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William L. Chenoweth

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URANIUM OCCURRENCES OF THE NACIMIENTO-JEMEZ REGION, SANDOVAL AND RIO ARRIBA COUNTIES, NEW MEXICO*

by

WILLIAM L. CHENOWETH
U.S. Atomic Energy Commission
Grand J unction, Colorado

SUMMARY

Uranium in the Nacimiento-Jemez region of north-central New Mexico occurs in rocks of Pennsylvanian, Permian, Triassic, Jurassic, Cretaceous, and Tertiary age. Deposits consist of uranium minerals disseminated in sandstone, siltstone, carbonaceous shale, coal, and limestone and in association with carbonized plant debris in sandstone and in "red bed" copper deposits. Uranium minerals fill interstices of a silicified rhyolite breccia at a single occurrence. Known deposits are small and subeconomic. Slightly more than 600 tons of ore have been produced to date.

INTRODUCTION

The first report of uranium in New Mexico was made by Jones in 1904 in volcanic rocks of the Jemez Mountains. During the uranium boom of the 1950s the presence of visible uranium minerals in sedimentary rocks of the Nacimiento-Jemez region was brought to the attention of the Atomic Energy Commission (AEC) in 1952 by prospectors who were exploring the outcrops of the Chinle and Morrison Formations. Since the region was known to contain "red bed" copper deposits, which elsewhere contain uranium, these old copper mines and prospects were additional prospecting targets.

During the 1950s, the region was extensively prospected and numerous claims were located covering radioactive occurrences. The more promising occurrences were explored with pits, trenches, and short adits; a few prospects were drilled.

In the mid-1950s small shipments were made from a prospect in the Todilto Limestone, and from three prospects in the Abo Formation near Coyote, New Mexico, and from two prospects in the Abo Formation south of Gallina, New Mexico. Only those in the Coyote area proved to be of economic grade. Two small trial shipments from the Agua Zarca Sandstone Member of the Chinle Formation near Coyote were non-economic. At the same time, small shipments of ore-grade material were made from the Dakota Sandstone and Morrison Formation in the southwestern part of the region. In 1959, a few hundred tons of ore were mined from a deposit in the Morrison Formation in the same area. Economic reserves were not developed in the remaining deposits and activity in the area ceased.

Renewed interest for uranium in the late 1960s led to exploratory drilling down dip from the Morrison occurrences in southwestern and northeastern parts of the region. Although the results have not been disclosed, the lack of additional exploration suggests that no deposits of economic significance have been found in the southwest. Continued drilling for the past several years in the northeast suggests encouraging results.

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The AEC and the U.S. Geological Survey have carried on geological investigations in the region related to uranium. The U.S. Bureau of Mines also has investigated the area, but its work was restricted to copper. The AEC work was supplemented by airborne surveys which located numerous radioactive anomalies. AEC investigations have been summarized by Brown (1955), Brassfield (1956), Chenoweth (1957), and Kittleman and Chenoweth (1957). Geological Survey investigations, pertinent to uranium, include Baltz (1955), Lovering (1956), and Bachman and others (1959). Copper investigations of the Bureau of Mines are summarized by Soule (1956). Recent copper investigations by geologists of the University of New Mexico include Kaufman and others (1972) and Woodward and others (1974). The bulk of the information presented in this paper, including property names, is taken from preliminary reconnaissance reports prepared by the author and other AEC geologists who worked in the area. These reports have been placed on open file by the AEC.

GEOLOGIC SETTING

Occurrences containing 0.02 percent U_3O_8 or greater in the Nacimiento-Jemez region are known in the Madera Limestone; the Abo Formation; the Chinle Formation; the Todilto Limestone; the Morrison Formation; the Dakota Sandstone; the Mesaverde Group; the Ojo Alamo Sandstone; the San Jose Formation; and a rhyolite breccia. Ore-grade shipments have been limited to the Abo, Todilto, Morrison, and Dakota Formations. All localities mentioned in the text are shown on Figure 1.

