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URANIUM IN THE SANTA FE AREA, NEW MEXICO*

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INTRODUCTION

The Colorado Plateau prospecting boom of the early 1950s spread eastward into the Rio Grande trough and the Sangre de Cristo Mountains in the mid-1950s. In the Santa Fe area, uranium occurrences are located in pegmatites, shear zones and quartz veins in Precambrian rocks, in sandstones of Triassic, Cretaceous and Tertiary age, and in Tertiary volcanic and intrusive rocks. Some 8,754 metric tons of ore have been mined from a vein-type deposit in the Espinaso Volcanics of Oligocene age, and a significant low-grade deposit has been developed in the Galisteo Formation of Eocene age. The occurrences described in this paper are within an area bounded by T12N, T25N, the Rio Grande and R14E. Figure 1 shows all of the known occurrences of material containing 0.02 percent U308 or greater.

DESCRIPTION OF AREAS

Rincon Range

Uranium minerals are known in the southern Rincon Range, where they occur as sparsely disseminated crystals in pegmatites in Precambrian rocks. Jahns (1946), in his detailed description of the Elk Mountain district, noted the occurrence of uranium-bearing minerals in mica-bearing pegmatites. Northrop (1942), in his tabulation of minerals of New Mexico, noted a 1938 reporting of uraninite and cyrtolite southwest of Las Vegas in San Miguel County. Prospecting for uranium in the middle 1950s led to the discovery of other uranium-bearing pegmatites in the southern Rincon Range. Geologists of the Atomic Energy Commission (AEC) examined seven pegmatites (localities 14-20, fig. 1) in the area of T15-17N, R13-14E (USAEC, 1970). In addition, the Old Priest pegmatite in the SW1/4 sec. 26, T15N, R14E (loc. 21), was found to contain uranium minerals and may have been the locality cited by Northrop.

The principal uranium mineral in pegmatites is samarskite, a complex niobium-tantalum oxide that contains calcium, iron, uranium, thorium and rare-earth elements. Other uranium minerals which have been identified include uraninite, uranophane, autunite and cyrtolite, a zirconium silicate which contains calcium, iron, uranium and rare earths. Monazite, a thorium mineral which may contain minor amounts of uranium, also has been identified. Samarskite generally is not amenable to commercial uranium milling circuits.

The small, erratically distributed amounts of uranium-bearing minerals in the pegmatites are too sparse to encourage exploration. According to Jahns (1946, p. 282), the Guy No. 1 mine in the NE1/4 SW1/4 sec. 36, Ti 8N, R1 3E (loc. 13) produced more than 227 kg of tantalum, uranium and rare earths between 1930 and 1945. In late 1955, a trial shipment was made to the AEC buying station at Grants, New Mexico from the Spark-Stone No. 1 pegmatite in the SW1/4 NW% NWA sec. 5, Ti 6N, R1 4E (loc. 18). This 3.6-metric ton lot averaged 0.06 percent U308 and contained 2.3 kg of U308. In the summer of 1956, a 9.5-metric ton shipment was made which averaged 0.13 percent U308 and contained 12.2 kg of U308. Redmon (1961, p. 75-76), in his description of this pegmatite, noted autunite crystals as large as 3 mm in diameter in iron-stained fractures.

Picuris Range

Uranium has been found in fractures in Precambrian quartzite adjacent to copper-bearing quartz veins in the workings of the old Copper Hill mine in the S1/2 sec. 17, T23N, R11E (loc. 2). Uranium-bearing minerals also have been identified at the Blue Feather in the SWY4 sec. 27, T23N, R11 E (loc. 3), and the Paul Burch pegmatites near the center of sec. 36, T24N, R11 E (loc. 1).

Hagan Basin

During November 1954, an AEC_ aerial radiometric survey located two anomalously radioactive areas near Hagan (USAEC, 1966, p. 50). Ground investigations revealed that these anomalies are associated with a trachyte sill which intrudes rocks of the Mesaverde Group. Autunite was noted in joints and fractures near the base of the sill at the Mimi No. 4 claim in the NE14 sec. 4, Ti 2N, R6E (loc. 29). Prospecting in the Hagan area located uranium minerals associated with carbonaceous material in sandstones of the Santa Fe Group (loc. 25) and in the Galisteo Formation. Secondary uranium minerals also were found in sandstones and shales of the Mesaverde Group (loc. 28).

At the We Hope claims, secs. 4 and 5, Ti 3N, R6W (loc. 26), autunite and other secondary uranium minerals occur in carbonaceous zones in sandstones in the upper part of the Galisteo. Selenium is associated with the uranium minerals. On the outcrop, the host rock is a buff to gray, medium-grained, tuffaceous sandstone having a maximum thickness of approximately 46 m. During the past 20 years, exploration drilling by several companies in the Hagan basin has located a considerable amount of low-grade uraniferous material in the Galisteo Formation (see Moore, this guidebook). Only with the recent increase in the price of uranium have the deposits been economic. During 1977, Union Carbide Corporation began development of the Diamond Tail Ranch deposit in sec. 16, Ti 3N, R6E (loc. 27). This development consists of a 190 decline, approximately 90 m long. At the present time, further development is in the planning stage.

