ABSTRACT

Uranium deposits in New Mexico occur in rocks of many geologic ages and lithologic types. Bedded deposits in continental, fluvial sandstones of the Morrison Formation of Jurassic age are the most important. A cluster of large deposits in McKinley and Valencia Counties, comprises the Grants Mineral Belt, the largest uranium area in the United States.

During the period 1948-1975, 52,250,000 tons of ore with an average grade of 0.22 percent U₃O₈ and containing 112,684 tons of uranium oxide have been produced in New Mexico, almost entirely from the Grants Mineral Belt. This amounts to 40 percent of the total United States uranium ore production. The discovered ore reserves and the undiscovered potential resources of the state are expected to maintain New Mexico's position as the nation's principal source of uranium for years to come.

INTRODUCTION

New Mexico has produced more uranium than any other state. Nearly all production has come from the Grants Mineral Belt (fig. 1). This belt, which extends from near Gallup, southeasterly for 80 miles and has a width of 10 to
Figure 1. Uranium occurrences in New Mexico
20 miles, is the most important uranium area in the United States. This paper describes the growth of the uranium raw materials industry in the state, summarizes the geologic setting of the ore deposits, and reviews the resource base.

HISTORY OF EXPLORATION

Uranium minerals were reported at several localities in New Mexico in the early 1900s (Jones, 1904), and were regarded largely as mineralogical curiosities. The first significant discovery of uranium was in vanadium-bearing carnotite ores in the eastern Carrizo Mountains west of Shiprock in 1918 (John Wade, 1955, personal communication). No ore was mined then, due to lack of demand for either vanadium or uranium.

About 1920, autunite and torbernite were identified on the dumps of base and precious metal mines in the White Signal district in Grant County (fig. 1). At the same time, pitchblende was discovered in nickel-cobalt-silver veins in the Black Hawk district, also in Grant County (fig. 1). Offers of $50 per ton for 0.30 to 0.50 percent uranium ore revived mining activity, and a small amount of ore was mined in the White Signal district for pharmaceutical and cosmetic purposes (Granger and Bauer, 1952, p. 2).

One of the earliest observations of uranium minerals in the Grants area was in 1937 when V. C. Kelley (1963, p. 1) noted carnotite in a hand specimen which had been collected by a local prospector. In his tabulation of New Mexico minerals, Northrop (1942) listed nine uranium minerals reported from nine localities. The Grants area was not included as Kelley's observation was unrecorded.
During 1942 to 1944, carnottite ores were mined from the Salt Wash Member of the Morrison Formation in the eastern Carrizo Mountains in San Juan County (fig. 1). Although these ores were mined for their vanadium content, uranium was later recovered from the mill tailings. Webber (1947, fig. 59) lists this production as 1,500 tons, having an average grade of 0.27 percent $U_3O_8$ and 3 percent $V_2O_5$.

In 1948, prospecting for uranium was stimulated by the ore-buying schedules and other incentives of the Atomic Energy Commission (AEC). Uranium deposits were discovered in many parts of the state shortly thereafter. The well publicized find of Paddy Martinez in the Todilto Limestone near Haystack Butte in Valencia County in the fall of 1950 brought a wave of prospectors into the Grants area, and in January 1951, uranium was discovered nearby in a sandstone of the Morrison Formation in Poison Canyon. This discovery led to the subsequent delineation of the Poison Canyon trend deposits. In November 1951, an airborne radioactive anomaly was detected by the Anaconda Copper Mining Company, which led to the development of the Jackpile mine north of Laguna in Valencia County. Since this discovery was made by a large company, it did not receive the publicity that individual discoveries received. During 1953 to 1956, the AEC conducted airborne radiometric surveys throughout the state. Results of this activity led prospectors to several areas not previously considered for uranium. By 1956, most of the surface occurrences known today had been discovered.

Using the cuttings of an oil well on the nearby Ambrosia Dome to ascertain the drilling depths to the Morrison Formation, Louis Lothman began a wildcat uranium drilling project in April 1955, in sec. 11, T. 14 N., R. 10 W. (Louis
Lothman, 1957, written communication). The second hole penetrated uranium-bearing sandstone in the Westwater Canyon Member of the Morrison Formation. The resulting publicity stimulated an intensive exploration effort and led to the discovery and development of the multimillion-ton deposits in the Ambrosia Lake area.

