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RECONNAISSANCE OF GEOLOGY AND URANIUM OCCURRENCES OF THE UPPER ALAMOSA CREEK VALLEY CATRON COUNTY, NEW MEXICO

By George O. Bachman, Elmer H. Baltz, and Roy L. Griggs

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Trace Elements Investigations Report 521

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RECONNAISSANCE OF GEOLOGY AND URANIUM OCCURRENCES OF THE UPPER ALAMOSA CREEK VALLEY, CATRON COUNTY, NEW MEXICO*

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George O. Bachman, Elmer H. Baltz,
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Trace Elements Investigations Report 521

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

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RECONNAISSANCE OF GEOLOGY AND URANIUM OCCURRENCES OF THE UPPER ALAMOSA CREEK VALLEY, CATRON COUNTY, NEW MEXICO

By George O. Bachman, Elmer H. Baltz, and Roy L. Griggs

ABSTRACT

The Crevasse Canyon formation and Point Lookout(?) sandstone of Late Cretaceous age and the Baca and Datil formations of Tertiary age were mapped in an area of 168 square miles in the upper Alamosa Creek Valley along the northern edge of the Datil Mountains, Catron County, N. Mex. The investigation was made to determine the potentialities of the area for producing uranium and to learn the geologic controls for the concentration of uranium.

Uranium occurs in the Point Lookout(?) sandstone and in the lower part of the Baca formation in the map area. Detailed studies of uranium occurrences in the map area indicate that deposition of the uranium was influenced by ground water and that concentration of the uranium was controlled by variations in permeability of aquifers and by minor structural features. Uranium is concentrated at the contact of porous sandstones with underlying impermeable shale beds and shale stringers. Minor synclines in the Point Lookout(?) sandstone may have controlled the concentration of uranium at two localities. At one locality concentration of uranium is in the wedge-edge of a lenticular sandstone in the Baca formation. The uranium is associated with ferruginous and carbonaceous material.

Uranium content of samples from the Red Basin claims in the map area contain as much as 2.31 percent uranium and 1.64 percent vanadium. Uranium content of samples from other prospects in the map area ranges from 0.002 to 0.33 percent. Uranium content of samples collected from the Hook Ranch area east of the map area ranges from 0.006 to 3.27 percent. Uranium minerals may include tyuyamunite or carnotite, as well as unidentifiable disseminated minerals.

INTRODUCTION

In the summer of 1954, an area of 168 square miles located in the upper Alamosa Creek Valley on the northern edge of the Datil Mountains, Catron County, N. Mex., was mapped by R. L. Griggs. The work was undertaken by the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission. The purpose of the work was to determine the potentialities of the area for producing uranium and to learn the geologic controls for the concentration of the uranium. Three uranium occurrences were mapped by plane table and Brunton compass traverse methods by G. O. Bachman and E. H. Baltz, Jr. These occurrences of uranium were studied to determine geologic control of uranium concentration.

The map area is located about 12 miles north of the village of Datil (fig. 1) from which it is readily accessible by dirt roads. Relief in the map area is moderate and elevations range from approximately 7,500 feet to 9,000 feet. Much of the area is covered by juniper and piñon pine in the lower elevations and Ponderosa pine in the upper elevations; however, exposures of rock are fair to good. Streams are intermittent and drainage is part of the network of Alamosa Creek which flows to the east and northeast out of the map area.

The area of the geologic map (fig. 2) includes Tps. 1 and 2 N., Rs. 10 and 11 W., and the two southern tiers of sections in T. 3 N., Rs. 10 and 11 W. All known occurrences of uranium in the map area were examined and an effort was made to determine the extent of these occurrences of uranium along surface exposures. In addition numerous other occurrences of uranium outside the map area were examined (fig. 1). Exposures were tested for radioactivity with Geiger-Mueller counters and portable scintillation counters.

GEOLOGY

Sedimentary rocks

Four formations are exposed along the northern edge of the Datil Mountains in the area studied. They are the Crevasse Canyon formation and Point Lookout(?) sandstone of the Mesaverde group of Late Cretaceous age; the Baca formation of Eocene(?) age; and the Datil formation of Miocene(?) age. Classification of Cretaceous rocks follows the