Uranium in the Madera Limestone

Some radioactivity was detected in the Madera Limestone of Pennsylvanian age at the Pajarito Azul claims (locality 34), south of Gallina. No uranium minerals were observed in the radioactive zones which occur in a very coarse-grained, light-gray, arkosic sandstone containing carbonized plant debris and copper carbonates. Similar occurrences have been observed east of Cuba at the Mining Mountain claims (locality 43).

Uranium in the Abo Formation

The Abo Formation of Permian age contains more uranium occurrences in the Nacimiento-Jemez region than any other formation. North of latitude 36° N., Wood and Northrop (1946) arbitrarily assigned equivalents of the Abo to the lower part of the Cutler Formation. Brown (1955) recognized that the deposits south of Gallina occurred in a lithology typical of the Abo Formation to the south. Recent copper investigations (Kaufman and others, 1972) do not recognize the Cutler Formation in the Nacimiento region. For the purposes of this paper, all of the uranium occurrences in Permian rocks north of latitude 36° N. are considered to occur in the Abo Forma-

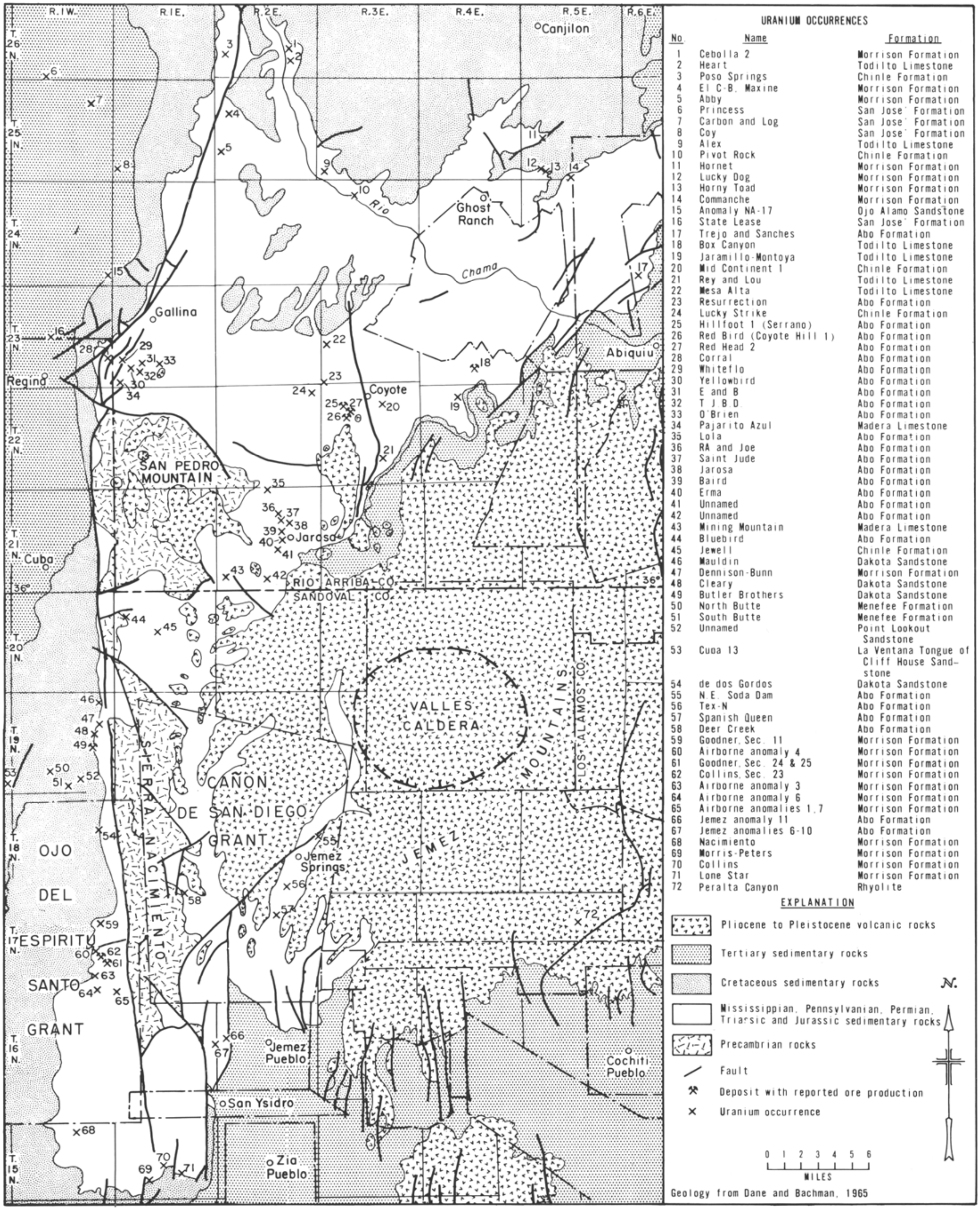

Figure 1. Generalized geologic map of the Nacimiento-Jemez region showing uranium occurrences.

tion. Deposits are clustered in five areas: near Coyote (localities 23, 25-27); south of Gallina (localities 28-33); near the Jarosa Forest Service cabin (localities 35-42); in the vicinity of Jemez Springs on the Canon de San Diego Grant (localities 55-58); and west of Jemez Pueblo (localities 66, 67). Single deposits are known southeast of Cuba (locality 44) and north of Abiquiu (locality 17). The deposits south of Gallina were studied by Brown (1955) and those on Jemez Indian lands were examined by Brassfield (1956).

Uranium in the Chinle Formation

In the region, uranium is known at six localities in the Chinle Formation of Triassic age. Two occurrences are near Coyote. Single occurrences are located north of Gallina, Coyote, and Abiquiu, respectively, and a single occurrence is located southeast of Cuba. The Lucky Strike property (locality 24), the Mid Continent 1 claim (locality 20), and the Jewell claims (locality 45) are in the Aqua Zarca Sandstone Member and are similar in that uranium occurs with carbonized plant debris and copper carbonates in medium- to coarse-grained, gray sandstone beds. Yellow uranium minerals have been observed. Small trial shipments in 1955 from the Mid Continent 1 and in 1957 from the Lucky Strike contained 0.05 percent and 0.07 percent U_3O_8, respectively.