During the extensive prospecting that followed the initial discoveries in the Grants area, several small ore bodies were discovered in outcrops of the Morrison and Dakota Formations in the Gallup and Thoreau areas in late 1951 and early 1952. Drilling downdip from these deposits led to the discovery of the larger Blackjack and Churchrock ore bodies in 1958 by the Lance Corporation and Phillips Petroleum, respectively.

In 1962, an ore body was found by Sabre Pinon Corporation in the northeast Churchrock area, where holes previously drilled by Phillips Petroleum had penetrated ore-grade material at a depth of about 1,875 feet. Exploration by Kerr-McGee on adjacent Navajo Tribal lands led to the discovery of its northeast Churchrock ore body in 1966. Following the competitive sale of Navajo leases in 1971, the exploration effort has continued in the northeast Churchrock area and has been extended eastward into the Crownpoint area, where undeveloped ore bodies occur.

A significant event was the discovery of ore by the Fernandez Joint Venture near San Mateo in the fall of 1968 at a depth of 2,700 feet. This discovery led to the eastward extension of the Ambrosia Lake area. Nearly a year later, ore-grade intercepts were found at a depth of 4,000 feet in a hole drilled by the
Bokum Corporation on the flanks of Mt. Taylor. By early 1971, Gulf Oil had purchased the San Mateo and Mt. Taylor ore bodies to consolidate its holdings in the east Ambrosia area. At about the same time, exploration on the eastern side of Mt. Taylor, especially in the Marquez area, identified ore in the Westwater Canyon Member in an area previously explored only for ore in the Jackpile sandstone of the overlying Brushy Basin Member.

The magnitude of the exploration effort that has been expended in the Grants Mineral Belt can be measured by the amount of surface drilling that has taken place. Records of the Grand Junction Office of the Energy Research and Development Administration (ERDA) show that from 1960 to 1976, there were 28,056 holes, having a total footage of 25,894,723 feet, drilled in the search for new deposits. In addition, 27,479 holes having a total footage of 14,761,915 feet were drilled for the development of new deposits.

In the late 1960s, exploration activities resumed at nearly all known uranium areas in the state. This latest exploration phase was not particularly successful in locating ore deposits outside of the Grants Mineral Belt. Saucier (1974, p. 211) reports that deposits having potentially economic significance have been found in the Burro Canyon Formation in the southern Chama Basin. Since 1967, approximately 17 percent of the surface drilling for uranium in New Mexico has taken place outside the Grants Mineral Belt. Excluding the Grants Mineral Belt, 594,000 feet of exploration drilling was done during 1975, compared to 150,000 feet in 1973.
In January 1974, the Exxon Company signed an agreement with the Navajo Tribe to explore 400,000 acres of tribal land in the western San Juan Basin. Exploration has been deferred until the agreement has been reviewed by the Secretary of the Interior.

In December 1975, the Phillips Petroleum Company announced the discovery of a large deposit located approximately 12 miles north of Crownpoint in McKinley County. Since this discovery is considerably north of the present concept of the Grants Mineral Belt, it likely will have a marked effect on future exploration concepts in the San Juan Basin.

PRODUCTION

Records of ERDA indicate that during the period 1948-1975, the state of New Mexico has produced 52,250,000 tons of ore having an average grade of 0.22 percent $U_3O_8$ and containing 112,684 tons of uranium oxide ($U_3O_8$). This is 40 percent of the total United States production through 1975. The yearly production for New Mexico is shown graphically in figure 2.

Production has been recorded from 200 properties in 14 counties (table 1). More than 99.8 percent of the output has come from the Grants Mineral Belt (fig. 1), which is the largest uranium area in the nation.

When AEC buying schedules for uranium went into effect in 1948, mining commenced in the King Tutt Mesa area of the eastern Carrizo Mountains. Production from the eastern Carrizo Mountains continued sporadically until June
Figure 2  New Mexico uranium production 1948 through 1975
<table>
<thead>
<tr>
<th>County</th>
<th>No. of Properties</th>
<th>Tons U₃O₈</th>
</tr>
</thead>
<tbody>
<tr>
<td>McKinley</td>
<td>112</td>
<td>112,496.0*</td>
</tr>
<tr>
<td>Valencia</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>San Juan</td>
<td>40</td>
<td>140.2</td>
</tr>
<tr>
<td>Santa Fe</td>
<td>1</td>
<td>45.6</td>
</tr>
<tr>
<td>Socorro</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Grant</td>
<td>2</td>
<td>.7</td>
</tr>
<tr>
<td>Sandoval</td>
<td>2</td>
<td>.6</td>
</tr>
<tr>
<td>Catron</td>
<td>3</td>
<td>.6</td>
</tr>
<tr>
<td>Rio Arriba</td>
<td>4</td>
<td>.2</td>
</tr>
<tr>
<td>San Miguel</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sierra</td>
<td>3</td>
<td>.1</td>
</tr>
<tr>
<td>Quay</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Harding</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hidalgo</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>200</strong></td>
<td><strong>112,684.0</strong></td>
</tr>
</tbody>
</table>