East of the Hagan basin, in the northeast corner of the Ortiz mine grant, uranium minerals have been found associated with a monzonite dike (loc. 30), and nearby in the Galisteo Formation (loc. 31).

La Bajada

The La Bajada mine (loc. 22) is located in the canyon of the Santa Fe River on the La Majada grant, in the NWA sec. 9, T1 5N, R7E (projected). The mineralized outcrop was found in

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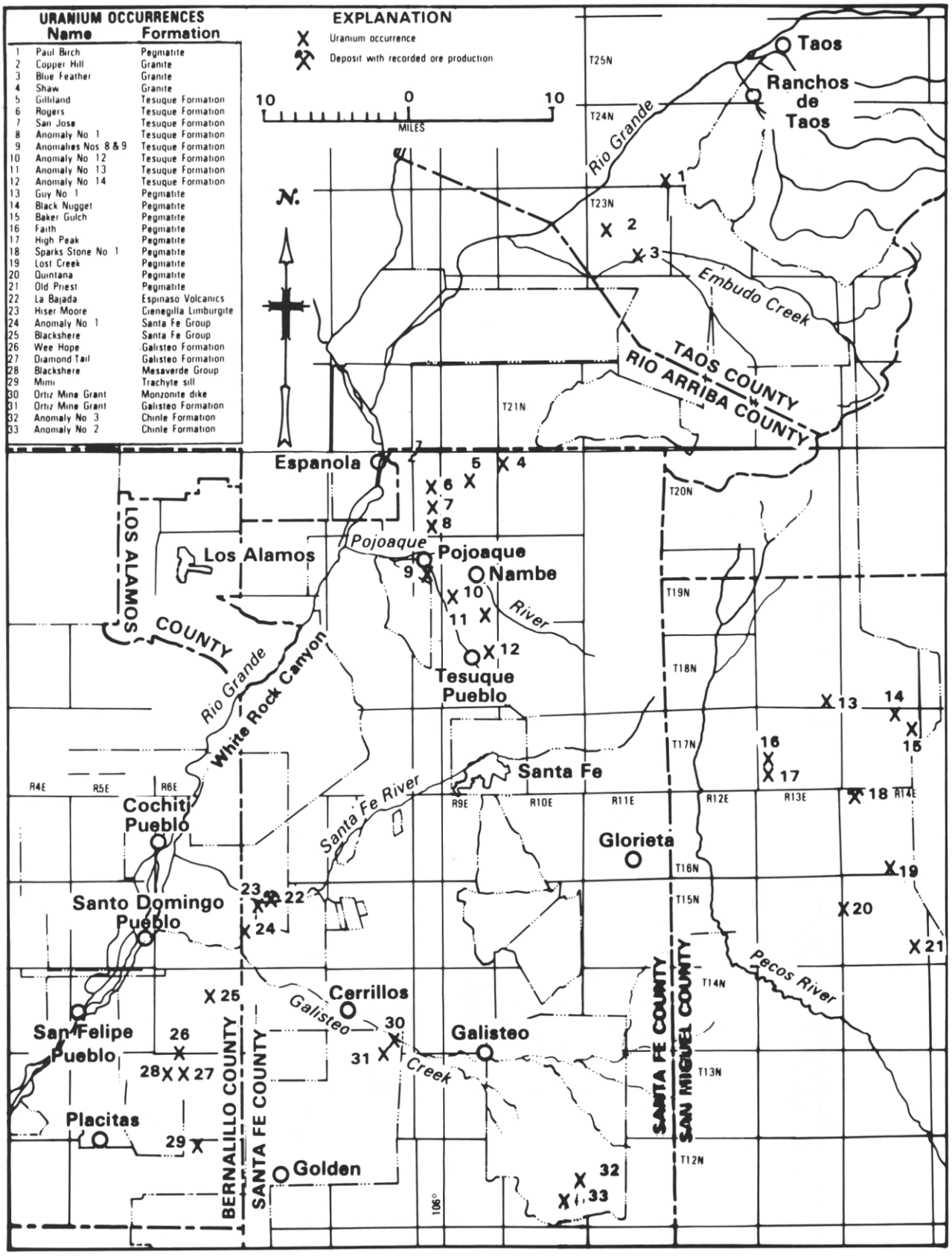

Figure 1. Index map of the Santa Fe area showing locations of uranium occurrences (0.02 percent U_3O_8 or greater).