North of Coyote at the Pivot Rock claims (locality 10), in the canyon of the Rio Chama, uranium occurs with carbonaceous plant debris in a coarse-grained sandstone and conglomerate in the top of the Agua Zarca, and in and around petrified logs and adjacent to thin limestone beds in the lower 15 feet of the overlying Salitral Shale Tongue.

North of Gallina at Poso Springs (locality 3) uranium occurs in the Poleo Sandstone Lentil(?) in association with carbonaceous plant debris and copper carbonates.

Inasmuch as the uranium in the Abo Formation is associated with copper, the relative lack of uranium in the Agua Zarca is surprising. The Agua Zarca contains the largest and most significant copper deposits in the region (Soule , 1956; Kaufman and others, 1972), yet a reconnaissance of these mines yielded only trace amounts of uranium, suggesting that the periods of copper and uranium mineralization were unrelated. Woodward and others (1974) place the time of the copper deposition shortly after the deposition of the Agua Zarca whereas the author believes the uranium is much younger.

Uranium in the Todilto Limestone

Uranium in the Todilto Limestone of Jurassic age is known from four localities near Coyote and two localities southwest of Canjilon. At the Box Canyon claims (locality 18) uranium occurs in a small intraformational fold, 25 to 30 feet wide with an amplitude of several feet, in the upper part of the Todilto Limestone. Here the limestone is 10 to 15 feet thick, and the overlying gypsum unit is locally absent. A total of 132 tons, containing 0.10 percent U_3O_8, was mined from a small open pit in 1957 and shipped to the mill at Bluewater, New Mexico. A yellow uranium mineral, probably tyuyamunite, was observed on fracture planes in the fold. Similar intraformational folds occur at the Rey and Lou claims (locality 21) and at the Jaramillo-Montoya claims (locality 19), but contain lesser amounts of uranium.

Small folds containing secondary uranium minerals are present on the Heart claims in the canyon of the Rio Chama (locality 2), and uranium also occurs in a limonite-stained sandstone which overlies the gypsum unit. This sandstone may be an equivalent to the Summerville Formation, but it is generally considered to be in the Morrison Formation. Pieces of float containing tyuyamunite are known from the Alex claims (locality 9) also in the canyon of the Rio Chama. Uranium at the Mesa Alta claims (locality 22) occurs in a pod of limestone breccia overlying the Todilto gypsum unit and below a sandstone in the Morrison Formation(?).

