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CRITICAL MINERALS IN THE ALBUQUERQUE AREA, NEW MEXICO

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Abstract—The New Mexico Bureau of Geology and Mineral Resources (NMBGMR), in cooperation with the U.S. Geological Survey (USGS) Earth Mapping Resources Initiative (MRI) and the Department of Energy (DOE) Carbon Ore, Rare Earth Elements-Critical Minerals (CORE-CM) programs, are examining the potential for critical minerals in the United States, including New Mexico. Critical minerals are nonfuel mineral resources that are essential to our economy and defense and whose supply may be disrupted; many critical minerals are 100% imported into the United States. Although there is no present production of critical minerals within the Albuquerque area, several mineral deposits occur that could have potential for development of critical minerals in the future. Potentially economic concentrations of uranium, vanadium, and rare earth elements (REE) are found in sandstone- and limestone-hosted uranium deposits in the Grants uranium district and should be considered for recovery in the future. Potentially economic concentrations of REE are found in carbonatites in the Monte Largo area and in episyenites at Lobo Hill, near Moriarty. Lithium is found in the Estancia Basin. Historic mining districts in the San Pedro, Ortiz, Sandia, and Manzano Mountains once produced silver, barite, fluorite (as fluorspar), lead, and zinc. Additional critical minerals are known to occur, but these areas have limited future potential because of small size and low concentrations. Ultimately, the potential for economic development depends upon the grade and tonnage of the primary mineral as well as the critical minerals present

INTRODUCTION

In the mining industry, the term "mineral" refers to any rock, mineral, or other naturally occurring material of economic value, including metals, industrial minerals, energy minerals, gemstones, aggregates, and synthetic materials sold as commodities (BLM, 2026). The definition of "critical mineral" in the United States is a mineral commodity that is essential to the economic and national security of the nation and is from a supply chain that is vulnerable to supply chain disruptions; many critical minerals are 100% imported into the country (McLemore and Gysi, 2023). Critical minerals are essential in the manufacturing of products needed for the energy transition, such as wind turbines, solar panels, batteries, and magnets. The U.S. Geological Survey (USGS) first developed the critical minerals list in 2019 (McLemore and Gysi, 2023) and revises it at least every three years (per the Energy Act of 2020) to address evolving supply chain vulnerabilities, geopolitical risks, and changing economic needs. The list was most recently revised during the fall of 2025 (U.S. Geological Survey, 2025). The New Mexico Bureau of Geology and Mineral Resources (NMBGMR), in cooperation with the USGS Earth-Mapping Resources Initiative (Earth-MRI) and the Department of Energy (DOE) Carbon Ore, Rare Earth Elements-Critical Minerals (CORE-CM) programs, is examining the potential for critical minerals in the United States, including New Mexico. Today there are 60 minerals on the critical minerals list, and 45 are found in potentially economic concentrations in mineral deposits in New Mexico (Fig. 1). Many are found in mineral deposits in the Albuquerque area (Fig. 2).

Some critical minerals, such as copper, silver, lead, zinc, tungsten, fluorite, and REE occur in distinct mineral deposits that can be produced as stand-alone commodities. However, many critical minerals on the current list (Fig. 1) do not occur as distinct, economically viable mineral deposits that can be mined as separate, stand-alone commodities, but are mined solely as coproducts or byproducts of host primary mineral deposits. For example, copper deposits can host many critical minerals including silver, cobalt, rhenium, tellurium, gallium, and REE. Gold deposits can host tungsten, antimony, bismuth, tellurium, and arsenic. Zinc and lead deposits can host indium, cadmium, gallium, germanium, antimony, bismuth, and tellurium. See McLemore et al. (2026b) for a summary on how critical minerals occur in mineral deposits.

New Mexico has a wealth of mineral resources (John and Taylor, 2016; McLemore, 2017; McLemore and Austin, 2017; McLemore and Chenoweth, 2017; McLemore and Lueth, 2017; McLemore and Trivitt, 2026) and critical minerals are found in many of these mineral deposits. Current mineral production in the Albuquerque area is limited to cement, aggregate, clay, and gypsum. Although no critical minerals are currently produced within the Albuquerque area, several mining districts contain U-V, REE, Li, Ti, Zr, W, and Nb that may warrant renewed exploration under current market and federal policy incentives. Active uranium exploration, resource re-evaluation and mine permitting are occurring in the Grants uranium district west of Albuquerque (Fig. 2, Table 1; McLemore and Chenoweth, 2017). The purpose of this paper is to briefly summarize some of these critical minerals found within selected mining districts within approximately 100 km (60 mi) of Albuquerque, New Mexico.

METHODS

Data used in this report are compiled from a literature review and field investigations and include published and unpublished results by the author. Some of the deposits were mapped and samples were collected; chemical data are presented in Appendix 1. A summary of mining districts in the Albuquerque area

is in Table 1. Sampling and analytical methods used in this study are described in detail in McLemore and Trivitt (2026).

