# Uranium in the Poison Basin Area, Carbon County, Wyoming - A Preliminary Report

By J. D. Vine, and G. E. Prichard



**Trace Elements Investigations Report 410**

UNITED STATES DEPARTMENT OF THE INTERIOR
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James D. Vine and George E. Prichard

December 1953

Trace Elements Investigations Report 410



*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

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# URANIUM IN THE POISON BASIN AREA, CARBON COUNTY, WYOMING - A PRELIMINARY REPORT

By James D. Vine and George E. Prichard

## ABSTRACT

Uranium minerals were found on October 15, 1953, about seven miles west of Baggs in the Browns Park formation of the Poison Basin area, Carbon County, Wyo. The occurrences extend over an area of at least several square miles in secs. 4 and 5, T. 12 N., R. 92 W., and secs. 32 and 33, T. 13 N., R. 92 W. Uranophane-bearing sandstones contain as much as 3.21 percent uranium in select samples. The occurrences cannot be evaluated because their dimensions and average grade have not been determined. The presence of uranium, however, is significant because it indicates that uranium deposits may be present in the Browns Park formation and also in the underlying formations unconformably overlapped by the Browns Park.

## INTRODUCTION

The Poison Basin area is located seven miles west of Baggs on the southeast flank of the Washakie Basin in southwestern Carbon County, Wyo. Unusually high radioactivity in the Browns Park formation of Miocene(?) age was discovered by the writers on October 15, 1953, as a result of a reconnaissance with a car-mounted recording scintillation detector. The area was investigated because of the occurrence of uranium in rocks of Miocene(?) age in the Miller Hill area, Carbon County, Wyo., about 35 miles to the northeast (Love, 1953a).

The area was revisited on October 19 and 20, 1953, to collect samples, locate land corners, and map the deposits. Prichard returned to the area on November 14 with aerial photographs to map the geology. Vine returned to the area on February 7 and 8 to examine radioactivity and anomalies recorded by the U. S. Geological Survey airborne radioactivity survey.

Several days after the discovery of uranium, an airborne radioactivity survey was made in the immediate area by the U. S. Atomic Energy Commission, and a few weeks later another airborne radioactivity survey was made of a large area in southern Wyoming, including this area, by the U. S. Geological Survey.

The reconnaissance of the Poison Basin area was made on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

## GEOGRAPHIC SETTING

The Poison Basin area is a small topographic basin tributary to the Little Snake River, which drains the area west of the Continental Divide on both sides of the Colorado-Wyoming boundary and flows across northwestern Colorado to join the Colorado River drainage system.

A small group of low hills in the area is locally known as Poison Buttes, which derive their name from the fact that vegetation in the area is toxic to livestock. Investigation of the vegetation and of the sandstone on which it is growing has indicated that the content of selenium is unusually high and that it is the principal toxicant (Beath, and others, 1946, p. 13). Because a high percentage of the selenium is in a water soluble form, suitable precautions should be taken by persons working in the area or processing samples from the area to prevent the inhalation of selenium-bearing dust. Selenium-bearing dust can be a deadly poison to human beings.

The area is easily accessible by car from Baggs, Wyo., one of several ranching towns in the valley of the Little Snake River. To reach the area from Baggs proceed north on State Highway 330 a distance of about 1 mile and turn west on a graveled county road. Proceed on the main traveled road about 5.5 miles to a road junction and take the right fork. Proceed another 1.5 miles to pit 1. The occurrences are located in secs. 4 and 5, T. 12 N., R. 92 W., and secs. 32 and 33, T. 13 N., R. 92 W., about 3 miles north of the Colorado border (fig. 1).

The nearest railroad is the Denver and Salt Lake line at Craig, Colo. about 41 miles south of Baggs. The Union Pacific Railroad is at Creston, Wyo., about 50 miles north of Baggs. The only inhabitants in the area live along the alluvial plain of the Little Snake River to the south. Sheep and cattle ranching are the chief industries, though several oil and gas test wells have been drilled in the vicinity.