Uranium in the Morrison Formation

In the northern part of the region, there are occurrences of uranium in outcrops of the Morrison Formation in four localities south, and three localities west of Canjilon. A single occurrence is known south of Cuba in the western part of the region. In the southwestern part of the region, uranium occurrences are known in four localities west and southwest of San Ysidro. There is another cluster of occurrences in the central part of the Ojo del Espiritu Santo Grant, northwest of San Ysidro. The most important deposits in this latter area are at the Goodner lease (localities 59 and 61) described by Kittleman and Chenoweth (1957).

From 1957 to 1959, 395 tons of ore containing 0.13 percent U_3O_8 were produced from the Goodner and Collins leases (locality 61 and 62). The ore was mined from several small pits in the Brushy Basin Member. The host rocks are fine- to medium-grained, lenticular quartzose sandstone beds, generally 10 to 30 feet thick, interbedded with greenish-gray mudstones and siltstones. The normal color of the sandstone is tan to light gray, but near ore, the sandstone is red (Fig. 2).

Although most of the uranium on the Collins and Goodner leases is in the Brushy Basin Member, some uranium also occurs in the Westwater Canyon Member (Fig. 2). Visible yellow and green uranium minerals occur along fracture planes and are disseminated in sandstone, especially near greenish-gray clay galls and at interfaces with mudstone. Visible uranium minerals also are present in fracture planes in the underlying siltstone. Carnotite, tyuyamunite, and metatyuyamunite have been identified in samples from the Goodner lease (E. B. Gross, written communication, 1956). The mineralized rock ranges in thickness from a few inches to 3 feet. At the Section 11 deposit (locality 59), a yellow uranium mineral occurs as a

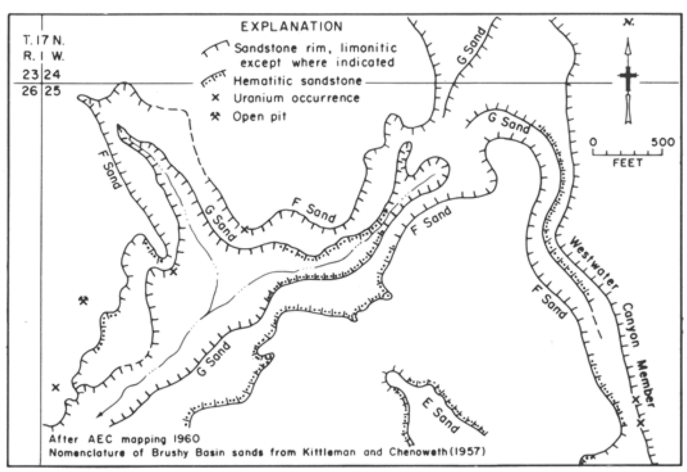

Figure 2. Map of a portion of the Goodner lease showing uranium occurrences and sandstone alteration.

halo surrounding a small area where the sand grains are coated with a substance that resembles asphaltite.

At the airborne radiometric anomalies near the Goodner lease (localities 60, 63, 64 and 65), and at the occurrences west and southwest of San Ysidro (localities 68-71), radioactivity is concentrated around mudstone galls, at sandstone-mudstone interfaces, and in limonite-stained sandstone lenses in the Brushy Basin Member. Visible uranium minerals are rare but have been observed on fractures in sandstone. Drilling in the vicinity of the mineralized outcrops has located additional low-order radioactivity which was not indicated on Figure 1.

Bayleyite, a magnesium uranium carbonate, and liebigite, a calcium uranium carbonate, have been identified (E. H. Schot and R. S. Wegrzyn, personal communication, 1974) in samples from the Westwater Canyon Member at the Dennison-Bunn claims (locality 47) south of Cuba.

South of Canjilon on the rim of Mesa Montosa (localities 11-14) uranium occurs in a white, fine-grained sandstone in the Brushy Basin Member immediately below the Dakota Sandstone. This sandstone, considered to be equivalent to the Burro Canyon Formation by some geologists and as basal Dakota by others, is the target for exploratory drilling northeast of the occurrences.