*Includes uranium recovered from mine water.

Table 1. New Mexico uranium production 1948-1975, by county
1968. Vanadium was recovered as a co-product from these ores. Since 1948, 130,000 tons of ore, averaging 0.23 percent \( \text{U}_3\text{O}_8 \) and 2.43 percent \( \text{V}_2\text{O}_5 \), have been produced from 28 properties in the area.

In the Sanostee area of San Juan County, south of the Carrizo Mountains, uranium mining began in late 1951 at the Enos Johnson mine and continued intermittently until early 1971. Production from this mine, which is in the Recapture Member of the Morrison, was nearly 37,000 tons averaging 0.19 percent \( \text{U}_3\text{O}_8 \). It has been the largest uranium mine in New Mexico outside the Grants Mineral Belt.

In the Grants area, production of limestone and sandstone ore from open cuts, adits, and shallow shafts began in 1951. The first ore from the Jackpile mine was produced from adits in late 1951. Stripping of the main Jackpile ore body commenced in early 1954, and open pit mining began on a small scale by mid-1954.

The first production from the Ambrosia Lake area was in March 1956 from the Dysart No. 1 mine. By late 1958, shafts were completed to most of the known ore bodies in the area.

In the western part of the mineral belt, mining began in 1951 at some of the smaller mines on the outcrop, but the deeper Churchrock ore body did not come into production until March 1960. Output at the United Nuclear's Northeast Churchrock ore body began in September 1972.
By 1958, mining essentially ceased in areas outside the Grants Mineral Belt. The exception was the Rio Grande trench in Santa Fe and Socorro Counties, where properties continued to produce sporadically through 1966.

As the mines in the Ambrosia Lake area came into production, the amount of uranium ore produced increased rapidly (fig. 2). Production reached an all-time high of slightly more than 7,900 tons of U₃O₈ in 1962, but declined sharply in 1963 during the AEC stretchout program. This program, announced November 17, 1962, extended the government procurement program from January 1, 1967, to December 31, 1970. It deferred delivery to 1967 and 1968 of some uranium concentrates which were originally contracted for delivery before 1967, and provided for purchase of additional amounts of concentrates in 1969 and 1970 equal to the amounts deferred to 1967 and 1968.

Since January 1, 1971, when the AEC ceased its procurement program, the market for uranium has consisted entirely of the nuclear electrical power industry. Recent declines in uranium sales have been due to a saturated market. The decline accentuated in 1973 by a long strike against Kerr-McGee Corporation.

Except for 1973, New Mexico has led the nation in production of uranium ore each year since 1956.
PROCESSING FACILITIES

Early output from the eastern Carrizo Mountains was shipped to the Vanadium Corporation of America (VCA) mill at Durango, Colorado. Shipments continued to the Durango mill until it closed in March 1963. In January 1952, the AEC opened an ore-buying station at Shiprock, New Mexico, and in 1954, Kerr-McGee Oil Industries began operating a mill at Shiprock. Although this plant was built to treat ore from the Lukachukai Mountains in northeastern Arizona, it did treat some ore from the eastern Carrizo Mountains. VCA acquired the Shiprock mill in March 1963, and operated it until it closed in 1968.

At first, limestone and sandstone ores from the Grants area were shipped to the AEC buying station at Monticello, Utah. In June 1952, an AEC buying station was established at Bluewater, New Mexico, and closed when the Anaconda mill went on-stream at Bluewater in mid-1953. This mill, using a carbonate-leaching circuit, was constructed to treat limestone ores. In 1955, Anaconda constructed a second mill to treat sandstone ores derived chiefly from the Jackpile mine. The carbonate mill was closed in May 1959.