Geochemical data are essential for evaluating the potential economic concentrations of critical minerals resources in mineral deposits. Central to the mission of the USGS Earth-MRI, DOE CORE-CM, and NMBGMR programs, mineralized samples were collected at the surface and from drill core in these areas. The whole-rock geochemical data of selected samples collected by the author before 2010 were analyzed at NMBGMR laboratories by inductively coupled plasma atomic emission spectrometry (ICP-AES) and X-ray fluorescence spectroscopy (XRF). Other chemical analyses are from the literature, as cited. Samples collected since 2010 were analyzed by either USGS or ALS Global Laboratories for major and trace elements by a variety of analytical methods (Appendix 1), including XRF, ICP-AES, and inductively coupled plasma mass spectrometry (ICP-MS). Laboratory methods and analytical precision for samples collected after 2010 are described in McLemore and Trivitt (2026). Samples were submitted to the laboratory where sample preparation and analyses occurred. Duplicate samples and standards also were analyzed, and the uncertainty of analyses were generally <5%. Chemical plots were created using ioGAS-6.4 software (IMDEX Limited, 2015). Chemical analyses and quality control and quality assurance data are found in McLemore and Trivitt (2026).

CURRENT MINERAL PRODUCTION AND EXPLORATION IN THE ALBUQUERQUE AREA

Current mineral production in the Albuquerque area is limited to aggregates (sand, gravel, and crushed stone) for road and general construction, gypsum for wall board and cement manufacture, clay for brick manufacture, and limestone and shale for cement manufacture. Road and general construction rely on the production of aggregates and the aggregate industry has continued since Albuquerque became an industrial and populated city. However, critical minerals are not found in aggregates mined in the Albuquerque area. Gypsum is produced from the White Mesa mine near San Ysidro and shipped to wall board plants at Bernalillo and Albuquerque. Wall board is an important manufactured material used in building construction. Clay is mined for manufacturing bricks. Cement is

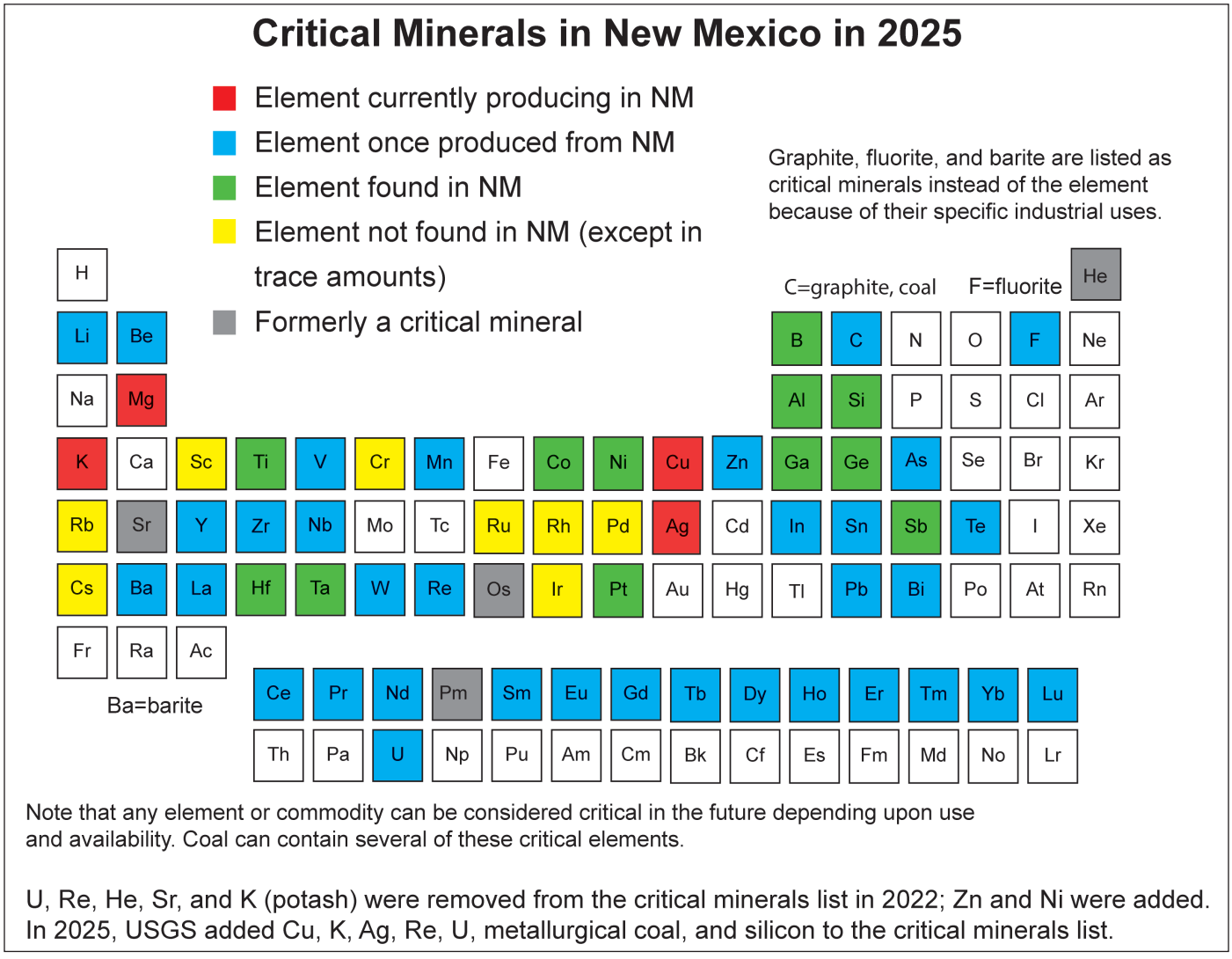


FIGURE 1. Periodic table showing critical minerals in New Mexico (USGS final 2025 list). Modified after McLemore and Gysi (2023).