## GEOLOGIC SETTING

The Poison Basin area is a topographic basin eroded chiefly from the Browns Park formation of probable Miocene age (fig. 2). The Browns Park was deposited on an erosion surface developed on gently dipping and

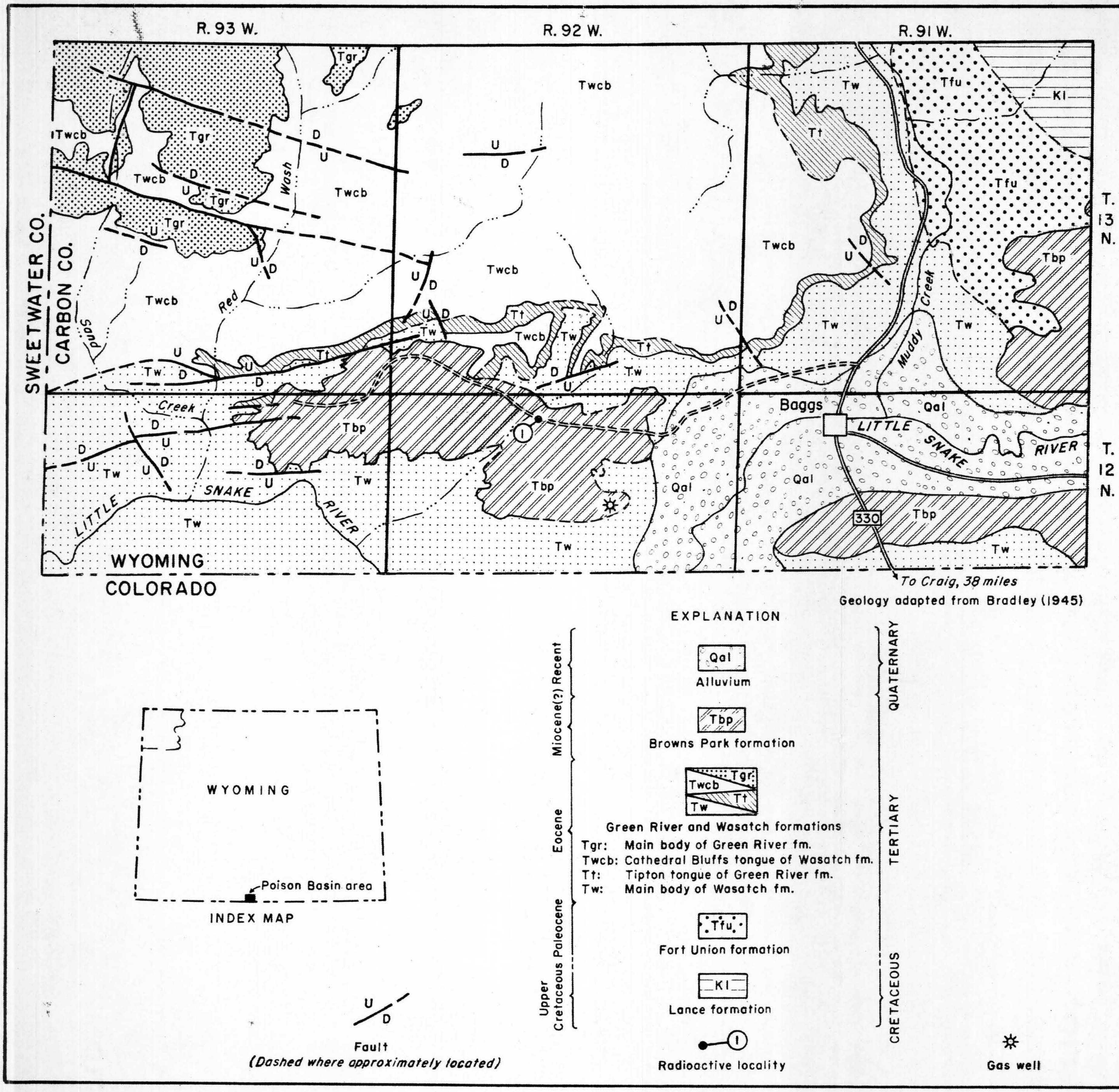
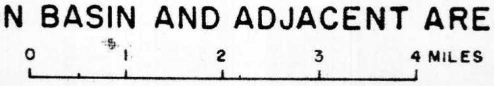
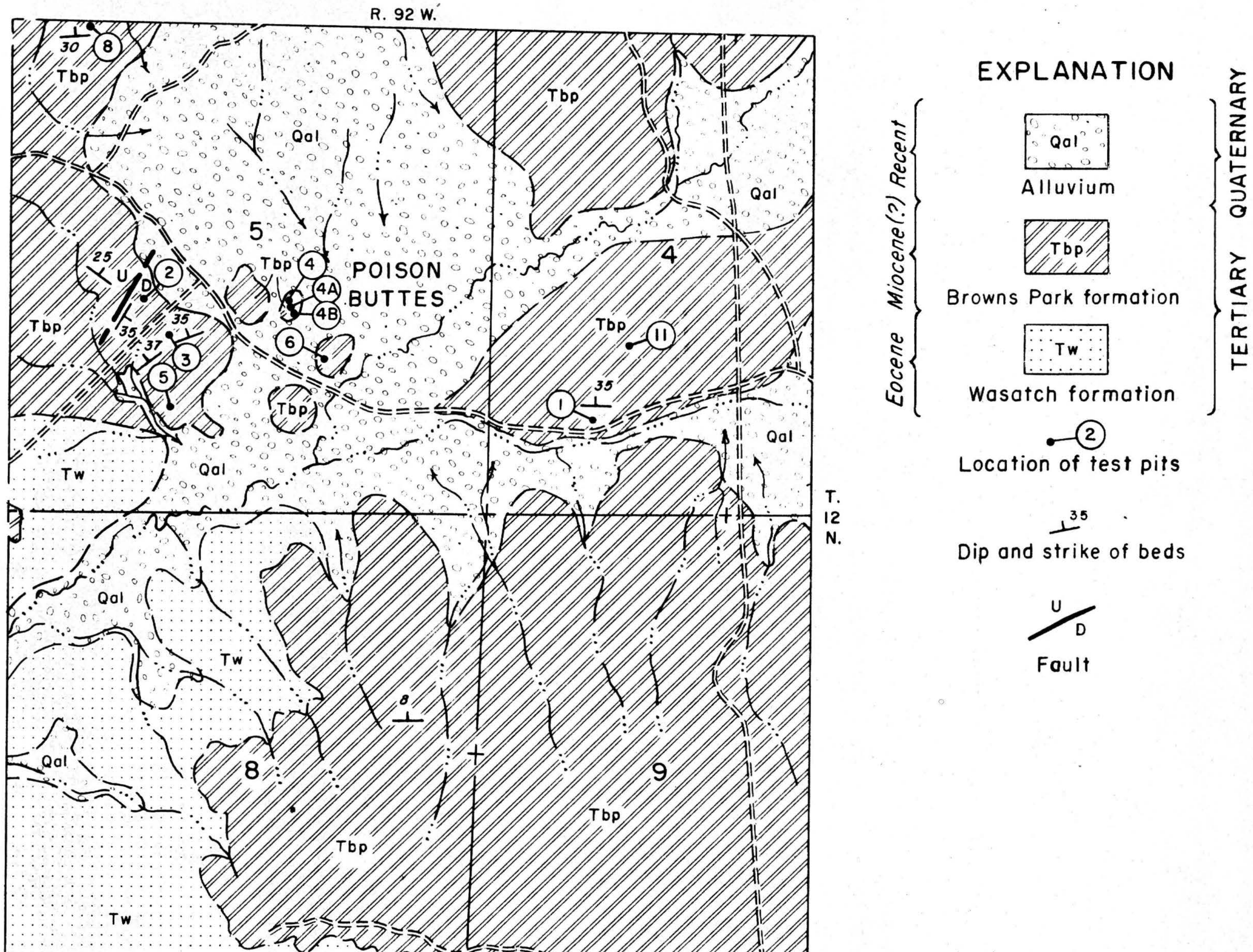