Uraniferous dinosaur bones have been found at three properties (localities 1, 4, 5) west of Canjilon along the drainages of the Rio Chama and Rio Gallina.

Uranium in the Dakota Sandstone

The Dakota Sandstone of Cretaceous age contains uranium at four localities southeast of Cuba where the formation forms a hogback that dips steeply to the west adjacent to the Nacimiento and Pajarito faults. At the Butler Brothers deposit (locality 49), a total of 23 tons of ore containing 0.63 percent U3[1]38 was mined and shipped in 1954 and 1957. The ore came from a small pit in a 1-foot thick, carbonaceous shale or peat bed at the base of the formation, which is dipping 45 to 60 degrees westerly. No uranium minerals were observed in the radioactive zone which is present for approximately 100 feet along the strike of the beds (Gabelman, 1956).

Uranium occurrences similar to the Butler Brothers deposit, but of lower grade, occur at the Mauldin (locality 46) and Cleary prospects (locality 48) which are 21/2 miles and 1 mile, respectively, north of the Butler Brothers, and at de dos Gordos Wash (locality 54) 51/2 miles to the south.

Uranium in the Mesaverde Group

All three formations comprising the Mesaverde Group of Cretaceous age in the La Ventana Mesa area south of Cuba contain uranium. The formations, in ascending order, are the Point Lookout Sandstone, Menefee Formation, and the La Ventana Tongue of the Cliff House Sandstone. The majority of the uranium is in Menefee Formation on North Butte (locality 50) and on South Butte (locality 51). At these localities, uranium-bearing coal, carbonaceous shale, and carbonaceous sandstone form a mineralized zone several feet thick in the upper part of Menefee immediately below the La Ventana Tongue. There are no visible uranium minerals, but coffinite, a uranium silicate, has been identified in samples from the coal (Bachman and others, 1959).

In the same area, uranium is found in carbonaceous shale near the top of the Point Lookout Sandstone at locality 52 and in a carbonaceous sandstone near the base of the La Ventana Tongue at the Cuba 13 claim (locality 53).

Studies by the U.S. Geological Survey (Bachman and others, 1959) indicate that a resource of 132,000 tons of coal and carbonaceous shale, containing an average of 0.10 percent uranium, is present in the La Ventana area, principally on North Butte.

Uranium in the Ojo Alamo Sandstone

The Ojo Alamo Sandstone of Paleocene age contains uranium (locality 15) northwest of Gallina. The uranium occurs in a coarse-grained, light-yellowish-gray, resistant sandstone. Although there are no visible minerals, a sample from the strongest radioactive area contained 0.02 percent U_30_8.

Uranium in the San Jose Formation

Within the area covered by Figure 1, uranium is known at four localities in the San Jose Formation of Eocene age (Chenoweth, 1957). Three occurrences north of Gallina (localities 6, 7 and 8) are alike and occur in sandstone beds of the Llaves Member of the San Jose. The uranium is associated with carbonaceous plant debris in very coarse- to fine-grained light-gray, to light-yellowish-gray, felspathic to arkosic, friable sandstone. Limonite staining of the sandstone is common near fossil plant material.

West of Gallina at the State Lease (locality 16), a yellowish-green mineral, probably meta-autunite, a calcium uranium phosphate, coats fractures in a gray-green mudstone of the Regina Member of the San Jose. Associated with the uranium mineral are limonite staining and black manganese minerals.

Uranium in Volcanic Rocks

Uranium in volcanic rocks of the Cochiti (Bland) mining district was reported by Jones (1904) and noted by Lindgren and others (1910). At a single occurrence, locality 72, uranium minerals fill interstices of a silicified rhyolite breccia in association with malachite. Although Jones reported "oxides of uranium and vanadium", the mineral was probably torbernite, a copper uranium phosphate, rather than carnotite.

The host rocks in the Cochiti district are volcanic and intrusive rocks considered early Tertiary in age (Smith and others, 1970). In the small area of the mining district, the older rocks are exposed in canyons beneath the upper Tertiary and Quaternary volcanic rocks of the Jemez Mountains and are not shown separately on Figure 1.