manufactured at the Tijeras cement plant east of Albuquerque. Cement is composed of limestone, and minor amounts of shale, gypsum, and iron ore, which are generally mined locally near the plant. Iron ore (magnetite) is from a stockpile at the Continental-Hanover copper mine, now operated by Freeport McMoRan near Silver City. Magnetite is used as a flux in the manufacture of cement. None of these materials contain economic concentrations of critical minerals.

Although no uranium mines are currently in production in the Grants uranium district, several projects are actively moving through exploration, permitting, and regulatory review, reflecting renewed interest in the U.S. uranium supply. The Grants Precision ISR (In-Situ Recovery) project is progressing through federal and state permitting processes. The La Jara Mesa and Roca Honda projects near Ambrosia Lake will be conventional underground uranium mines; permit applications were submitted and are under review as required by New Mexico's 1993 Mining Act. Other exploration projects include the Churchrock–Crownpoint, Cebolleta, and Mount Taylor. Exploration for uranium in sandstones also is ongoing in the Hooks Ranch–Riley and Red Basin–Pietown districts in Socorro and Catron Counties. Reclamation of past uranium mines and mills also is occurring in the Grants district. See McLemore et al. (2013) and McLemore and Chenoweth (2017) for more details on these and other potential uranium-vanadium deposits in the Grants district.

Other exploration for critical minerals in the Albuquerque area is limited to acquiring mining claims and surface sampling for geochemistry and mineralogy in known mining districts (Table 1). Mine wastes and tailings are also being examined for potential recovery to help pay for reclamation (McLemore et al., 2025a). Only two mills in the Grants district recovered vanadium (Homestake and Bluewater); therefore, mill tailings at other sites should contain vanadium. Uranium mine wastes and tailings are particularly interesting because vanadium and molybdenum were recovered from Grants uranium deposits

TABLE 1. Mining districts and prospect areas in the Albuquerque area (from McLemore, 2017). Critical minerals are in bold.

District ID, Mining district	District alias	Discovery	Production	Est. cumulative production	Commodities produced	Other commodities
DIS001, Albuquerque		Before 1900	1900–present	>$1,000,000	brick, clay, scoria, gyp., aggregate	
DIS012, Bernabe Montaño subdistrict	Grants uranium district	1970s	No production	No production		**U, V, Ti, Zr, REE,** Th, Mo
DIS002, Coyote Canyon	Soda Springs, Tijeras Canyon, & Coyote Springs	1900	1910–1916	$4,000-12,000	**F, Pb, Ag**, Au	**Cu, Ba, Be**
DIS250, Hell Canyon	Milagras & Star	1880	1880–1976	$350,000	Au, **Ag, Cu,** Mo	
DIS004, Tijeras Canyon	Carnuel, Manzanita Mountains, Star Canyon, Tijeras, Soda Springs, La Luz	1880	1880–present	>$1,000,000,000	cement, limestone, clay, **Cu, Pb**, Au, **Ag, F**	**Zn, U, Ba, Ni, REE,** Th
DIS178, Placitas	Algodones, Bernalillo, Capulin Peak, Juan Tabo, La Luz, La Madera, Las Placitas, Montezuma, Negro placers, Sandia, Sandia, & Tejon	1860s	1904–1961	$2,400	**Cu, Ag,** Au**, Pb, Zn**	**Ba, F**
DIS186, New Placers	Amarillo, Carnahan, Golden, Lazarus Gulch, Nero Placers, Placer Mountain, San Isidro, San Pedro, San Ysidro, San Zaro, Santa Fe, Silver Butte, Tuerto Mountain, & Tuertos Range	1839	1839–1968	$5,750,000	Au, **Ag, Cu, Pb, Zn, Mn,** garnet	**W,** Mo, Fe, **Te**
DIS187, Old Placers	Cunningham Gulch, Dolores, El Real de Dolores, Lone Mountain, Ortiz, Rio Galisteo, San Lazao, San Zaro, Sierra del Oro, & Silver Butte	1828	1828–1986	>$4,000,000	Au, **Ag, Cu, Pb**	**W**, Fe, **Te**
DIS256, Lobo Hill		1980	1990–present	<$10,000	aggregate	**REE, U,** Th
DIS182, El Cuervo Butte	Crow & Crow Butte	1950s	No prod.			**Ba, Pb, F, Ag**
San Juan Basin Beach placer		1950s	No prod.			**REE, Y, Nb, Ti, Zr**
San Juan Basin humate		1950s			humates	
San Juan Basin coal		1800s			coal	

when the prices of these commodities were favorable. These elements, along with REE and other critical minerals, are in the mine wastes (McLemore et al., 2026a).