FIGURE 1.--GEOLOGIC MAP OF POISON BASIN AND ADJACENT AREAS, CARBON COUNTY, WYOMING






Geologic mapping by J. D. Vine and G. E. Prichard.
Base compiled from aerial photographs.

FIGURE 2.--SKETCH MAP OF PART OF POISON BASIN AREA SHOWING LOCATION OF TEST PITS

0 1/2 1 mile

truncated beds of the Wasatch and Green River formations of lower Eocene age. These formations comprise the outer rim of the Washakie Basin, a structural depression between the Rock Springs uplift on the west and the Sierra Madre Mountains on the east. Later movement along an east-trending fault zone, which extends across the entire south side of the Washakie Basin, has folded and faulted all of these strata (Bradley, 1945). A second group of faults in the area, which strike north or northwest, is believed to be younger.

Both early and late Tertiary igneous intrusions are present in the Elkhead Mountains of Colorado 15 to 50 miles southeast of Baggs, Wyo. (Gale, 1910). The Hahns Peak mining district, about 45 miles southeast of Poison Basin has produced gold, silver, lead, and copper from vein deposits in rhyolite, latite and andesite porphyry (Gale, 1906).

## STRATIGRAPHY

Although no stratigraphic studies were made during this reconnaissance, the rocks exposed in this area were described by Bradley (1945) and the following descriptions are summarized chiefly from his work.

All the exposed rocks are of Tertiary age and include the Wasatch, Green River, and Browns Park formations.

### Wasatch formation

The Wasatch formation of Eocene age is the oldest rock sequence exposed in the vicinity of the Poison Basin. It consists of several thousand feet of fluviatile deposits, chiefly sandy gray mudstone with irregular lenses of sandstone. The main body of the Wasatch is chiefly gray, banded with red, green and yellow. The upper part of the Wasatch interfingers with the Green River formation and a member of Green River known as the Tipton tongue separates the main body of the Wasatch from the upper member which is called the Cathedral Bluffs tongue. In the Poison Basin area, the Tipton tongue, which is well developed to the north and west, has thinned to a feather edge. The Cathedral Bluffs tongue consists chiefly of gray mudstone, banded with red, and is probably about 1,000 feet thick.

## Green River formation

The Green River formation consists of lacustrine deposits which interfinger with and overlie the Wasatch formation and is also of Eocene age. It consists chiefly of thin-bedded marlstone, oil shale, and carbonaceous shale containing numerous fresh water fossils including fish, gastropods, and ostracods. The Tipton tongue which is separated from the main body of the Green River by the Cathedral Bluffs tongue of the Wasatch is the principal member of the Green River formation exposed in the Poison Basin area. It consists chiefly of soft, brown, papery, organic shales about 75 feet thick north of Poison Basin but becomes sandy and carbonaceous, and loses its identity in the area south and west of Poison Basin.

## Browns Park formation

The Browns Park formation of probable Miocene age was deposited on an erosion surface which cut the slightly tilted Eocene rocks. Discontinuous erosion remnants of the Browns Park formation overlie various older rocks along the south flank of the Washakie Basin as well as in areas to the east, south, and west. They were probably once continuous with the Browns Park formation of northwestern Colorado and northeastern Utah where the formation overlies rocks as old as the pre-Cambrian at the east end of the Uinta Mountains.

At the base of the Browns Park formation is a conglomerate about 75 feet thick consisting largely of quartzite pebbles and cobbles in a sandy matrix. Above the conglomerate is a thick series of soft, white, highly cross-bedded sandstone and tuffaceous sandstone. This material weathers into a loose sand which covers most of the land surface. Beds of dense quartzite form the top of the formation exposed in this area. Bradley (1936) states that the lower part of the Browns Park formation along the south side of the Washakie Basin consists largely of glassy tuffs, though this lithology was not observed during the reconnaissance of the Poison Basin area. No figures are available on the total thickness of the Browns Park formation and though over 1,000 feet may be present elsewhere the top has been subjected to erosion in the Poison Basin area and it is estimated that only about 300 feet of strata are present.

Bradley (1936, p. 182-184) discusses the origin of the Browns Park formation and considers that the presence of rounded and frosted sand grains, prominent cross-bedding, and wind-faceted cobbles are probable evidence that the material was wind-blown. In the Poison Basin area widely divergent strike and dip readings taken on isolated exposures of cross-bedded sandstones in the Browns Park formation make structural interpretation difficult.