ORIGIN

There is no direct evidence regarding the origin of the uranium deposits in the Nacimiento-Jemez region. Field relationships suggest that the source of the uranium could have been in overlying volcanic rocks or thermal springs.

The rhyolitic Bandelier Tuff of the Tewa Group of Pleistocene age is the most widespread volcanic unit in the Jemez Mountains; it is composed of pumice, pumiceous tuff, breccia, and ash flows. On the west flank of the mountains almost all of the volcanic rocks shown on Figure 1, which occur west of a line connecting Coyote, Jemez Springs, and Jemez Pueblo, are composed of Bandelier rocks (Smith and others, 1970). At one time the Bandelier Tuff covered the entire Nacimiento region, but now only remnants remain in the San Pedro Mountain, on the east flank of Sierra Nacimiento, and in the Gallina, Coyote, and Jarosa areas (Fig. 1).

Radioactivity in the Bandelier Tuff is sufficient to have induced the staking of claims in the early 1950s. During carborne radiometric surveys made by the U.S. Geological Survey in the areas south of Coyote and Jarosa, Baltz (1955) noted that the radioactivity of the Bandelier was 11/2 to 4 times the background of sedimentary rocks. AEC airborne surveys in the southern Nacimiento-Jemez region detected four radiometric anomalies in pumice beds in the Bandelier on the Canon de San Diego Grant (Allison, 1954).

Grab samples of the pumice rather uniformly contained 0.003 percent U_3O_8, and the highest grade sample contained only 0.008 percent U_3O_8. Baltz (1955) states that the uranium content in samples of the Bandelier collected by the U.S. Geological Survey in the southwestern part of the Jemez Plateau (probably the Carion de San Diego Grant) averaged 0.003 percent U and varied from 0.003 to 0.006 percent equivalent uranium. Although this conclusion probably is based on analyses of relatively few samples, the Bandelier contains higher than average amounts of uranium in similar rocks elsewhere.

Numerous thermal springs occur in and around the Valles caldera. Other thermal springs are known near Jemez Springs, Jemez Pueblo and west and northwest of the San Ysidro. Radioactivity has been detected only at Soda Dam near Jemez Springs and at the Arroyo Peñasco springs northwest of San Ysidro.

The temperature of the water from the Arroyo Penasco springs averages 85° F. Calcareous tufa and travertine is being deposited by the springs and certain of these deposits are highly radioactive and are the source of three radioactive anomalies detected by AEC airborne surveys northwest of San Ysidro (Allison, 1954, and Brassfield, 1956). Samples of water collected from several of the radioactive springs contained from 0.002 to 0.036 ppm uranium. Warm water flowing from an abandoned oil test in the same area is also uraniferous and is depositing radioactive tufa.

The radioactive spring deposits at Soda Dam were studied by Granger of the U.S. Geological Survey in 1950 (Lovering, 1956). Temperature of the water from the springs at Soda Dam ranges from 104-110° F. Three of Granger's samples contained 0.036 ppm uranium and a fourth contained 0.04 ppm uranium.

Renick (1931) concluded that the Arroyo Peñasco springs represent original volcanic waters modified by the addition of meteoric waters, whereas the springs at Soda Dam represent meteoric waters heated by igneous masses at depth. Radioactivity in the spring deposits in both areas is thought to be caused by radium.

The radioactive thermal springs in the Nacimiento-Jemez region suggest a possible source for the uranium in the small deposits. The springs appear to be spatially related to major faults; however, no radioactivity is known in the fault zones nor is there evidence of upward migration of deep-seated uraniferous solutions.

The author favors the concept that uranium was derived from the devitrification of tuffaceous Bandelier rocks. As the Bandelier was eroded, migrating ground waters may have carried the solubilized uranium into permeable sandstones where it could have been precipitated under reducing conditions. A similar hypothesis is favored by Bachman and others (1959) for the North and South Butte deposits. The relative proximity of the permeable sandstone of the La Ventana Tongue on the west side of the Pajarito fault to the surface on which the Bandelier Tuff was deposited, makes this hypothesis less speculative in this area than elsewhere.