DESCRIPTIONS OF CRITICAL MINERALS DEPOSITS

It is beyond the scope of this paper to describe all of the critical minerals deposits found in the Albuquerque area (Fig. 2, Table 1) and only a few economically important deposits are summarized here. Most critical minerals deposits are described in more detail by McLemore and Austin (2017), McLemore and Lueth (2017), McLemore and Chenoweth (2017), and McLemore and Trivitt (2026).

Uranium Deposits

Grants uranium district

Today, uranium (Fig. 1) is used primarily in nuclear reactors to produce electricity via nuclear fission. The Grants uranium district is a large area in the San Juan Basin, extending from east of Laguna to west of Gallup, and includes eight subdistricts (Fig. 3; McLemore and Chenoweth, 2017). The Grants district is probably the seventh largest in terms of total world uranium production behind East Germany, the Athabasca Basin in Canada, Australia, South Africa, Russia, and Kazakhstan (McLemore and Chenoweth, 2017). No mines in the district are in production today. The most important deposits in the state are within the sandstones of the Jurassic Morrison Formation

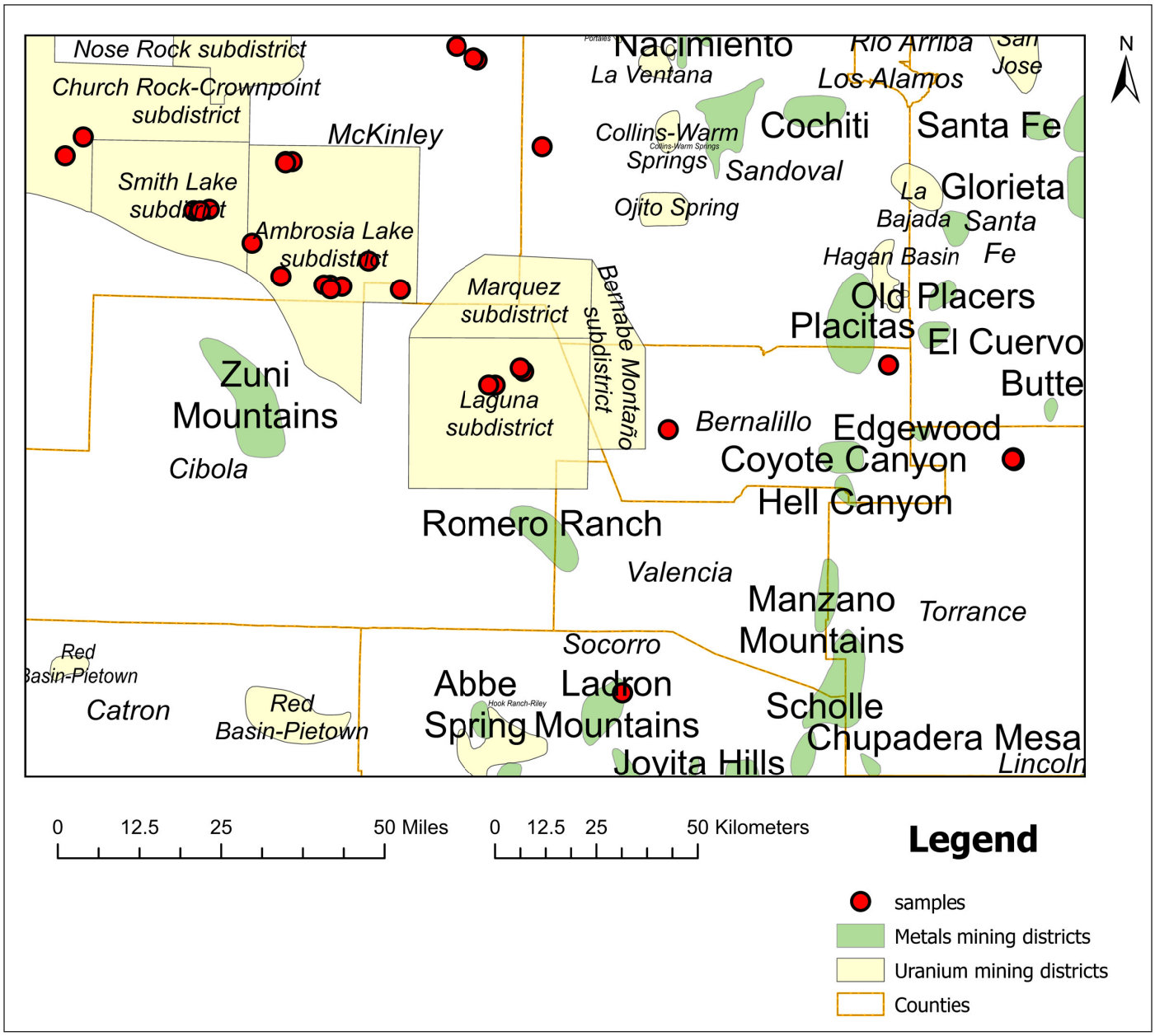


FIGURE 2. Critical minerals in the Albuquerque area, New Mexico.

in the Grants district (McLemore and Chenoweth, 2017). More than 13,600 tonnes (330 million pounds) of U_3O_8 were produced from Morrison Formation deposits between 1948 and 2002, accounting for more than 90% of the total production in New Mexico and more than 30% of the total production in the United States. In addition, more than 9 million pounds of vanadium and some molybdenum were produced in New Mexico as coproducts from these deposits (McLemore et al., 2026a).