## URANIUM OCCURRENCES

As much as 3 percent uranium occurs in sandstone in the Browns Park formation in isolated exposures on a group of low hills known as Poison Buttes and in the surrounding area in secs. 4 and 5, T. 12 N., R. 92 W., and secs. 32 and 33, T. 13 N., R. 92 W., 6th principal meridian (figs. 3 and 4). Uranophane, $Ca(UO_2)_2Si_2O_7.6H_2O$, has been identified by R. S. Jones, W. F. Outerbridge, and A. J. Gude, 3rd as the principal uranium mineral in 3 select samples. Schroeckingerite, $NaCa_3(UO_2)(CO_3)_3(SO_4)F.10H_2O$, has been identified as the principal uranium mineral in 1 sample. Both these minerals are known from other nearby localities in Wyoming. Uranophane is the principal uranium mineral in the Miller Hill area, Carbon County, Wyoming (Vine and Prichard, 1953). Schroeckingerite is the principal uranium mineral prospected along Lost Creek in the Great Divide Basin, Sweetwater County, Wyoming (Sheridan and others, 1952). Samples for analysis were collected from eleven shallow pits dug at various points of high radioactivity on Poison Buttes and adjacent hills. Most of these pits are shown on figure 2. All analyses are listed in table 1.

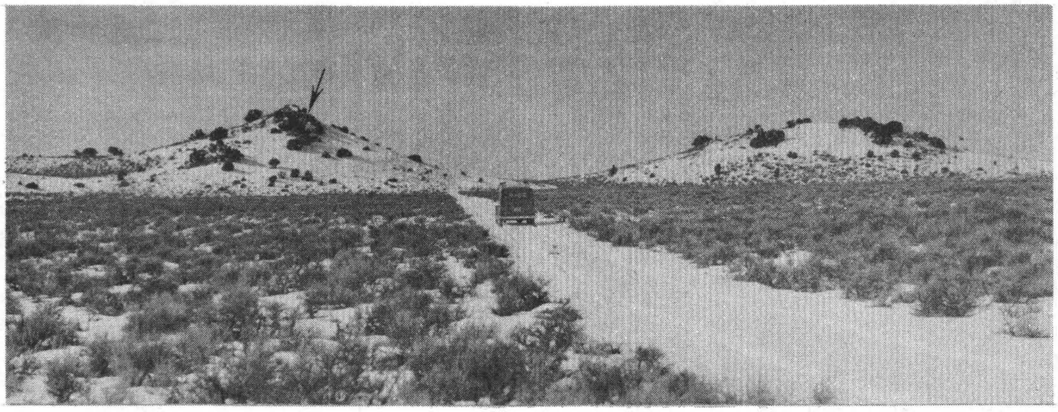


Figure 3.--Close view of Poison Buttes, looking southwest.
Arrow indicates approximate location of Pit No. 3.

Figure 4.--Poison Basin, Carbon County, Wyoming.
View looking south.

Pit 1. Radioactive loose brown sand lies on the bedrock for several hundred feet along the north side of the main east-trending road through the area. A shallow pit dug at the most radioactive point detected on the ground uncovered about 18 inches of brown, friable, medium-grained sandstone containing fracture coatings and disseminations of uranophane. Sample VW3-91 is an 18 inch channel sample of this sandstone and contains 0.43 percent equivalent uranium and 0.39 percent uranium. Channel samples VW3-470, 471, and 472 through 6 feet of the radioactive zone contains an average of 0.068 percent equivalent uranium, but chemical uranium analyses are not yet available. The most radioactive portion of the rock consists of a dark-brown lens of sandstone about 2 inches thick with fracture coatings of uranophane. Sample VW3-89 was collected from this lens and contains 0.86 percent equivalent uranium and 0.90 percent uranium. An unidentified black mineral colors a 1 to 2 inch streak through the radioactive zone. A grab sample from this black streak, sample VW3-401 contains 0.5 percent equivalent uranium and 0.69 percent uranium. A second sample from this same zone, VW3-473, contains 1.5 percent equivalent uranium but the chemical uranium analysis is not yet available.

Above pit 1 is a bed of medium- to coarse-grained cross-bedded sandstone about 8 feet thick which appears to strike east and dip about 35° north.