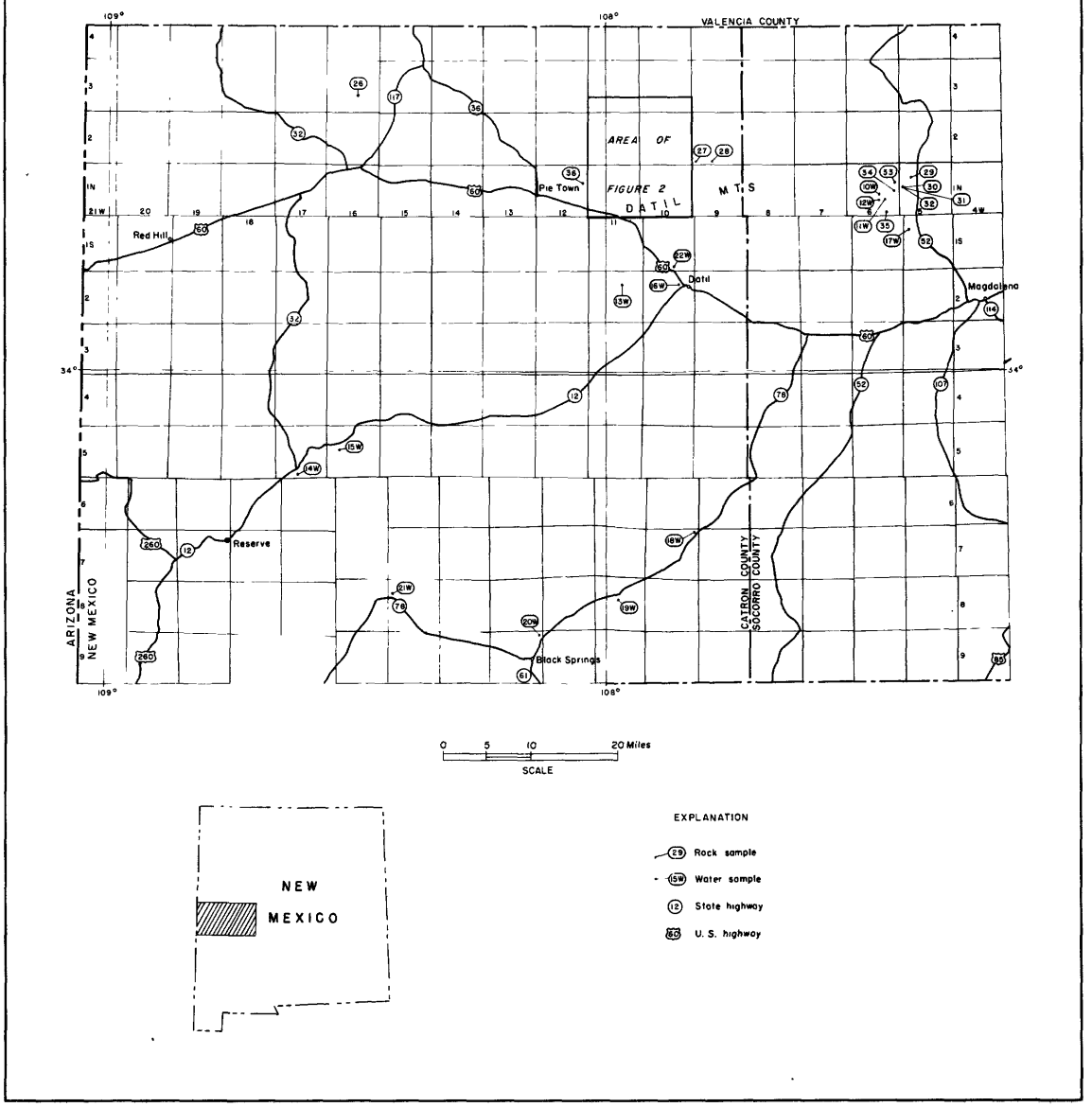


FIGURE 1-INDEX MAP SHOWING LOCATION OF MAPPED AREA AND OTHER LOCALITIES EXAMINED

recent revision of nomenclature proposed by Dane, Wanek, and Reeside (1957, p. 181-196).

Crevasse Canyon formation

The Crevasse Canyon formation crops out across the northern one-quarter to one-third of the area mapped. The formation consists of alternating sandstone and shale. The sandstone beds are light gray, weathering to buff and reddish-tan, and vary from thin-bedded to massive. They are commonly lenticular and individual beds are not persistent for more than one to three miles. Cross-lamination is common. The sandstones are relatively clean, well-sorted, and composed chiefly of fine- to medium-grained, sub-round to round quartz. The shales are gray, greenish-gray, or black and are commonly carbonaceous. Carbonized fossil wood is common in many beds, ranging in size from tiny fragments to small twigs and logs. Thin coal beds are present at places.

Point Lookout(?) sandstone

The Point Lookout(?) sandstone crops out south of the Crevasse Canyon formation in an irregular but continuous northwest-trending band. The Point Lookout(?) forms the cap rock of several buttes, mesas, and cuestas which are the physiographically highest features in the northern part of the area. The sandstone is composed of fine- to coarse-grained sub-round to round quartz and a small amount of dark minerals. In the northeast corner of T. 2 N., R. 11 W., and in the northwest corner of T. 2 N., R. 10 W., the Point Lookout(?) forms two massive

sandstone ledges separated by a thin shale bed and attains a maximum thickness of about 100 feet. In the map area the Point Lookout(?) thins toward the south and southeast, and in secs. 18, 19, and 20, T. 2 N., R. 10 W., it interfingers with shale beds and splits into several smaller sandstone tongues. Bedding in the Point Lookout(?) sandstone is highly irregular at places in the southernmost exposures but becomes more regular to the northeast. Intraformational channeling, lenses of carbonaceous shale, and fossil logs are common in the lower part of the formation but much less common in higher beds. The Point Lookout(?) sandstone of the map area is believed to have been deposited as beach and near-shore marine deposits. Rapid southwestward thinning and interfingering with beds of the Crevasse Canyon formation may indicate that the depositional edge of the Point Lookout(?) is not far to the southwest of the present area of outcrop.

In the east-central part of sec. 19, T. 2 N., R. 10 W., the thinned Point Lookout(?) sandstone is overlain by a thin sequence of olive- to greenish-gray siltstone, fine sandstone and shale which is truncated by overlying beds of the Baca formation. Lithology of these beds is believed to indicate marine origin.

Baca formation

The Baca formation was named for exposures in Baca Canyon in the Bear Mountains about 30 miles to the east of the map area (Wilpolt, and others, 1946). There, and at points in the Rio Grande Valley to the east of Socorro (Wilpolt, and others, 1951), the Baca formation is highly conglomeratic. In the map area the Baca formation is generally finer grained than at the type locality.

In the map area the Baca formation consists of sandstone, siltstone, and shale. Most of the sandstones are lenticular in form, cross-laminated, and rather friable. The dark red color of many of the siltstone and shale beds is one of the most distinctive characteristics of the formation. In the eastern part of T. 1 N., R. 10 W. a channel-fill at the base of the formation is composed of coarse conglomerate.