Although no active uranium mining operations exist in New Mexico today, numerous companies have acquired uranium properties within the Grants, Hooks Ranch–Riley, and Red Basin–Pietown districts and plan to explore and develop deposits in the future. Total resources and reserves of known undeveloped uranium deposits in New Mexico are estimated as 409,122,587 pounds of U_3O_8 (McLemore et al., 2013; McLemore and Chenoweth, 2017). These remaining resources could be developed if the price of uranium continues to increase, and the advancement of small modular reactor technology and uranium enrichment for fuel is accelerated. Some of the uranium will require conventional milling for processing. Only one mill is operating in the United States, White Mesa mill at Blanding, Utah, which would require expensive transportation costs. There are also two additional mills that are currently on standby, the Shootaring Canyon mill in Utah, and the Sweetwater mill

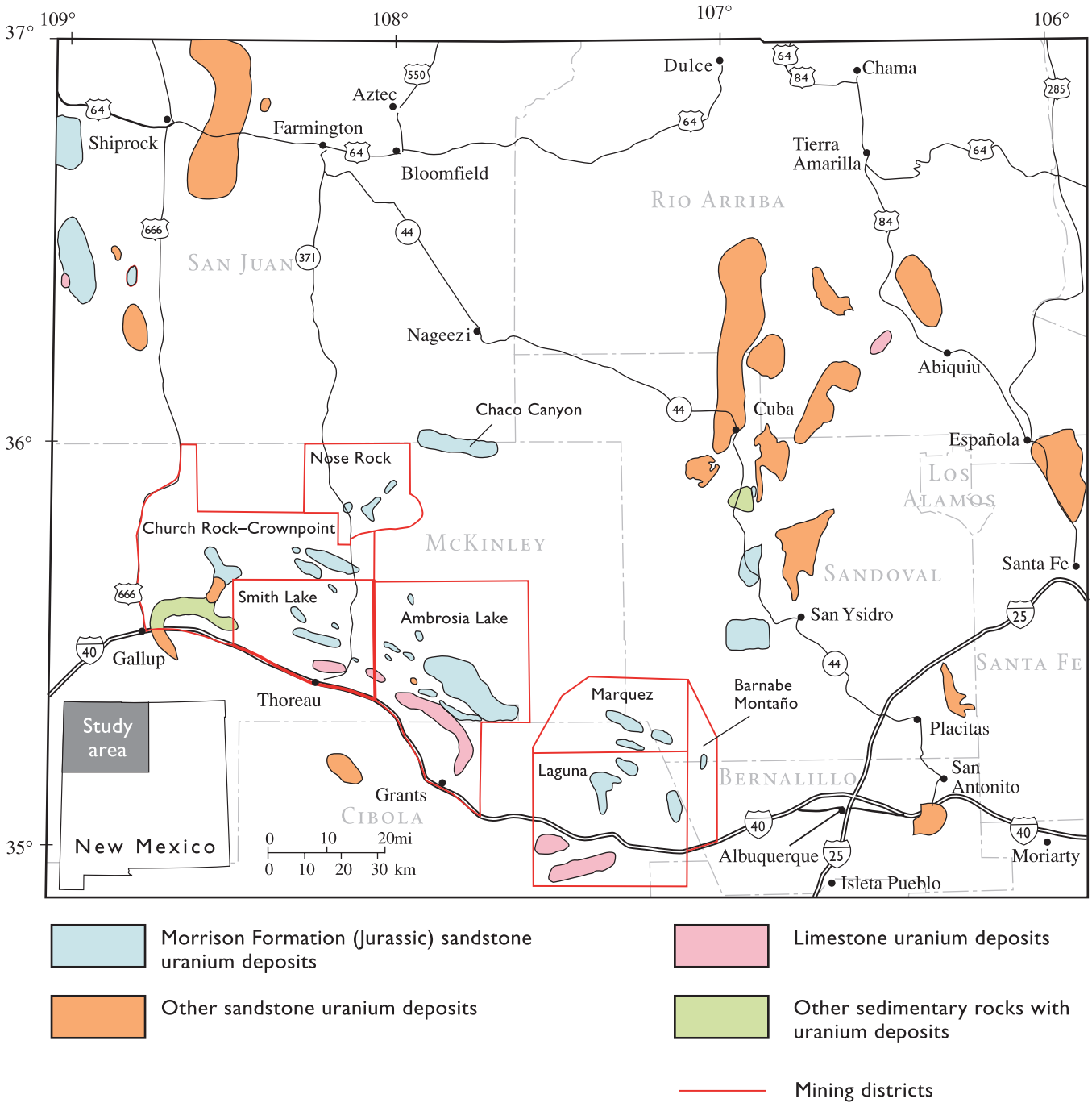


FIGURE 3. Grants uranium district (McLemore and Chenoweth, 2017).

in Wyoming, also distant from New Mexico. Many uranium deposits are being examined for the feasibility of in-situ recovery (ISR), stope leaching in existing underground mines, and heap leaching, where the uranium would be recovered from pregnant leach solutions using ion-exchange technology.