Pit 2. An 18-inch zone of reddish-brown radioactive sandstone was uncovered at pit 2. No yellow uranium minerals were observed. A 12-inch channel sample from this pit, sample VW3-94, contains 0.024 percent equivalent uranium and 0.004 percent uranium. A grab sample from the most radioactive portion of the same pit contains 0.25 percent equivalent uranium and 0.011 percent uranium. The sandstone exposed in the pit appears to dip less than 5° but a nearby outcrop of sandstone at the top of the hill dips about 35° and strikes about N. 30° E.

Pit 3 was dug at a point of high radioactivity along a radioactive zone which appeared to be parallel to the dip of the beds on the side of a hill. Digging uncovered a reddish-brown and greenish-gray, friable sandstone. The greenish tint in part of the sand may be due to the presence of disseminated uranium minerals. A 12-inch channel sample from this pit, sample VW3-95 contains 0.7 percent equivalent uranium and 0.69 percent uranium.

Pit 4. A zone of radioactive, soft, friable, light greenish-gray, massive sandstone at the top of a small hill is highly radioactive about 6 inches below the surface in pit 4. The greenish tint of the sandstone may be due to disseminated uranium minerals. A 12-inch channel sample from this zone, sample VW3-96, contains 0.1 percent equivalent uranium and 0.018 percent uranium.

Pit 4A was dug at a point of high radioactivity about 25 feet southeast of pit 4 on the same hill. Friable sandstone in the pit contains fracture coatings of yellow uranophane. A sample, VW3-97, of selected yellow-stained sandstone fragments contains 1.5 percent equivalent uranium and 3.21 percent uranium. This sample contains the highest percent uranium of any of the samples collected from the Poison Basin area.

Pit 4B, on the same hill as pits 4 and 4A, was dug about 50 feet southeast of pit 4. This pit uncovered a 2-inch thick lens of radioactive, reddish-brown sandstone, estimated to be about 15 feet stratigraphically lower than the sandstone sampled in pit 4A. A grab sample, VW3-98, collected from this lens contains 0.13 percent equivalent uranium and 0.027 percent uranium.

Pit 5 was dug at a point of relatively low radioactivity along a zone of moderately radioactive, light-gray sandstone similar in appearance to that encountered in pit 4. A 12-inch channel sample from this pit contains 0.037 percent equivalent uranium and 0.021 percent uranium. A grab sample, VW3-474, from the same pit shows a trace of unidentified yellow mineral and contains 0.39 percent equivalent uranium but no chemical uranium value is available.

Pit 6. A fine-grained sandstone with a pale yellowish tint was uncovered in this pit. The yellowish stain may be due to a uranium mineral disseminated through the matrix of the sandstone. A 6-inch channel sample from this sandstone contains 0.34 percent equivalent uranium and 0.016 percent uranium.

Pits 7 through 11 were located and sampled in February, 1954, after the area had been prospected by claim holders. Only pits 8 and 11 fall within the area shown on figure 2. The samples collected from these pits have been analyzed for equivalent uranium only. Chemical uranium analyses are pending.

Pit 7 was dug at a point of high radioactivity only about 2 feet in diameter. A 12-inch channel sample, VW3-475, contains 0.052 percent equivalent uranium. The pit is located about 1,200 feet north of the 1/4 corner between sec. 32, T. 13 N., and sec. 5, T. 12 N., R. 92 W.

Pit 8. A bulldozer trench about 75 feet long and 6 feet deep was dug in essentially barren sandstone except for one small mineralized zone at its southern end. On the east wall of the trench and about 3 feet below the ground surface, a yellow fluorescent mineral occurs in the sandstone. A 12-inch channel sample, VW3-476, of the mineralized zone contains 0.033 percent equivalent uranium. The mineral has been identified as schroeckingerite.

Pit 8A is located about 300 feet north of pit 8. A grab sample, VW3-477, of brown sandstone from the pit contains 0.018 percent equivalent uranium.

Pit 9 was dug to a depth of 3 feet at a point about 650 feet north-northeast of pit 8. Three channel samples, VW3-478, 479, and 480, were collected to represent the 3 foot interval of exposed sandstone. The average percent equivalent uranium content of these samples is about 0.1.