1915 or 1916 by a Mr. Rinaldi of Bland, New Mexico. Most of the subsurface development was done in the 1920's by the La Bajada Copper Mining Company. The company reportedly sold stock worth $2 million, and the only production was in 1928 when 8.8 metric tons of ore containing 680 gm of silver and 1099 kg of copper were shipped to the smelter at El Paso, Texas. In that year, the total value of the ore was $363 (Lustig, 1957, p. 53).

Radioactivity was noted on the dump in 1950, and the property was acquired by the Lone Star Mining and Development Corporation in 1955. When the mine was first examined by AEC geologists in 1957, the workings consisted of two shafts, one (no. 1) with 101 m of drift in the 170 level and 46 m of drift on the 142 level, and the other (no. 2) had 27 m of drifting and stoping on the 34 level.

An initial shipment of uranium ore from the 170 level of the no. 1 shaft was made to the AEC buying station at Grants in the latter part of 1956. This shipment consisted of 41.7 metric tons averaging 0.18 percent U308. An additional shipment of 46.3 metric tons averaging 0.20 percent U308 was made from the no. 1 shaft in early 1957. Due to the unsafe conditions of the old workings, it was determined that further development of the deposit would be by open-pit methods. In the early 1960s, a pit was stripped in the area between the two shafts (fig. 2). Mining commenced in 1962 and continued intermittently through 1964. A final shipment from a stockpile was made in late 1966. Total production purchased by the AEC was 8,754 metric tons averaging 0.14 percent U308 and containing 12,298 kg of uranium oxide. All of the ore from the open-pit operation was shipped to the Homestake-Sapin Partners plant at Grants. Since the rim of the pit is only

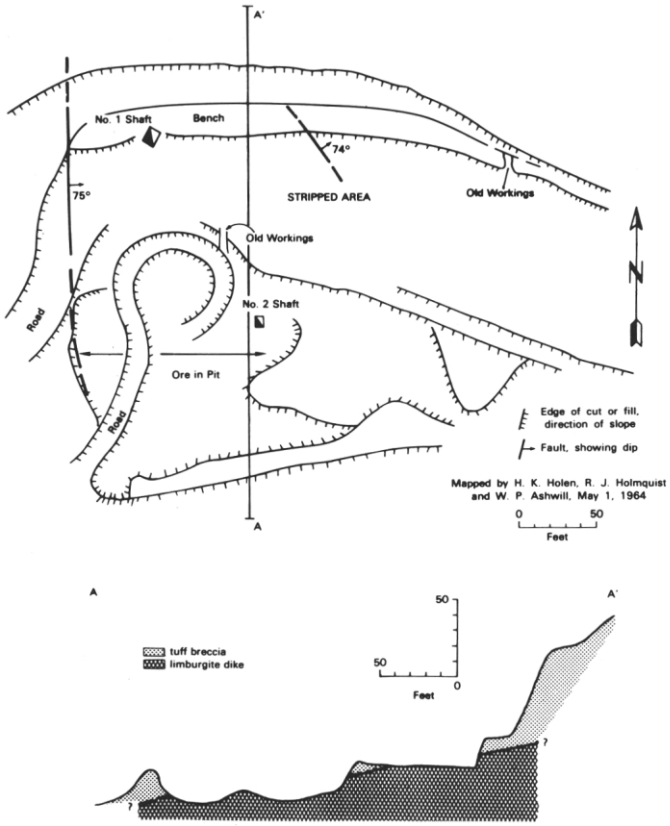

Figure 2. Map and cross section of the La Bajada mine.

slightly above the river level, the pit has filled with water since the mining ceased.

The La Bajada deposit occurs in the Espinaso Volcanics (Oligocene) where the formation is intruded by a nearly vertical limburgite dike along a north-trending fault. At this locality, the Espinaso was probably a tuff breccia, but it is disguised by intense alteration and impregnation with massive iron sulfides. In detail, the deposit consists of a complex network of thin sulfide-mineral veins in the mafic dike and an impregnation of fine-grained sulfide minerals in the brecciated footwall of the dike, where it is altered to clay. Lustig (1957) described 23 minerals from the deposit (6 from the dump, 7 ore minerals and 6 gangue minerals from the workings of the no. 1 shaft, and 4 alteration products from the wall rock). The principal ore minerals are pyrite, sphalerite, marcasite, colusite, chalcopyrite and bornite, formed in that order. Colloform textures characterize the ore minerals and suggest a low temperature of formation. Cobalt, nickel, molybdenum and germanium are present in more than trace amounts. A pulp sample from one lot of ore contained about 1.50 percent copper, 0.03 percent nickel, 0.13 percent arsenic and 18.4 percent sulfur (Hilpert, 1969, p. 106).