Sandstone beds are tan to salmon-pink in color, medium- to coarse-grained, and are composed of angular to subangular fragments. Fresh feldspars, mica flakes, and heavy minerals make up a high percentage of the rocks. The shale and siltstone beds are mostly salmon-pink to dark red with only a few interbeds of gray shale. Carbonaceous material is locally abundant in association with the gray shale interbeds or as detritus in sandstone lenses but is sparse elsewhere in the formation.

Near the top of the Baca formation in the map area pebble conglomerate has been observed. The pebbles are well-rounded and consist chiefly of quartzite. In the map area no volcanic detritus was noted in the Baca formation. However, to the west of the map area such volcanic material

[illegible] present

At places in the area a sequence of light gray to tan lenticular channel sandstones and interbedded carbonaceous shale occurs beneath typical pink and red Baca beds and above the Point Lookout(?) sandstone and associated shale beds. This sequence ranges in thickness from 0 to 100 feet. The sandstones are medium-grained and contain a high percentage of well-rounded quartz grains. They differ from sandstone of the Point Lookout(?) in that they are coarser grained, contain a higher percentage of angular fragments and heavy minerals, are more friable, and are highly lenticular. The sandstones differ from overlying beds of the Baca formation mainly in color. Shale beds in this portion of the stratigraphic section are usually gray with only occasional dark red lenses. The channel sandstone sequence rests with erosional unconformity on the Point Lookout(?) sandstone, and, in the canyon west of the Red Basin claims (SW 1/4 NW 1/4 sec. 20, T. 2 N., R. 10 W.), an angular unconformity of about 10 degrees is clearly observable between the white channel sandstone and shale and sandstones of the Point Lookout(?). The channel sandstone sequence appears to be conformable with overlying pink beds of the Baca formation and thus is believed to represent a local basal sequence of the Baca composed of reworked Mesaverde sediments.

In the Rio Grande Valley the Baca formation ranges from 80 to 1,023 feet thick (Wilpolt, and others, 1951) and in the Bear Mountains to the east of the map area it is 694 feet thick (Wilpolt, and others, 1946). In the map area the Baca formation has been examined at numerous localities, but a

complete stratigraphic section has not been measured. In Tps. 1 and 2 N., R. 11 W., it is estimated to be 1,500 feet thick.

The Baca formation in the Rio Grande Valley is believed to be of Eocene age (Wilpolt, and others, 1951). In the Datil Mountains no fossil evidence has been found.

Datil formation

The Datil formation was named and described briefly by Winchester (1920, p. 9-10). It consists of gray to purple tuff, gray to tan welded tuff, and other pyroclastics. In places the welded tuff stands out as prominent cliffs. The composition of the Datil formation ranges from rhyolite to quartz latite and may include some material as mafic as andesite. In the map area no shale was noted in the Datil formation; however, to the east and to the west of the map area some shale may be present. The relationships of the Datil formation outside the map area have not been studied in detail and its age is in question. Miocene(?) age has been assumed by some authors (Wilpolt, and others, 1951).

In the map area the basal contact of the Datil formation with the underlying Baca formation is sharp at most places and is drawn at the lowest occurrence of volcanic material. Occasionally, however, the red colors of the Baca formation carry upward for several feet into the Datil formation. To the west of the map area the admixture of Baca-like sediments and volcanic material becomes more complex and detailed studies in that region will be necessary to determine the relationship of the two formations.

In the map area the Datil formation rests with apparent structural conformity on the Baca formation. About 10 miles east of the map area the Datil formation rests unconformably on the Mesaverde group. The top of the Datil formation is eroded in the map area, but a thickness of at least 1,500 feet is preserved. Vents from which the pyroclastics of the Datil formation were extruded are present in the higher parts of the Datil Mountains in the southern part of the mapped area (fig. 2). No attempt was made to map individual vents or extrusive centers, but their presence is indicated in several places by bedding steeply inclined away from all sides of a central area. Many of the extrusive centers form hills above the general topographic level of the Datil Mountains. One of these centers is well displayed in the NW 1/4 T. 1 N., R. 11 W., in the southwestern part of the mapped area. These centers of volcanic activity in the Datil Mountains are alined in a broad east-trending band from just west of the mapped area to northwest of Magdalena.

Pediment gravel and alluvium

Pediment gravel of Quaternary age is present on the summits of the highest hills in the south part of the map area. The gravel is on a conspicuous topographic surface which slopes to the north from the Datil Mountains. The gravel consists of quartzite pebbles reworked from the Baca formation and pebbles and boulders of volcanic rock which have been reworked from the Datil formation.

Alluvial sand, silt, and clay deposits of Quaternary age are present in arroyo bottoms and along the valley flats of larger streams.

Igneous rocks

In addition to volcanic rocks of the Datil formation, igneous rocks are exposed in the map area as dikes. In T. 2 N., R. 11 W., a prominent dike which trends northwest is exposed. This dike is approximately 20 feet wide and is nearly vertical. It has been intruded along a normal fault in Baca and Mesaverde rocks. The dike rock is basaltic in composition. A dike of similar composition has been intruded into the Baca formation in secs. 17 and 18, T. 1 N., R. 10 W.

The relationship of these dikes to igneous rocks in the Datil formation is not known. The dikes are post-Baca and therefore of Tertiary or Quaternary age.

Geologic structure

The geologic structure of the map area is simple. The regional dip ranges from one to six degrees to the southwest and averages about three degrees. At places there are gentle folds whose axes trend roughly parallel to the direction of regional dip. Several synclines were noted in the vicinity of uranium deposits, and the axes of some of these synclines were mapped (fig. 2) where they were of sufficient length to be shown at the map scale.

In general, faults are not common within the map area. A few normal faults were mapped; however, their displacement does not exceed 50 to 100 feet. The conspicuous dike in T. 2 N., R. 11 W., has been intruded along a nearly vertical fault which cuts Baca and Mesaverde rocks.