Pit 10. A bulldozer trench was dug about 10 feet deep at a point about 450 feet northeast of the northwest corner of sec. 4, T. 12 N., R. 92 W. At the bottom of the bulldozer trench a 3 foot hole was dug and a channel sample collected, VW3-481. This sample, representing the 3-foot mineralized zone, contains 0.008 percent equivalent uranium.

Pit 11. A point of high radioactivity was sampled from the top of a shallow bulldozer trench on top of a hill about 900 feet northeast of pit 1.

A 1-foot channel sample, VW3-482, from the top of a limonite-stained sandstone contained 0.073 percent equivalent uranium.

All of the pits from which samples were collected were dug on or near the tops of low hills. Radioactivity is relatively high throughout the area, but it is not known whether or not the uranium minerals follow stratigraphic zones which might be continuous between the hills beneath soil cover. The dominant structural trend throughout the area appears to be east-west but locally the attitude of the rocks is widely divergent from this general trend. Some of this divergence may be due to large scale cross-bedding similar to that along the south side of Washakie Basin which Bradley (1936, p. 182) describes. Some of the erratic dips, however, may be structural in origin. Some of the zones of radioactive, friable sandstone may be localized along faults or other structural features. Detailed geologic mapping, stratigraphic studies, and extensive pitting will probably be necessary to determine the structure.

## ORIGIN OF THE URANIUM

The uranium in the occurrences now known in the Poison Basin area appears to have been deposited by ground water in the enclosing sandstone. The geologic features or geochemical conditions that controlled the precipitation of the uranium are not suggested by the present data.

The source of the uranium in the ground water from which it was deposited is problematical. The Poison Basin area is similar to the Pumpkin Buttes (Troyer and others, 1953), Red Desert (Masursky and

Table 1.--Analyses of samples collected from the Poison Basin area

| Pit No. | Field No. | Lab. No. | Equivalent uranium (percent) | Uranium (percent) | $V_2O_5$ (percent) | As (ppm) | Se (ppm) | Description |
|---|---|---|---|---|---|---|---|---|
| 1 | VW3-89 | D98776 | 0.86 | 0.90 | <0.05 | 250 | 30 | Grab Dark brown uranophane-bearing ss. |
| 1 | VW3-91 | D98777 | 0.43 | 0.39 | <0.08 | 200 | 20 | 18 in. Brown ss. |
| 1 | VW3-401 | D99839 | 0.50 | 0.69 | -- | - | - | Grab Black ss. |
| 1 | VW3-470 | 204323 | 0.026 | -- | -- | - | - | 24 in. Top of 6 ft of ss. |
| 1 | VW3-471 | 204324 | 0.14 | -- | -- | - | - | 24 in. Next 2 ft ss. |
| 1 | VW3-472 | 204325 | 0.039 | -- | -- | - | - | 24 in. Bottom 2 ft ss. |
| 1 | VW3-473 | 204326 | 1.5 | -- | -- | - | - | Grab Black ss. |
| 2 | VW3-93 | D99831 | 0.25 | 0.011 | 0.08 | 250 | 15 | Grab Reddish-brown ss. |
| 2 | VW3-94 | D99832 | 0.024 | 0.004 | 0.06 | 150 | 12 | 12 in. Reddish-brown ss. |
| 3 | VW3-95 | D99833 | 0.70 | 0.69 | 0.16 | - | - | 12 in. Brown and green ss. |
| 4 | VW3-96 | D99834 | 0.10 | 0.018 | 0.13 | 50 | 40 | 12 in. Greenish-gray ss. |
| 4A | VW3-97 | D99835 | 1.5 | 3.21 | 0.10 | 100 | 80 | Grab Uranophane-bearing ss. |
| 4B | VW3-98 | D99836 | 0.13 | 0.027 | 0.11 | - | - | Grab Reddish-brown ss. |
| 5 | VW3-99 | D99837 | 0.037 | 0.021 | 0.08 | - | - | 12 in. Gray ss. |
| 5 | VW3-474 | 204327 | 0.39 | -- | -- | - | - | Grab Brown ss. |
| 6 | VW3-400 | D99838 | 0.34 | 0.016 | 0.08 | - | - | 6 in. Yellowish ss. |
| 7 | VW3-475 | 204328 | 0.052 | -- | -- | - | - | Grab Brown ss. |
| 8 | VW3-476 | 204329 | 0.033 | -- | -- | - | - | 12 in. Schroeckingerite-bearing ss. |
| 8A | VW3-477 | 204330 | 0.018 | -- | -- | - | - | Grab Brown ss. |
| 9 | VW3-478 | 204331 | 0.073 | -- | -- | - | - | 12 in. Top ft of 3 ft ss. |
| 9 | VW3-479 | 204332 | 0.19 | -- | -- | - | - | 12 in. Next ft ss. |
| 9 | VW3-480 | 204333 | 0.051 | -- | -- | - | - | 12 in. Bottom ft ss. |
| 10 | VW3-481 | 204334 | 0.008 | -- | -- | - | - | 36 in. Brown ss. |
| 11 | VW3-482 | 204335 | 0.073 | -- | -- | - | - | 12 in. Brown ss. |