The uranium mineralogy of the deposit is not known. Although the Colorado School of Mines Research Foundation reported brannerite in a single sample they examined, none was found by Lustig (1957). It is the author's observation that the majority of the uranium appears to be associated with organic material in the vein. The organic material occurs as spherical inclusions and as fillings in cavities and fractures. Uraniferous pod-like masses ranging in size from 1 to 20 mm have been observed. Studies by Haji-Vassiliou and Kerr (1972) indicate that the organic material may be a petroleum derivative which would have had its source in the underlying Mesaverde Group.

The high sulfide content of the ore makes it nonamenable to carbonate leaching processes due to excessive carbonate consumption. Also, the high clay content of the ore causes excessive slimes which are not desirable.

Southwest of the La Bajada mine, at the Hiser-Moore claims in the E1/2 sec. 8, T1 5N, R7E (projected) (loc. 23), yellow uranium minerals occur on joint surfaces near the top of the Cieneguilla limburgite flow. Four kilometers southwest of the La Bajada mine, an AEC aerial radiometric survey detected anomalous radioactivity in the Santa Fe Group (USAEC, 1966, p. 45). Here, radioactive limonite and silica fill a fracture in a sandstone bed (loc. 24). Traces of malachite and azurite are present in the radioactive zone.

Pojoaque-Nambe Area

Uranium minerals were discovered in the Santa Fe Group southeast of Española in July 1954 by L. E. Rogers, Q. B. Rogers and H. R. Rogers. As the result of this discovery (loc. 6), the area was prospected heavily, and several hundred claims were staked. During November 1954, the AEC conducted an aerial radiometric survey of the area and located 14 additional areas of anomalous radioactivity. These anomalies and the occurrences (loc. 5, 8, 9, 10, 11 and 12) have been described by Collins and Freeland (1956).

The majority of the uranium in the Santa Fe Group is concentrated in a small area near Pojoaque in T19 and 20N, R9E, and are all within a stratigraphic interval of about a hundred meters in the Tesuque Formation of middle (?) Miocene age.

In this area, the Tesuque consists of poorly consolidated sandstone and siltstone with interbedded claystone and tuffaceous units. The occurrences contain carnotite, schroekingerite and meta-autunite that coat fractures and bedding surfaces in sandstone, siltstone and claystone. The minerals are concentrated in the vicinity of clay gall zones and pockets of carbonaceous plant material in the sandstone. Limonite staining of the radioactive sandstone is common and radioactive opal also is present. In the summer of 1957, a trial shipment of 11.8 metric tons, averaging 0.05 percent U_3O_8, was made from the San Jose No. 13 claim in the SEA NWA sec. 29, T2ON, R9E (loc. 7). Intermittent exploration drilling for uranium in the Santa Fe Group since the middle 1950s has failed to develop any orebodies. Prospecting in the area adjacent to the occurrences in the Santa Fe Group located uranium minerals in shears and fractures in Precambrian granite near the Santa Cruz Dam. At the Shaw No. 2 claim in sec. 7, T2ON, R1OE (loc. 4), secondary yellow-green uranium minerals are associated with secondary copper minerals in a small shear zone. Redmon (1961, p. 55) noted that during 1954-1955, many claims were staked in the Cordova-Truchas and Nambe pegmatite districts due to the presence of radioactive minerals in the pegmatites.

Estancia Basin

The southeast corner of Figure 1 includes the northern portion of the Estancia basin. This area was included in an AEC aerial radiometric survey of the Cerrillos-Galisteo area which was conducted in early 1954. This survey discovered two areas of radioactivity in the southern part of the San Cristobal land grant (USAEC, 1966, p. 46). At anomaly no. 2 (loc. 33), yellow, secondary uranium minerals occur in a 1-meter-thick bed of gray, calcareous conglomerate in the Chinle Formation (Triassic). Anomaly no. 3 (loc. 32), located 1.8 km northeast of anomaly no. 2, is in a thin bed of a brown, calcareous conglomerate also in the Chinle Formation.

POSSIBILITIES FOR ADDITIONAL DISCOVERIES

The La Bajada mine appears to be a unique deposit. Similar occurrences in the area are not known, and the possibilities of locating additional ones are remote. Uranium minerals in pegmatites, shear zones and quartz veins in Precambrian rocks are too scattered to encourage exploration, even with today's high uranium prices.

Although the rocks of the Santa Fe Group occur over a large portion of the area, uranium favorability appears to be restricted to an area near Pojoaque. The favorability of this area may be due to a combination of volcanic debris derived from the Jemez volcanic center to the west and arkosic sediments derived largely from Precambrian crystalline rocks to the east. However, exploration in the area over the past 20 years has failed to disclose any orebodies.

The Galisteo Formation in the Hagan basin has the greatest potential for additional uranium discoveries. The recognized widespread distribution of low-grade material suggests that higher-grade material may exist.

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