REFERENCES

Allison, J. W., 1954, Airborne anomalies 6 through 12: U.S. Atomic Energy Commission, Preliminary Reconnaissance Reports ED: R-414 through 420, open-file reports.

Bachman, G. 0., Vine, J. D., Read, C. B. and Moore, G. W., 1959, Uranium-bearing coal and carbonaceous shale in the La Ventana Mesa area, Sandoval County, New Mexico: U.S. Geol. Survey Bull. 1055-J, p. 295-307.

Baltz, E. H., Jr., 1955, A reconnaissance for uranium in parts of New Mexico and Colorado, 1954: U.S. Geol. Survey TEM-929, issued by the U.S. Atomic Energy Commission, Tech. Information Service, Oak Ridge, Tenn.

Brassfield, J. C., 1956, Preliminary report on uranium possibilities of the Jemez Indian Reservation and Jemez Pueblo Grant, Sandoval County, New Mexico: U.S. Atomic Energy Commission, TM-82, open-file report.

Brown, H. G., III, 1955, Uranium deposits of the Vegitas cluster, Rio Arriba and Sandoval Counties, New Mexico. U.S. Atomic Energy Commission, RME-84, open-file report.

Chenoweth, W. L., 1957, A reconnaissance for uranium in the uppermost Cretaceous and early Tertiary rocks of the eastern San Juan Basin, New Mexico: U.S. Atomic Energy Commission, RME-97 (pt. 2), open-file report.

Dane, C. H. and Bachman, G. 0., 1965, Geologic map of New Mexico: U.S. Geol. Survey.

Elston, W. E., 1967, Summary of the mineral resources of Bernalillo, Sandoval, and Santa Fe Counties, New Mexico: New Mexico Bureau of Mines and Min. Resources Bull. 81.

Gabelman, J. W., 1956, Uranium deposits in paludal black shales, Dakota sandstone, San Juan Basin, New Mexico, *in* Contributions to the geology of uranium and thorium by the United States Geological Survey and Atomic Energy Commission for the United Nations International Conference on Peaceful Uses of Atomic Energy, Geneva, Switzerland, 1955: U.S. Geol. Survey Prof. Paper 300, p. 303-319.

Jones, F. A., 1904, New Mexico mines and minerals: Santa Fe, N. Mex., The New Mexican Printing Co., World's Fair ed.

Kaufman, W. H., Schumacher, 0. L., and Woodward, L. A., 1972, Stratiform copper mineralization in the Nacimiento region, New Mexico: New Mexico Bureau of Mines and Min. Resources Target Exploration Report E-1.

Kittleman, L. R., Jr. and Chenoweth, W. L., 1957, Uranium occurrences on the Goodner lease, Sandoval County, New Mexico: U.S. Atomic Energy Commission, TM-184, open-file report.

Lindgren, Waldemar, Graton, L. C., and Gordon, C. H., 1910, The ore deposits of New Mexico: U.S. Geol. Survey Prof. Paper 68.

Lovering, T. G., 1956, Radioactive deposits in New Mexico: U.S. Geol. Survey Bull. 1009-L.

Renick, B. C., 1931, Geology and ground-water supplies of western Sandoval County, New Mexico: U.S. Geol. Survey Water-Supply Paper 620.

Smith, R. L., Bailey, R. A. and Ross, C. S., 1970, Geologic map of the Jemez Mountains, New Mexico: U.S. Geol. Survey Misc. Geologic Inv. Map 1-571.

Soule , J. H., 1956, Reconnaissance of the "red bed" copper deposits in southeastern Colorado and New Mexico: U.S. Bur. of Mines Inf. Circ. 7744.

Wood, G. H. and Northrop, S. A., 1946, Geology of Nacimiento Mountains, San Pedro Mountains, and adjacent plateaus in parts of Sandoval and Rio Arriba Counties, New Mexico: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 57.

Woodward, L. A., Kaufman, W. H., Schumacher, 0. L., and Talbott, L. W., 1974, Strata-bound copper deposits in Triassic sandstone of Sierra Nacimiento, New Mexico: Econ. Geology v. 69, no. 1, p. 108-120.