Occurrences of uranium

Occurrences of uranium have been reported in an east-trending belt through the map area which extends for a distance of about 60 miles along the northern edge of the Datil Mountains. At present all known occurrences of uranium are confined to the Baca formation and the Point Lookout(?) sandstone. A uranium-bearing mineral (probably tyuyamunite or carnotite) was observed in some prospects, but at many prospects radioactivity occurs but no uranium minerals are visible. At such localities it is assumed that uranium is disseminated and cannot be discerned by the unaided eye or that the uranium minerals are obscured by other more dominant coloration. Analytical data showing uranium and vanadium oxide content of 36 rock samples collected from the report area are shown in table 1.

Where uranium is present in this area it is usually, if not always, associated with carbonaceous material. Fragments of detrital carbon are present with the uranium in sandstone, and carbonized fossil plant material ranging in size from twigs to logs is present in the gray shale associated with uranium. This relationship indicates that the environment suitable for the preservation of carbon is also favorable for the deposition of uranium.

All the known occurrences of uranium in the map area were examined and an effort was made to trace the mineralized rock on the surface. At three localities within the map area detailed studies were made of uranium deposits in an attempt to determine the geologic controls of uranium deposition. All other localities indicated on figure 1 were examined, but no detailed studies were made. The detailed studies of prospects in the map

(Text continued on page 24.)

Table 1.--Analyses of rock samples.

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
		Rock samples from mapped area (fig. 2) in Catron County				
1	139637	12-2N-11W	0.015	0.004	0.34	Channel sample of the lower 1 foot of a 5-foot bed of bluish-gray shale in the Point Lookout(?) sandstone exposed in a bulldozer pit.
2	139638	12-2N-11W	.13	.14	.28	Channel sample of the upper 2 feet of a sandstone bed containing carbonaceous material in the Point Lookout(?) sandstone. This sandstone, exposed in the bottom of a bulldozer pit, underlies the shale of sample 1.
3	139639	12-2N-11W	.10	.009	.322	Channel sample of a 1-foot bed of thinly bedded sandstone in the Point Lookout(?) sandstone. The bed, containing carbonaceous material, is exposed in a bulldozer pit.
4	215704	11-2N-11W	.36	.33	.76	Grab sample of a bed of gray sandy shale containing carbonaceous material in the Point Lookout(?) sandstone. This bed is 0 to 2 feet thick.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
	Rock samples from mapped area (fig. 2) in Catron County--Continued					
5	215712	11-2N-11W	0.10	0.061	0.12	Grab sample of the upper 3 feet of a poorly exposed bed of white sandstone in the Point Lookout(?) sandstone.
6	201449	11-2N-11W	.074	.004	---	Channel sample of a lens of sandstone containing carbonaceous material in the Point Lookout(?) sandstone. Sampled where the lens is 1 foot thick.
7	201454	14-2N-11W	.062	.056	---	Selected sample of the lower three inches of sandstone bed in the Point Lookout(?) sandstone. The bed contains carbonaceous material.
8	201447	14-2N-11W	.056	.042	---	Selected sample of the lower 1 inch of a sandstone bed resting on black shale in the Point Lookout(?) sandstone.
9	201448	14-2N-11W	.003	.0017	---	Grab sample of the upper 2 feet of black shale immediately below sample 8.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
	Rock samples from mapped area (fig. 2) in Catron County--Continued					
10	201440	19-2N-10W	0.016	0.022	---	Grab sample of the lower 8 inches of a sandstone bed in the Point Lookout(?) sandstone. The sandstone contains shale pellets.
11	201441	19-2N-10W	.051	.019	---	Selected sample of the lower 2 inches of a sandstone bed in the Point Lookout(?) sandstone.
12	201442	19-2N-10W	.025	.004	---	Limonite deposited along the bedding plane immediately below sample 13.
13	201443	19-2N-10W	.005	.002	---	Grab sample of the upper 1 foot of black shale underlying sample 14.
14	139956	19-2N-10W	.040	.012	---	Grab sample of the lower 1 foot of an 18-foot bed of Baca sandstone. Pebbles and clay pellets are present in the base of the sandstone.
15	215710	19-2N-10W	1.6	2.31	1.64	Grab sample from a stock pile of ore at Red Basin mine.
16	205706	19-2N-10W	.19	.27	.37	Drill cuttings from the depth 47.5-50.0 feet in a drill hole in the Baca formation about 500 feet southeast of the Red Basin mine.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
	Rock samples from mapped area (fig. 2) in Catron County--Continued					
17	215707	19-2N-10W	0.71	1.05	0.21	Drill cuttings from the depth 67.5-70.0 feet in a drill hole in the Baca formation about 700 feet southeast of the Red Basin mine.
18	215709	20-2N-10W	.25	.40	.32	Drill cuttings from the depth 36-37 feet in a drill hole in the Baca formation about 800 feet east of the Red Basin mine.
19	215715	20 or 21-2N-10W	.081	.12	---	Drill cuttings from the depth 20-22.5 feet in a drill hole.
20	201444	21-2N-10W	.004	.002	---	Grab sample of sandstone in the Point Lookout(?) sandstone. The sandstone contains pieces of carbonized wood.
21	201439	27-2N-10W	.013	.011	---	Grab sample of the lower 6 inches of a sandstone bed in the Point Lookout(?) sandstone.
22	139636	27-2N-10W	.10	.14	.005	Grab sample of a 4 to 6-inch zone of mineralization in a poorly exposed sandstone bed in the Point Lookout(?) sandstone.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
	Rock samples from mapped area (fig. 2) in Catron County--Continued					
23	201446	27-2N-10W	0.095	0.017	---	Selected sample of the lower 1 inch of a sandstone bed in the Point Lookout(?) sandstone. The sandstone sample, from directly above black shale, includes a crust of limonite deposited along the bedding plane between the sandstone and shale. The limonite contains a yellow uranium mineral.
24	201445	27-2N-10W	.023	.026	---	Grab sample of the lower 4 inches of a sandstone bed in the Point Lookout(?) sandstone. The sandstone rests on black shale.
25	215708	35-2N-10W	.009	.005	.14	Grab sample of the lower 3 inches of a sandstone bed in the Point Lookout(?) sandstone. The sandstone rests on black shale.
	Rock samples from Socorro and Catron Counties outside mapped area					
26	215699	22-3N-16W Catron County	.044	.053	.1	Grab sample of a 3-inch bed of gray sandy shale containing carbonaceous material in the Mesaverde group.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
		Rock samples from Socorro and Catron Counties outside mapped area--Continued				
27	139640	31-2N-9W Catron County	0.025	0.029	0.074	Grab sample of a 3 to 6-inch zone of black sandstone within a thick bed of massive gray sandstone in the Baca formation.
28	215703	31-2N-9W Catron County	.054	.026	.1	Grab sample of the lower 3 inches of a sandstone bed in the Mesaverde group. The sandstone rests on gray shale.
29	215720	8-1N-5W Socorro County	.004	.001	---	Grab sample of rhyolitic tuff in the Datil formation.
30	215701	18-1N-5W Socorro County	.14	.26	.1	Grab sample of a 2-foot bed of white sandstone about 50 feet above the base of the Baca formation.
31	215721	NW 1/4 18-1N-5W Socorro County	.001	---	---	Channel sample of a 30-inch coal bed at an abandoned coal mine.
32	215700	18-1N-5W Socorro County	.63	.31	.1	Channel sample of a 2-foot zone of mineralization in a poorly exposed bed of light gray sandstone in the Baca formation. The sandstone contains carbonaceous material.