Three types of sandstone-hosted uranium deposits are in the Westwater Canyon Member of the Morrison Formation: (1) primary, tabular (trend or blanket), (2) redistributed (roll-type or stack), and (3) remnant-primary sandstone (McLemore and Chenoweth, 2017). Primary uranium is also found in the Jackpile Member sandstone that overlies the Morrison Formation. A fourth type, tabular sandstone uranium-vanadium deposits, is found in the Salt Wash and Recapture Members of the Morrison Formation in the western San Juan Basin. Other types of uranium deposits are found in New Mexico but have not been major producers (McLemore and Chenoweth, 2017).

Uranium is found only in a few limestones in the world, but the deposits in the Jurassic Todilto Formation are some of the largest and most productive (Chenoweth, 1985). Uranium minerals were found in the Todilto Formation in the early 1920s, although it was Paddy Martinez's discovery in 1950 that resulted in the development of the Grants uranium district. From 1950 to 1981, mines in the Grants district from the Todilto Formation yielded 3026 tonnes (6,671,798 pounds) of U_3O_8 and some vanadium, amounting to approximately 2% of the total uranium produced from the Grants district (Table 1; McLemore and Chenoweth, 1991).

Jeter mine, Ladron Mountains, and Socorro County

North and McLemore (1986) originally classified two deposits in New Mexico as supergene-copper-uranium (silver) deposits: La Bajada and Jeter (Ladron Mountains). McLemore (1983) described them as Jeter-type low-temperature, vein-type uranium deposits and La Bajada-type low-temperature, uranium-base metal, vein-type deposits. Similar copper–silver vein deposits have been identified in other areas in the Rio Grande valley in New Mexico and the deposit type has been renamed Rio Grande rift copper–silver (± uranium) vein deposits (McLemore and Lueth, 2017; McLemore and Chenoweth, 2017; McLemore, 2017). These vein deposits were formed at low temperatures, near-surface, and along Tertiary-age faults in Rio Grande rift basins.

The Jeter fault is a gently-dipping, normal fault that places upper Santa Fe Group fanglomerates against Proterozoic Capirote granite. Uranium veins at the Jeter mine are along the Jeter fault and appear to be controlled by the distribution of carbonaceous mudstone (Collins and Nye, 1957). From 1954 to 1958, 26.6 tonnes (58,562 pounds) of U_3O_8 at a grade of 0.33% U_3O_8 and 3,202 pounds of V_2O_5 were produced from the Jeter mine (McLemore, 1983). Drilling is required to determine if there are any remaining uranium resources at the Jeter mine.

Critical minerals potential

Many uranium deposits in New Mexico contain economic grades of uranium and vanadium (Fig. 4; Appendix 1); some of these deposits are elevated in other critical minerals. One sandstone-uranium sample contained 0.3 ppm Re and 408 ppm Mo (Appendix 1). Some samples are elevated in heavy REE (Fig. 5). Elevated copper and cesium are found in the Jeter uranium-vein samples (Appendix 1). Vanadium was recovered from some of the uranium deposits in the Grants district (McLemore and Chenoweth, 2017; McLemore et al., 2026a) and should be considered for recovery in future uranium production. Selenium and molybdenum are found in many Grants sandstone uranium deposits. Identification of critical minerals in uranium deposits should be an essential part of any exploration for mineral deposits in New Mexico. Additional sampling of mine wastes is required to determine if the mine wastes have elevated critical minerals that could be recovered.

Rare Earth Elements Deposits

Rare earth elements include the 15 lanthanide elements (atomic numbers 57 through 71), yttrium (Y, atomic number 39), and scandium (Sc, atomic number 21) and are used in manufacturing batteries, magnets, cell phones, lasers, electric cars, and other products. Rare earth elements are known as lithophile elements as they readily combine with oxygen forming stable oxides and occur in silicate and carbonate minerals. They are enriched in the crust, have similar physical and chemical properties, and occur together in mineral deposits. However, REE are not always concentrated in easily mined economic deposits and only a few deposits in the world account for current production. Recovery of individual REE can be challenging. In New Mexico, REE have been produced from a few pegmatite and vein deposits (McLemore and Austin, 2017), and exploration has occurred recently in some areas containing carbonatites and REE veins. The most economically promising REE deposits in New Mexico are found in deposits associated with the North American Cordilleran alkaline-igneous belt (magmatic REE deposits; McLemore, 2018; McLemore et al., 2025b), carbonatites (McLemore and Austin, 2017; McLemore and Lueth, 2017), and episyenites (McLemore et al., 2018, 2020).

Carbonatites

Carbonatites are carbonate-rich igneous rocks containing more than 50% magmatic carbonate minerals and less than 20% SiO_2. They are of apparent magmatic derivation and typically are found in zoned complexes consisting of alkaline igneous and/or carbonatite stocks, ring dikes, and cone sheets. They are found in several areas of New Mexico including the Lemitar and Chupadera Mountains near Socorro (McLemore and Austin, 2017). In the Albuquerque area, carbonatites are found at Lobo Hill (Moriarty) and Monte Largo (Sandia Mountains) (Fig. 2). Compositionally, the carbonatites found in New Mexico are sövites, silicocarbonatites, and rauhaugites.