Following the discovery of the Ambrosia Lake ore bodies, the AEC established a buying station near Grants in mid-1956. In late 1956, the AEC contracted to purchase uranium concentrate from Homestake-New Mexico Partners. During 1957, additional purchase contracts were signed with Homestake-Sapin Partners, Kermac Nuclear Fuels, and Phillips Petroleum Company. The four uranium mills required to fulfill these contracts began operating in 1958.
After the consolidation of the two Homestake mills in November 1961, the Homestake-New Mexico Partners mill was shut down in April 1962. When Phillips sold its interests to United Nuclear Corporation in March 1963, the Phillips mill was shut down and United Nuclear began shipping its ore for processing, on a toll basis, to the Homestake-Sapin Partners' mill. This is the only remaining carbonate leaching circuit mill in the Grants area and is now operated by United Nuclear in partnership with Homestake Mining Company.

In early 1976, the three mills still operating in New Mexico had a combined nominal operating capacity of 13,500 tons of ore per day, which is nearly half of the total daily national capacity. These mills and operating capacities are as follows:

<table>
<thead>
<tr>
<th>Company</th>
<th>Tons per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Anaconda Company</td>
<td>3,000</td>
</tr>
<tr>
<td>Kerr-McGee Nuclear Corporation</td>
<td>7,000</td>
</tr>
<tr>
<td>United Nuclear-Homestake Partners</td>
<td>3,500</td>
</tr>
</tbody>
</table>

United Nuclear announced plans to build a mill in the northeast Churchrock area in the early 1970s. In November 1975, ground was broken and the construction of this 3,000-tons-per-day mill commenced. In 1973, Sohio Petroleum Company and Reserve Oil and Minerals Corporation announced their intention to build a 1,600-tons-per-day mill on their property north of Laguna. Construction of this facility began in 1974, and should meet an operating target date in the fall of 1976. These two mills are the first to be constructed in New Mexico without benefit of government concentrate-purchase contracts.
GEOLOGIC SETTING

In New Mexico, bedded and vein uranium deposits are in rocks of many geologic ages and lithologic types. Bedded deposits in New Mexico are in many strata, varying in age from Paleozoic to Tertiary. Tabular deposits, especially in continental, fluvial sandstone of Jurassic age, are the most important. Only the significant occurrences are discussed in this paper. The uranium occurrences in New Mexico are described in detail by Hilpert (1965).

Rocks of Pennsylvanian age contain uranium in association with red-bed copper deposits in the Nacimiento Mountains of Sandoval and Rio Arriba Counties, and in the Guadalupita area of Mora County (fig. 1). A small uneconomic shipment has been made from the latter area.

Uranium in the Abo Formation of Permian age commonly is in sandstone beds closely associated with fossil plant material, iron and copper sulfides and copper carbonates. Such red-bed copper deposits are in the central part of the state in Sierra, Torrance, Bernalillo, Sandoval, and Rio Arriba Counties (fig. 1). Slightly more than 100 tons of ore have been produced from properties in Rio Arriba and Sierra Counties.

In the north-central and east-central parts of the state, deposits in Triassic rocks resemble the aforementioned deposits in Permian rocks. Slightly more than 100 tons of ore have been produced from the Chinle Formation in Quay and San Miguel Counties (fig. 1).
Jurassic rocks contain the most important uranium deposits in the state. Most such deposits are in the Grants Mineral Belt in McKinley and Valencia Counties. This cluster of large deposits extends more than 80 miles across the southern flank of the San Juan Basin. Although poorly defined, the belt is 10 to 20 miles wide. The four principal mining areas in the belt are Gallup, Smith Lake, Ambrosia Lake, and Laguna (fig. 1). Ore deposits occur from the surface to depths greater than 5,000 feet. All production has come from deposits shallower than 1,500 feet. Deposits in the Grants Mineral Belt have been described in Kelley (1963) and by Hilpert (1969).

The Todilto Limestone of Jurassic age contains uranium ore bodies along the southern margin of the Grants Mineral Belt, where the limestone has been deformed by intraformational folding and faulting. Some 2,635 tons $U_3O_8$ have been produced from 40 properties, mainly in the Ambrosia Lake area, accounting for 2.3 percent of the total output of the mineral belt. Occurrences in the Todilto also are known in the Sanostee area of San Juan County and near Coyote in Rio Arriba County. One property in the latter area has produced slightly more than 100 tons of ore.

