the Wind River formation of early Eocene age cover the entire region. Deposits of Quaternary alluvium are present along the dry washes and stream bottoms. The Wind River formation consists largely of drab gray-green siltstones and claystones interbedded with thick lenses of buff medium- to coarse-grained arkosic sandstone. Very few exposures of red variegated beds can be observed in the area.

The water samples containing the higher amounts of uranium were collected from an east-west belt along Muskrat Creek. The greatest concentrations

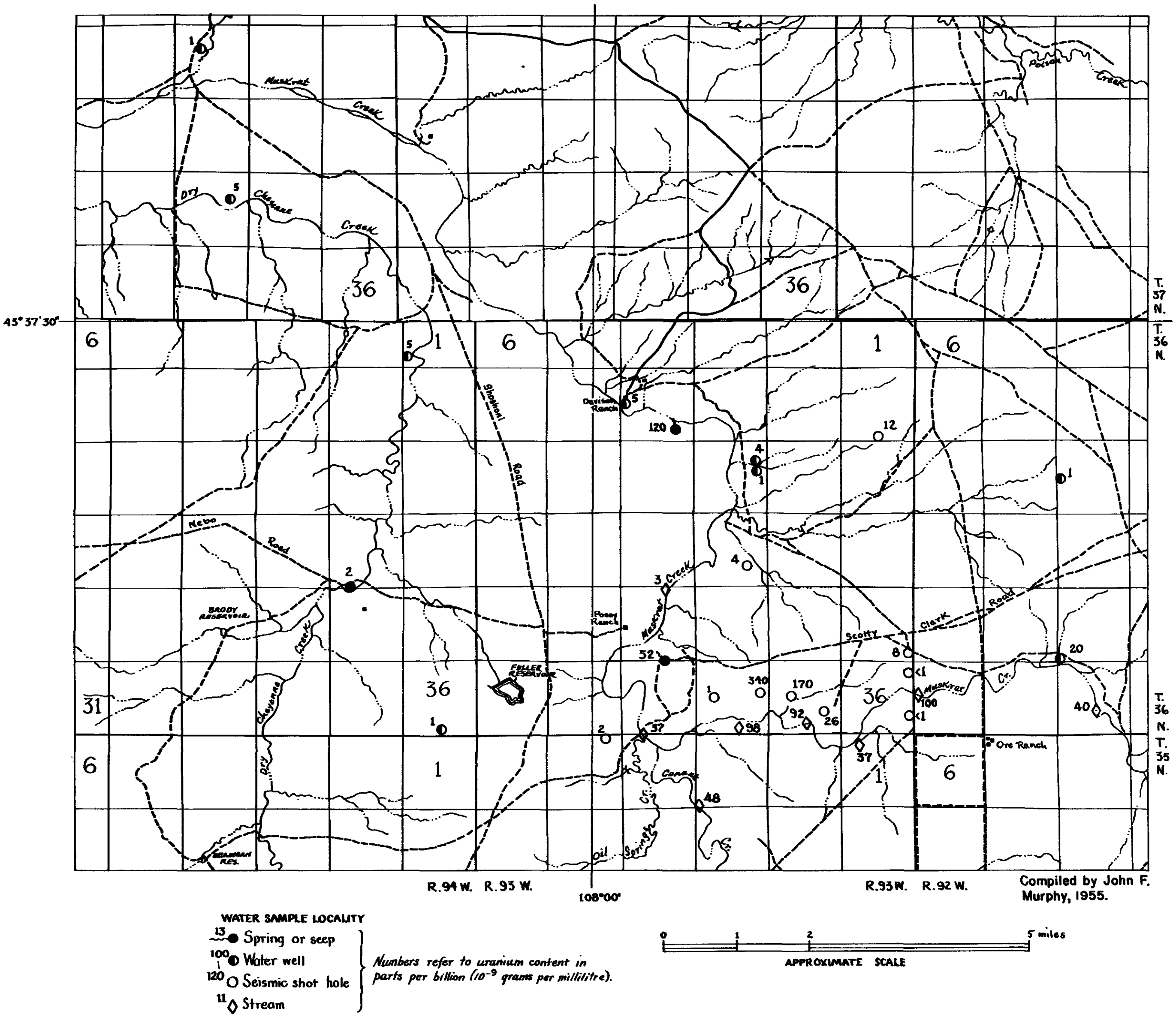

FIGURE 3.--MAP OF LOWER MUSKRAT CREEK AREA, FREMONT COUNTY, WYOMING, SHOWING LOCATION OF URANIFEROUS WATER SAMPLES

were found in seismic shot holes in sections 34 and 35, T. 36 N., R. 93 W. The shot hole, from which the water contained 340 parts per billion uranium, is 54 feet deep. Water was encountered at a depth of 48 feet. Approximately half a mile eastward, water containing 170 parts per billion uranium was sampled from a shot hole 58 feet deep. Water was found at a depth of 15 feet. The surface elevation at each hole is about equal. It is possible that the uranium content in the latter hole may have been diluted by a much greater column of water.

Many samples of water were collected from the surficially dry beds of Muskrat Creek and Conant Creek by digging holes two to three feet deep. Five samples, four of which are from south of the map area, were collected from Conant Creek over a stream distance of about six miles from its junction with Muskrat Creek. These samples ranged from 23 to 48 parts per billion uranium. Six samples from Muskrat Creek that were taken in, and upstream from, the area of greatest concentration, show uranium content ranging from 37 to 100 parts per billion. Three additional samples, ranging from 12 to 58 parts per billion uranium, were taken from Muskrat Creek over a distance of about 4 miles from the eastern edge of the area shown in figure 2. A single sample taken about 2½ miles downstream from the area of greatest concentration contains 3 parts per billion uranium.

The distribution and variable uranium content of the creek samples suggest the possibility that at least a part of the uranium is being transported in solution into the area of greatest concentration by the waters of Conant and Muskrat Creeks and is there being retarded in what may be more favorable host rocks. This possibility is supported by the sample containing a normal amount of uranium (3 parts per billion) which was taken 2½ miles downstream from the area of concentration. This sample, however, may have been diluted by local springs. More downstream water should be analyzed before any conclusion is reached.

The only significant sample of uraniferous water located outside the east-west belt was collected from a spring in section 9, T. 36 N., R. 93 W. This sample contained 120 parts per billion uranium. Pertinent data for all samples in this area are given in table 2.

The maximum uranium content of these samples is comparable to, and in many instances in excess of the uranium content found in water samples taken from mineralized areas in the Gas Hills and Crooks Gap areas. No surface radioactivity in excess of background count could be detected during a reconnaissance examination of the area, but more thorough examinations or drilling might indicate the presence of uranium minerals in rocks of the area.

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