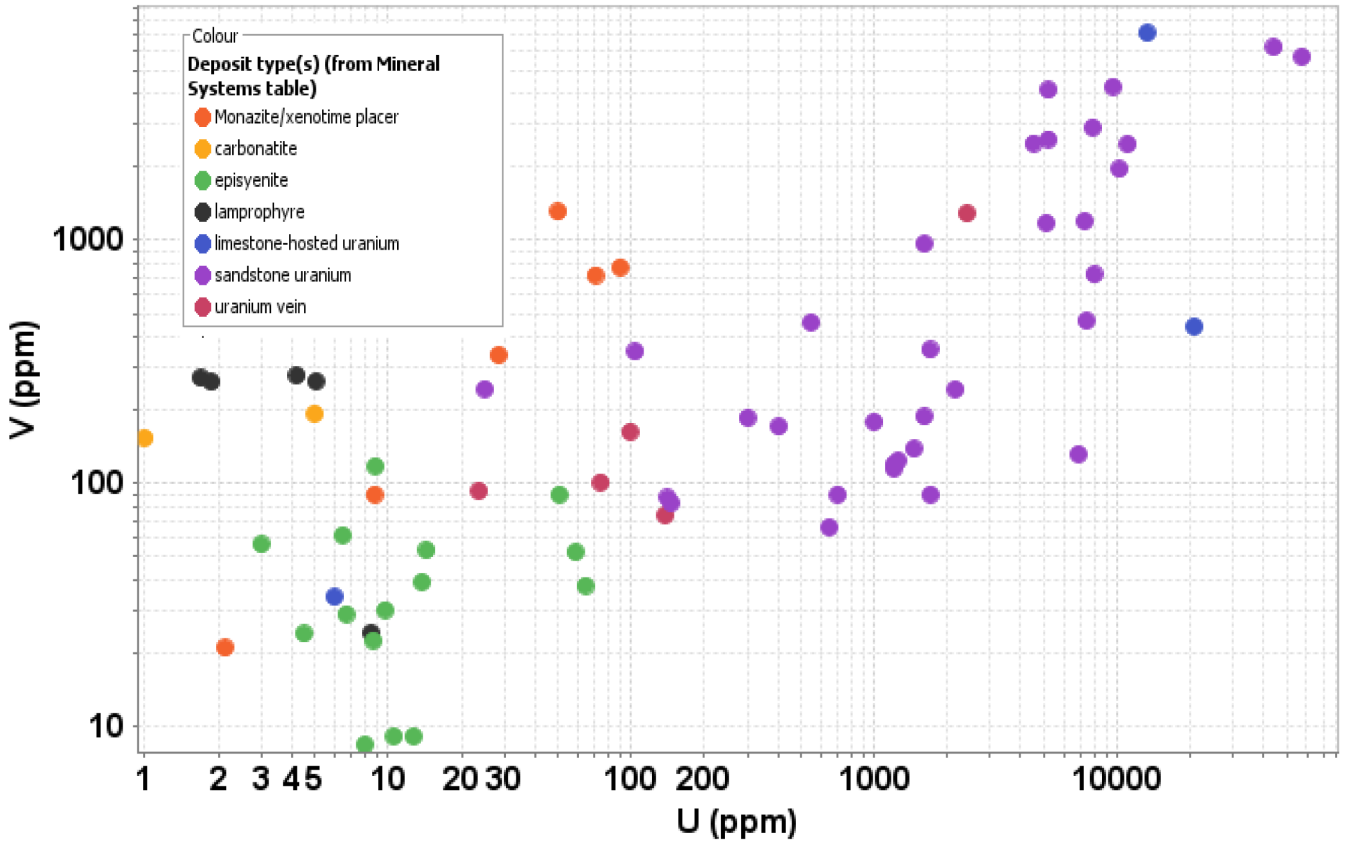


FIGURE 4. V vs. U plot. Economic uranium deposits can contain approximately 1,300 ppm U and 3,000 ppm V (McLemore and Trivitt, 2026).