Pipiringos, 1953, and Sheridan and others, 1952) and Miller Hill areas (Love, 1953) in that it contains no evidence of hydrothermal mineralization or alteration of the rocks, except possibly for the uranium occurrences themselves. The Poison Basin area is at least 15 miles from known igneous activity and 45 miles from the Hahns Peak mining district, but is situated adjacent to an east-trending fault zone which could have provided access to ground waters of relatively deep origin.

The Poison Basin area also is similar to the Pumpkin Buttes, Red Desert, and Miller Hill areas in that the area contains tuffaceous rocks.

The tuffaceous sandstones in the Browns Park formation may have contained small amounts of uranium that was leached by ground water and deposited in favorable host rocks.

## SIGNIFICANCE OF THE POISON BASIN AREA IN THE SEARCH FOR URANIUM

The occurrence of uranium minerals in the Poison Basin area is the second occurrence known to the authors of uranium in rocks of the Browns Park formation. The uranium occurrences in the Miller Hill area are in rocks of the Browns Park formation of Miocene(?) age (Love, 1953a), but there is reasonable doubt regarding the correlation of the rocks in the two areas, and it is possible that the uranium in the Miller Hill occurrences may be in a younger formation. These occurrences of uranium minerals in the Browns Park formation indicate that the large area covered by this formation in northwestern Colorado and adjacent parts of Wyoming and Utah can now be considered as favorable for prospecting. Similarly, though no uranium is yet known in the strata directly underlying the Browns Park in the Poison Basin area, it seems possible that uranium may have been leached from tuffaceous sandstone and redeposited at favorable places in the older rocks. Bradley (1936, plate 34) reconstructed much of the surface on which the Browns Park formation was deposited and this map should provide a useful guide to prospecting in areas only recently stripped of the Browns Park as well as in areas where the formation is present.

The occurrence of uranium in the Poison Basin area coincides remarkably with an area long known to be high in selenium content (Beath, and others, 1946, p. 13). The association of the two elements is probably not due to chemical combination in a specific mineral so it is probably best explained by a common origin. Selenium indicator plants have been useful guides to uranium prospecting in many areas and though the two elements do not always occur together, the association may be sufficiently common to continue prospecting for uranium in other areas of known high selenium content.

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## PLANS

The discovery of uranium in the Poison Basin area was followed immediately by an airborne radioactivity survey by the Atomic Energy Commission. The results of this survey have recently been made public by a map posted in the offices of the AEC showing points of anomalous radioactivity. This map shows 16 anomalies in secs. 4, 5, and 6, T. 12 N., R. 92 W., and secs. 31 and 32, T. 13 N., R. 92 W. This work was also followed by an airborne radioactivity survey conducted by the U. S. Geological Survey, the results of which will be made available shortly (Henderson, 1954).

A ground check should be made of the anomalies reported by these aerial surveys. Plans for field work should also include detailed geologic mapping of the area of the deposits, and stratigraphic studies of the Browns Park formation. Some preliminary physical exploration by bull-dozing trenches along the zones of high radioactivity may be helpful in mapping the deposits.

Additional work is planned for fiscal year 1954. This will include geologic mapping to provide the background geologic data for the occurrences and to attempt to identify geologic features that may have controlled the localization of uranium minerals.