Table 1.--Analyses of rock samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Equivalent uranium (percent)	Chemical uranium (percent)	Chemical V_2O_5 (percent)	Description
		Rock samples from Socorro and Catron Counties outside mapped area.--Continued				
33	215711	13-1N-6W Socorro County	2.0	3.27	9.21	Channel sample of a 1-foot zone of mineralization in light gray sandstone in the Baca formation. The dark colored mineralized portion of the bed contains a yellow uranium mineral.
34	215705	24-1N-6W Socorro County	.24	.19	2.98	Grab sample of a 2-foot zone of mineralization in light gray sandstone in the Baca formation. The sandstone contains carbonaceous material.
35	215705	35-1N-6W Socorro County	.13	.036	.1	Grab sample of a 1-foot zone of mineralization in a sandstone bed in the Baca formation. The sandstone contains carbonaceous material.
36	139462	12(?)-1N-12W Catron County	.002	.006	---	Grab sample of tuff in the Datil formation.

area suggest that uranium concentration was effected by ground water and that deposition of the uranium was controlled by changes in permeability and by minor structural warping.

Red Basin claims

Uranium occurs in the NE 1/4 sec. 19, and the NW 1/4 sec. 20, T. 2 N., R. 10 W. Two claims at this locality have been named the "Red Basin claims" and this name is applied to the locality for reference in this report. A plane table map (fig. 3) was made of the Red Basin claims locality, and a study was made of the uranium occurrence in this small area.

Uranium occurs at the base of a light gray sandstone which is believed to be the basal sandstone of the Baca formation at this locality. It was assigned to the Baca formation after careful lateral tracing into more typical Baca sediments and on the basis of an angular unconformity with the underlying units. The sandstone is light gray, except where mineralized, and is fine- to medium-grained. It is composed chiefly of quartz grains which are thought to be reworked from sandstones of the Mesaverde group. Some mica flakes and rock fragments are present in the sandstone. Where mineralized the sandstone is dark gray to brown and much ferruginous material is disseminated with the uranium. Some of the darker color is thought to be caused by stain from vanadium minerals. Detrital carbonaceous material was noted in association with the uranium.

The basal sandstone of the Baca formation in the vicinity of the Red Basin claims is of lenticular cross-section and has wedge-shaped edges. It is overlain by other lenticular sandstone and shale beds which appear to fill an ancient stream channel. At the large prospect pit near the center of the area of figure 3 the basal sandstone wedges out toward the southwest (fig. 4). The wedge-edge is confined between gray shale of the Mesaverde group below and a gray shale in the Baca formation above. South of the main prospect pit the basal sandstone is covered by higher Baca beds and position of the west edge is inferred on the basis of cuttings from drill holes in the vicinity.

About 1,400 feet east of the prospect pit, two small outliers of the basal sandstone thin rapidly toward the east and wedge out near the eastern side of the map area. Angular unconformity between the shale and sandstone beds at the top of the Point Lookout(?) and the larger outlier of the basal Baca sandstone can be observed on the east side of the small canyon in the northeast part of the area of figure 3. Approximate positions of wedge-out of the east and west edges of the basal sandstone are shown on figure 3. Position of the eastern edge is partly restored in areas where the sandstone has been eroded.

The sandstone was probably deposited in a stream channel cut in the underlying Point Lookout(?) beds. The rocks have been tilted to the southwest so that the southwest edge of the channel, which contains the mineral deposits, is now topographically lower than the northeast edge.

Fig. 4 - Western wedge-edge of basal sandstone of Baca formation, Red Basin claims.

It is believed that ground water carried uranium in solution into the basal sandstone of the Baca formation and that the uranium was deposited where this aquifer wedges out between the enclosing shales. Outcrops of rocks above and below the basal sandstone of the Baca formation have not been observed to be radioactive in this area. However, a shale at the top of the Point Lookout(?) which underlies the basal sandstone of the Baca formation is mildly radioactive at some localities. All radioactivity detected in this shale is present at the contact of the shale with the overlying Baca formation. Covered slopes do not permit close observation of other rock types in the Mesaverde group which may be in unconformable contact with the basal sandstone of the Baca formation.