The Morrison Formation of Jurassic age was deposited in a continental environment. It consists of interbedded fluvial sandstone, claystone, and mudstone. In the southern San Juan Basin, three members have been described. In ascending order, they are: Recapture, Westwater Canyon, and Brushy Basin Members. In the Grants Mineral Belt all three units contain ore deposits. The Recapture contains minor sandstone beds, and these contain only small deposits in the Ambrosia Lake and Laguna areas.
The Westwater Canyon Member consists of thick sandstones with interbedded relatively thin discontinuous lenses of claystone. This member contains large deposits in the Ambrosia Lake and Gallup areas. The Brushy Basin Member consists of greenish-gray mudstone and claystone with interbedded sandstone and a few thin beds of limestone. A thick lens of sandstone, named the Jackpile sandstone, occurs in the upper part of the Brushy Basin in the Laguna area, where it contains large deposits. The Brushy Basin also contains deposits in the Smith Lake area, although these are smaller than those at Laguna.

Uranium deposits of the Grants Mineral Belt are irregular in shape, and are generally elongated parallel to paleostreams. The deposits range in size from thin pods a few feet in width and length to large masses of ore several thousand feet long, several hundred feet wide, and several tens of feet thick.

The deposits are in many beds and form clusters along distinct trends. Some ore has been redistributed, generally in areas of faulting. The principal ore mineral in the Grants sandstone deposits is coffinite, a uranium silicate, which is intimately associated with grayish-black to brown carbonaceous humate, which impregnates the sandstone. Production from sandstones of the Morrison Formation in the Grants Mineral Belt has amounted to 108,500 tons U₃O₈.

In northwestern San Juan County, uranium-vanadium deposits occur in the Salt Wash Member of the Morrison Formation on the eastern side of the Carrizo Mountains. This member, composed of interbedded mudstones and fluvial sandstones, is the lowermost member of the Morrison and is present only in the
northwestern part of the state. Although most of the uranium-vanadium ore that has been produced in the Carrizo Mountains has come from Arizona, 69 tons $U_3O_8$ has been produced by mines in New Mexico.

South of the Carrizo Mountains, in the Chuska Mountains near Sanostee, both the Salt Wash and the Recapture Members have yielded ore. Sandstones in the Recapture have been the most productive host rock, from which 71 tons $U_3O_8$ have been obtained.

In other parts of the state, the Morrison Formation has yielded nearly 400 tons of ore from a property in Sandoval County and one ton of uraniferous petrified wood from a property in Harding County (fig. 1).

A sandstone bed at the top of the Morrison, containing uranium in Rio Arriba County, is now considered to belong to the Burro Canyon Formation of Lower Cretaceous age. Drilling down dip from the known occurrences has developed significant deposits, according to Saucier (1974).

The Dakota Sandstone of Cretaceous age has yielded approximately 250 tons $U_3O_8$ from nine properties in the Gallup and Ambrosia Lake areas of the Grants Mineral Belt. The host rocks for these deposits are carbonaceous sandstone, carbonaceous shale, and lignite. A small amount of ore has been mined from carbonaceous shale and lignite in the Dakota in Sandoval County. Although uranium occurs in rocks of the Mesaverde Group in northwestern New Mexico, ore has been mined from only one property, in the Hook's Ranch area of Socorro County (fig. 1). A sandstone bed in the lower part of the Fruitland Formation has yielded a small amount of ore in San Juan County.
Sedimentary rocks of Tertiary age contain uranium in Catron, Socorro, Santa Fe, Rio Arriba, and San Juan Counties. To date, only the Baca Formation of Eocene(?) age has yielded any ore grade material. Slightly more than 200 tons of ore has been produced from the Hook's Ranch area of Socorro County and the Red Basin area of Catron County (fig. 1).

Uranium occurs in vein deposits in New Mexico in a variety of rock types and structures. This type of deposit has not been an important source of uranium, as only 14 properties have produced a total of 113 tons $\text{U}_3\text{O}_8$. This uranium has largely come from a collapsed pipe structure in sedimentary rocks of Jurassic age in Valencia County, fault controlled deposits in sedimentary rocks of Permian and Tertiary ages along the Rio Grande trough in Socorro County, and fissure veins in Tertiary volcanic rocks in the La Bajada area of Santa Fe County (fig. 1). Fissure veins in Precambrian granite in Grant County have also been the source of some ore. Small amounts of ore have been mined from deposits in brecciated sedimentary and volcanic rocks of Pennsylvanian, Cretaceous, and Tertiary ages in Catron, Sierra, and Hidalgo Counties, and from a Precambrian pegmatite in San Miguel County. Small low-grade shipments have been made from occurrences in Dona Ana, Lincoln, Taos, and Rio Arriba Counties.

RESOURCES

Uranium resources include both discovered deposits that have been delineated as ore reserves, and undiscovered deposits generally referred to as potential resources. The resources estimated by ERDA, as of January 1, 1975, for the state of New Mexico are given in table 2.
The data from which ore reserves were estimated were derived from drill holes and other engineering sources, and were made available to ERDA by the uranium industry. Separate evaluations were made of the amount of uranium that could be exploited at maximum forward costs of $15 and $30 per pound U₃O₈.

Forward costs are those operating and capital costs yet to be incurred at the time an estimate is made. Profit and "sunk" costs, such as expenditures for property acquisition, exploration, and mine development, are not included. Therefore, the forward costs are independent of the market price at which the estimated resources would be sold.

As would be expected, nearly all of the reserves in both cost categories are in the Grants Mineral Belt, and many are associated with operating mines. The $15 reserves represent 50 percent of the total U.S. $15 reserves, and the $30 reserves represent 47 percent of the total $30 reserves of the nation.

Potential resources, as used by ERDA, are estimates based on geological judgement of the undiscovered tons U₃O₈ present in minable amounts in areas that are relatively unexplored in detail, but about which enough is known of

<table>
<thead>
<tr>
<th>Forward Cost Category</th>
<th>Discovered Ore Reserves</th>
<th>Undiscovered (Potential)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$15</td>
<td>211,400</td>
<td>210,000</td>
</tr>
<tr>
<td>$30*</td>
<td>280,500</td>
<td>290,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>325,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>445,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75,000</td>
</tr>
</tbody>
</table>

*Includes $15

Table 2. Uranium resources of New Mexico.

- 19 -
the uranium geology to permit prediction of the nature and extent of favorable environments or host rocks. The geographic locations of potential deposits may be definable only within broad limits. Providing the qualitative nature of potential is recognized and taken into account, potential plus reserves provide a more useful base for long-range predictions of domestic supply than do reserves alone.

The estimated potential resources of uranium are surmised to occur in (1) unexplored extensions of known deposits, (2) postulated deposits within known uranium areas, and (3) postulated deposits in other areas geologically favorable for uranium. The deposits are expected to be discoverable and exploitable within selected cost ranges.

Probable potential resources are those estimated to occur in the known uranium areas as extensions of known deposits or as new deposits in trends or areas of mineralization that have been identified by exploration. Possible potential resources are those estimated to occur in new deposits in formations or geologic settings which are productive elsewhere within the state under similar geologic conditions. An example of this type of potential would be the Westwater Canyon Member of the Morrison Formation in the San Juan Basin, but outside of the Grants Mineral Belt. Speculative potential resources are those estimated to occur in new deposits or geologic settings not previously productive.
The reliability of potential estimates varies with the classes. It is greatest in the probable class where there has been extensive exploration and where mines have been developed, thus defining ore habits, the nature and extent of the favorable host rocks, etc. The reliability is least in the speculative class where areas of favorability must be inferred solely from literature surveys, geological reconnaissance of formation outcrops, and/or the examination of the logs and cuttings of wells drilled for petroleum or other purposes.

There have been suggestions that the estimates by ERDA (formerly AEC) of the undiscovered uranium potential in New Mexico may be too conservative. As a step to evaluate its estimates, the AEC conducted a subjective probability assessment of the undiscovered resources in New Mexico (Ellis and others, 1975).

Estimates of the 36 participants in this study ranged from 4,769 to 4,763,000 tons $U_3O_8$ with a mean expected tonnage of 455,480 tons $U_3O_8$. These estimates were made without regard to cost, and the mean is substantially below the total of the ERDA estimates at costs up to $30 per pound. However, the total of the ERDA estimates is within the upper range of the results of the subjective probability study.

Both the ERDA estimates (Hetland, 1975, p. 117) and the subjective probability study concur that the San Juan Basin is by far the most favorable area for additional discoveries of uranium within the state.
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