Two truck loads of uranium-bearing sandstone had been shipped from the Red Basin area at the time of the field investigation in 1954. They averaged 0.24 percent uranium and approximately 0.3 percent vanadium. Approximately 10 to 15 tons of ore had been stock-piled preparatory to shipping. Some drilling had been done in this area as indicated on the map (fig. 3); however, most of the results of the drilling were not available.

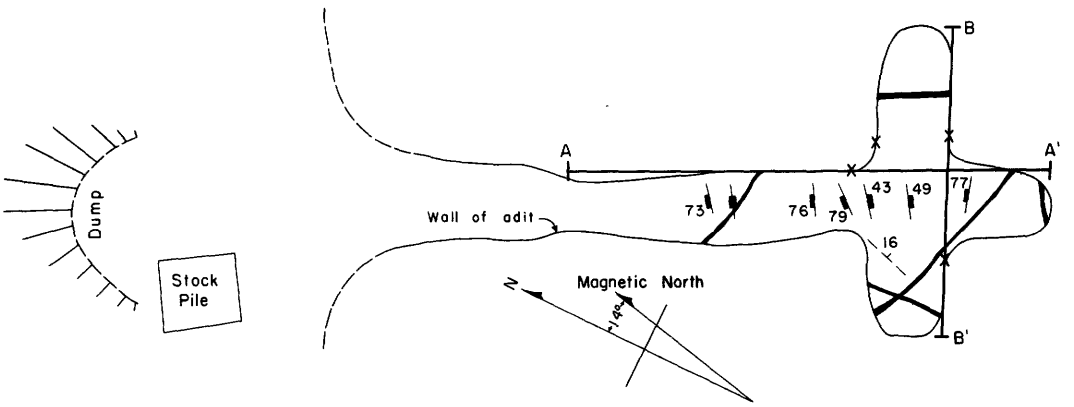
Since the field work was completed for this report some additional drilling has been done in the area of the Red Basin claims. According to information obtained from the Division of Raw Materials of the Atomic Energy Commission, a body of uranium-bearing rock was discovered as a result of this drilling. The body is thought to contain several thousand tons of rock averaging about 0.15 percent uranium with some vanadium.

Adit, S 1/2 NE 1/4 sec. 14, T. 2 N., R. 11 W.

A study was made of the geologic features exposed in an adit about 500 yards northeast of the McPhaul Ranch headquarters (fig. 5), where uranium occurs in the lower part of the Point Lookout(?) sandstone. Equivalent uranium content was estimated on the basis of Geiger-counter readings.

It was determined that uranium is concentrated in a ferruginous zone which ranges from a fraction of an inch to about three inches. The ferruginous zone is located at the contact of the Point Lookout(?) sandstone with underlying shale of the Crevasse Canyon formation, and it represents the lower level of free ground water movement within the sandstone bed. Downward into the relatively impermeable shale radioactivity decreases rapidly.

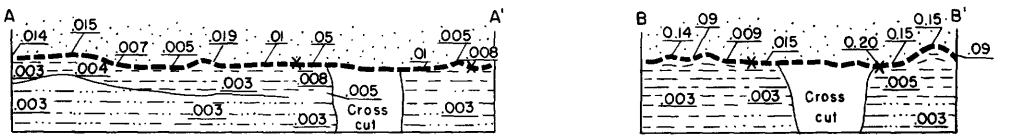
Along the ferruginous zone there is usually a rise in radioactivity with the presence of carbonaceous material. This relationship was noted especially in the vicinity of carbonized fossil logs and in carbonaceous clay which has been compressed into space formerly occupied by logs. There is no indication that radioactivity is associated with joints. However, there is a suggestion that increased radioactivity is associated in some places with planes of cross-bedding in the Point Lookout(?) along lines where these planes intersect the contact with shale of the Crevasse Canyon formation.



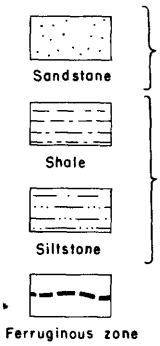
EXPLANATION OF PLAN

Geologic structures observed in roof. Plane of projection approximates contact of roof sandstone (Point Lookout? sandstone) and underlying shale (Crevasse Canyon formation).

- 73 — Dip and strike of joint
- Vertical joint
- 16 — Dip and strike of cross-bedding
- Carbonized fossil log, or clay squeezed into space formerly occupied by log at base of roof sandstone
- Intersection of cross bed in roof sandstone with ferruginous zone at contact of roof sandstone and underlying shale
- A — A' Line of cross section shown below



EXPLANATION OF CROSS SECTIONS



.005 Estimated percent equivalent uranium based on Geiger-counter readings

Intersection of cross bed in roof sandstone with ferruginous zone

Walls of adit projected to plane of vertical sections A-A' and B-B'

0 10 20 Feet

Scale (Horizontal and Vertical)

G.O.Bachman and E.H.Baltz, Jr.

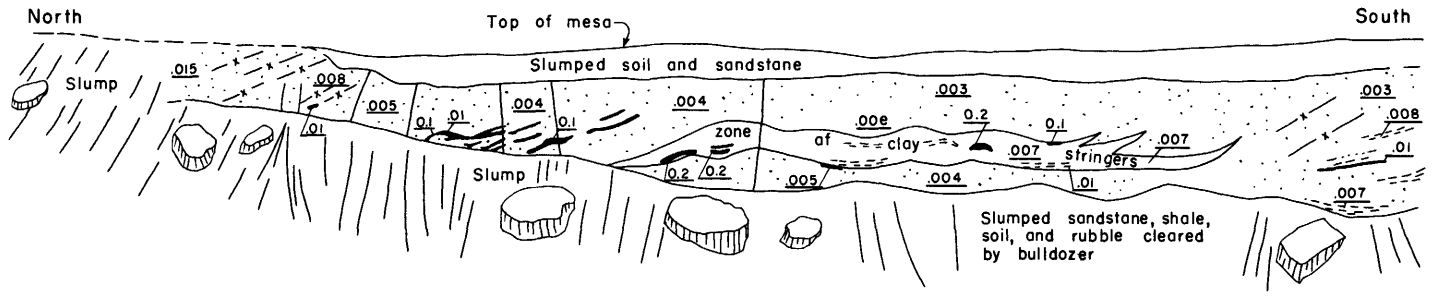
Fig. 5. PLAN AND CROSS SECTIONS OF ADIT
S ½, NE ¼, Sec. 14, T. 2N., R. 11W.

The adit is situated within a small, shallow syncline (fig. 2) about 150 feet west of the axis of the syncline. A normal fault having 10 to 20 feet of displacement is located about 150 feet west of the adit. The syncline lies on the downthrown side of the fault and drag has slightly accentuated dips along the west limb of the syncline. No evidence could be found which associated the uranium mineralization directly with the fault. The minor syncline seems to have served as a trough down which uranium-bearing solutions circulated in permeable sandstone of the Point Lookout(?) above impermeable shale of the Crevasse Canyon formation.

Exposure in E 1/2 sec. 11, T. 2 N., R. 11 W.

An examination was made of geologic features at a prospect in the E 1/2 sec. 11, T. 2 N., R. 11 W. (fig. 6). The prospect is located on a west-facing cliff of sandstone immediately below the top of a mesa. Workings consist of a nearly vertical face more than 100 feet long and 5 to 12 feet high. The sandstone, in the upper part of the Point Lookout(?) sandstone, is strongly cross-bedded and contains a zone of clay beds, or "stringers." Thin lenses of carbonaceous shale and compacted carbonized fossil logs occur in the zone of clay beds and along bedding planes in the sandstone.

Estimates of percentage of equivalent uranium were based on Geiger counter readings. Highest radioactivity is associated with lenses of carbonaceous material. A yellow uranium mineral was observed on



EXPLANATION

Sandstone

Clay

Carbonaceous material

.004 Estimated percent equivalent uranium

Cross bedding

Joint

0 10 20 Feet

Scale (Horizontal and Vertical)

G.O.Bachman and E.H.Baltz,Jr.

FIGURE 6–DIAGRAM OF EXPOSURE IN E ½, SEC.11, T. 2 N., R.11W., SHOWING RELATIONSHIP OF URANIUM CONCENTRATION TO SEDIMENTARY STRUCTURES IN UPPER PART OF POINT LOOKOUT (?) SANDSTONE

the weathered portion of several lenses of carbonaceous shale and carbonized fossil logs. Radioactivity slightly above background was detected at places in the sandstone. Uranium of possible economic value (0.1 percent or greater) is very limited in occurrence, and is restricted entirely to thin discontinuous lenses of carbonaceous material. A grab sample (no. 4) of gray carbonaceous sandy shale collected at this locality contains 0.33 percent uranium and 0.76 percent vanadium oxide. A grab sample of sandstone (no. 5) contains 0.061 percent uranium and 0.12 percent vanadium oxide.

The axis of a minor north-trending syncline is in the canyon immediately west of this locality (fig. 2). This syncline may have influenced circulation of uranium-bearing solutions through the Point Lookout(?) sandstone.

Water samples

Nine water samples were collected from the mapped area, and thirteen water samples were collected outside the mapped area. (See table 2.) Only four of the water samples contained 0.02 parts per million or more uranium.

Table 2.--Analyses of water samples.

Sample number	Laboratory serial number	Location sec., T., R.	Uranium (ppm)	pH	Description
	Water samples from the mapped area (fig. 2) in Catron County				
1W	201450	14-2N-11W	0.022	---	Water sample from the well at the McPhaul ranch headquarters. The well obtains water from the Point Lookout(?) sandstone.
2W	215060	27-2N-11W	.002	7.9	Water sample from a well. The well obtains water from the Baca formation.
3W	222165	15-2N-10W	.023	8.3	Water sample from a well. The well obtains water from Quaternary alluvium or from the Crevasse Canyon formation of the Mesaverde group.
4W	215047	21-2N-10W	.001	7.8	Water sample from a well. The well obtains water from the Crevasse Canyon formation of the Mesaverde group.
5W	222167	25-2N-10W	.002	8.2	Water sample from a spring. The spring emerges from the Crevasse Canyon formation of the Mesaverde group.

Table 2.--Analyses of water samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Uranium (ppm)	pH	Description
	Water samples from the mapped area (fig. 2) in Catron County--Continued				
6W	201451	34-2N-10W	0.036	--	Water sample from a well. The well obtains water from the Point Lookout (?) sandstone of the Mesaverde group.
7W	222164	34-1N-11W	.020	7.9	Water sample from a well. The well apparently obtains water from the Baca formation.
8W	222160	25-1N-10W	.002	8.2	Water sample from Blue Spring. The spring emerges from tuff in the Datil formation.
9W	215061	30-1N-10W	.001	9.3	Water sample from Davenport spring. The spring emerges from tuff in the Datil formation.
	Water samples from Socorro and Catron Counties outside the mapped area				
10W	215048	22-1N-6W Socorro County	.003	7.7	Water sample from a spring which emerges from the Baca formation.
11W	215049	26-1N-6W Socorro County	.002	7.5	Water sample from a spring which emerges from the Datil formation.

Table 2.--Analyses of water samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Uranium (ppm)	pH	Description
	Water samples from Socorro and Catron Counties outside the mapped area--Continued				
12W	215050	27-1N-6W Socorro County	0.003	7.8	Water sample from Dove Spring which emerges from the Datil formation.
13W	215051	10-2S-11W Catron County	.001	7.6	Water sample from Hidden Spring which emerges from the Datil formation.
14W	215052	33-5S-17W Catron County	.001	7.6	Water sample from Apache Creek.
15W	215053	17-5S-16W Catron County	.001	7.6	Water sample from Tularosa Creek.
16W	215054	11-2S-10W Catron County	.004	7.8	Water sample from a well. The well obtains water from the Datil formation.
17W	215055	7-1S-5W Socorro County	.003	7.8	Water sample from a well. The well is reported to be 2,000 feet deep and may obtain water from the base of the Datil formation.
18W	215056	1-7S-10W Catron County	.003	9.0	Water sample from a well.

Table 2.--Analyses of water samples.--Continued

Sample number	Laboratory serial number	Location sec., T., R.	Uranium (ppm)	pH	Description
	Water samples from Socorro and Catron Counties outside the mapped area--Continued				
19W	215057	16-8S-11W Catron County	0.002	8.1	Water sample from a well. The well probably obtains water from acidic tuff.
20W	215058	1-9S-13W Catron County	.001	8.0	Water sample from a well. The well probably obtains water from acidic tuff.
21W	215059	7-8S-15W Catron County	.001	8.0	Water sample from a well.
22W	222163	34-1S-10W Catron County	.001	7.8	Water sample from a well. The well obtains water from the Datil formation.

The nine samples from the mapped area were collected from wells and springs found in the area. Four of the samples (1W, 3W, 6W, and 7W) contained from 0.020 to 0.036 parts per million of uranium. Sample 1W, containing 0.022 parts per million, was collected from a shallow well at the McPhaul Ranch. The well obtains its water from the Point Lookout(?) sandstone, near a locality where this sandstone contains deposits of uranium minerals. Sample 3W contained 0.023 parts per million and was taken from a shallow well in the outcrop belt of the Crevasse Canyon formation. This well, however, may obtain its water from Quaternary alluvium, and the dissolved uranium may have been leached from minerals in the Point Lookout(?) sandstone which crops out a short distance to the south. Sample 6W contained 0.036 parts per million and was collected at a well which definitely obtains water from the Point Lookout(?). This well is down-dip from deposits of uranium minerals in the Point Lookout(?). Sample 7W, containing 0.020 parts per million, is from a well in the outcrop belt of the Datil formation, but it is believed that the well extends into the underlying Baca formation, and that the water is derived from the upper part of the Baca.

The thirteen water samples from outside the mapped area (fig. 1) were collected at random from wells, springs, and streams. None of these samples contained significant uranium.

Origin of uranium

Griggs (1954, p. 5) has suggested that descending meteoric waters may have leached uranium from volcanic rocks of the Datil formation and deposited it at the present locations. No attempt was made in this investigation to determine the origin of the uranium in the Datil area. Detailed mapping to the east of the map area where the Datil formation rests unconformably on the Mesaverde group may provide definite evidence bearing on origin.

Areas recommended for future prospecting

The Red Basin area (fig. 3) has not been prospected completely and more drilling in the area might locate additional ore. An effort should be made to determine by drilling the precise limits of the basal channel sandstone of the Baca formation which is uranium-bearing in that area.

A few miles to the east of the map area the Datil formation rests unconformably on the Mesaverde group. Prospecting along the Datil-Mesaverde contact in that area might disclose other uranium deposits. Particular attention should be given to structural troughs, the occurrence of carbonaceous material, and changes in porosity and permeability of the rocks.

To the west of the map area for a distance of at least 60 miles is a sequence of rocks similar to that described here. Although the stratigraphy of those rocks is not well understood, prospecting near the exposures of volcanic rocks appears to be warranted.

BIBLIOGRAPHY

Beaumont, E. C., Dane, C. H., and Sears, J. D., 1956, Revised nomenclature of Mesaverde group in San Juan Basin, New Mexico: Am. Assoc. Petroleum Geologists Bull., v. 40, no. 9, p. 2149-2162.

Dane, C. H., Wanek, A. A., and Reeside, J. B., Jr., 1957, Reinterpretation of section of Cretaceous rocks in Alamosa Creek valley area, Catron and Socorro Counties, New Mexico: Am. Assoc. Petroleum Geologists Bull., v. 91, p. 181-196.

Griggs, R. L., 1954, A reconnaissance for uranium in New Mexico, 1953: U. S. Geol. Survey Circ. 354, 9 p.

Pike, W. S., Jr., 1947, Intertonguing marine and nonmarine Upper Cretaceous deposits of New Mexico, Arizona, and southwestern Colorado: Geol. Soc. America Mem. 24, 103 p.

Wilpolt, R. H., MacAlpin, A. J., Bates, R. L., and Vorbe, Georges, 1946, Geologic map and stratigraphic sections of Paleozoic rocks of Joyita Hills, Los Piños Mountains, and northern Chupadera Mesa, Valencia, Torrance, and Socorro Counties, New Mexico: U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 61.

Wilpolt, R. H., MacAlpin, A. J., Zapp, A. D., Wanek, A. A., and Bates, R. L., 1951, Geology of the region from Socorro and San Antonio east to Chupadera Mesa, Socorro County, New Mexico: U. S. Geol. Survey Oil and Gas Inv. Map 121.

Winchester, D. E., 1920, Geology of the Alamosa Creek valley, Socorro County, New Mexico, with special reference to the occurrence of oil and gas: U. S. Geol. Survey Bull. 716, Pt. II, p. 1-15 (1921).