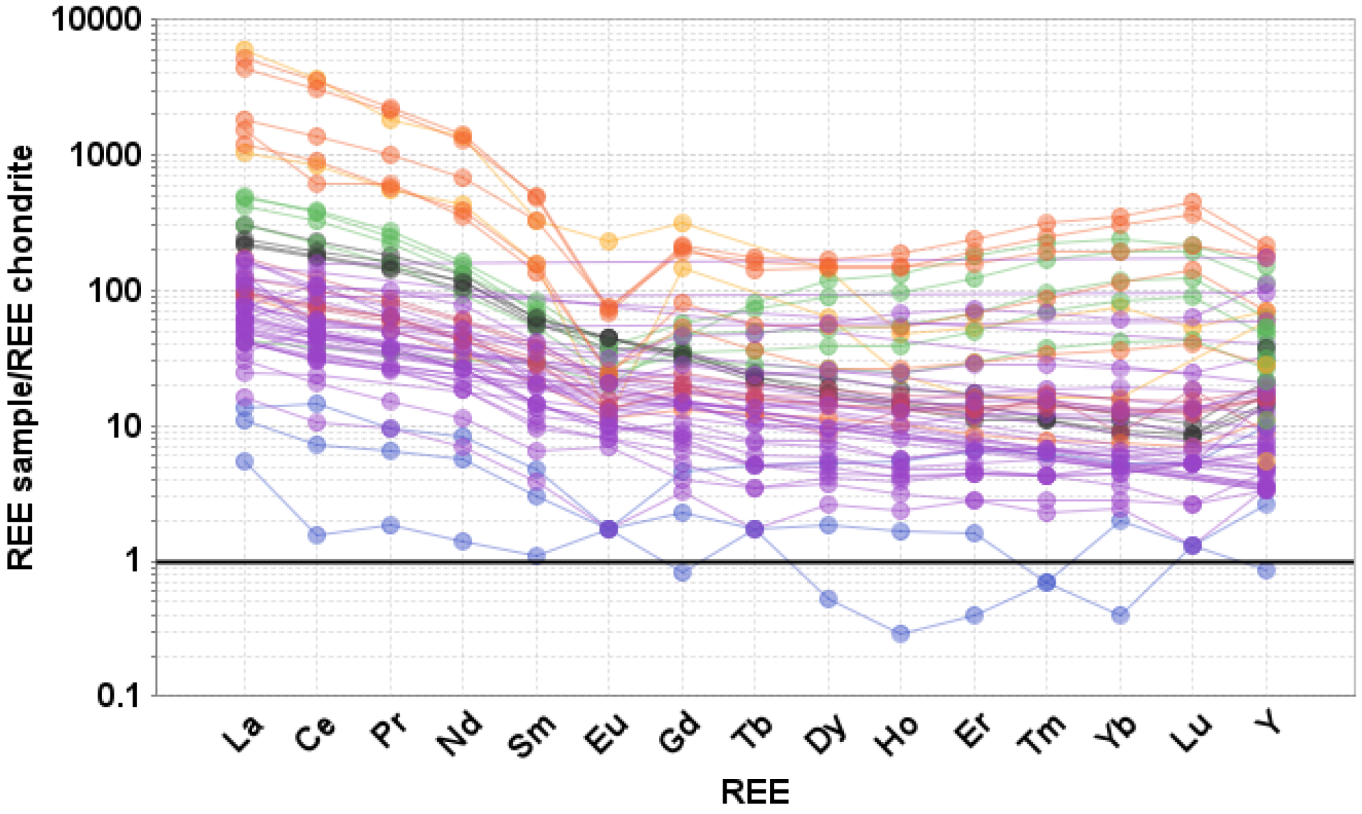


FIGURE 5. Chondrite-normalized REE (chondrite values from Taylor and McLennan, 1985). Legend in Figure 4.

Carbonatite dikes are typically 1–2 m (3–6 ft) wide and up to 500 m (1,640 ft) long and contain elevated concentrations of REE (Fig. 5), uranium (Fig. 4), thorium, and niobium (Fig. 6).

Episyenites

The term episyenite is used to describe altered rocks that were desilicified (subsolidus dissolution of quartz) and metasomatized by alkali-rich fluids. These metasomatic rocks are found in several areas in New Mexico, including the Caballo, Burro, and Zuni Mountains, Sevilleta Wildlife Refuge, and Lobo Hill. They were erroneously called syenites and alkali granites in previous studies, but episyenites are actually metasomatic in origin and not primary igneous rocks (McLemore and Lueth, 2017; McLemore, 2018; McLemore et al., 2018, 2020). The REE mineral deposits are found as spotty, discontinuous tabular bodies, narrow lenses, or as breccia zones along faults, fractures, and shear zones. These deposits contain locally elevated concentrations of REE (Fig. 5), uranium (Fig. 4), thorium, and niobium (Fig. 6). Select samples of veins from the Red Hills area in the Caballo Mountains contain as much as 2,329 ppm REE, 9,721 ppm uranium, 1,378 ppm thorium, 247 ppm niobium, and high concentrations of heavy REE (as much as 133 ppm Yb and 179 ppm Dy; McLemore et al., 2018).

The Proterozoic and Cambrian rocks at Lobo Hill near Moriarty are well exposed in the Mountain States (Davis) rock quarries (McLemore et al., 2018; Smith, 2018); but the rocks are poorly exposed outside of the quarries. Brick-red to reddish-orange K-feldspar episyenite, and magmatic monzonite, quartz syenite, and monzogranite dikes are found in the Proterozoic metamorphic rocks at Lobo Hill. Previous authors described the Lobo Hill alkaline rocks as a magmatic syenitic stock. However, better exposure during the quarrying and subsequent geochemical and petrographic studies indicates that the exposed alkaline rocks are metasomatic episyenites (Smith, 2018; McLemore et al., 2018, 2020). South of the main quarry, the episyenite is exposed in a small quarry as a plug-like body, roughly 100 m (330 ft) in diameter; drilling indicates it continues in the subsurface approximately 20–30 m (65–100 ft). The episyenites in the main quarry are unfoliated, unmetamorphosed, fine to medium grained, 0.6–1.2 m (2–4 ft) wide, dike-like to pipe-like bodies. These bodies vary in attitude from nearly flat-lying to nearly vertical and cut across metamorphic foliation. Some episyenites contain xenoliths of Proterozoic amphibolite schist that are several centimeters in diameter. Some episyenites contain up to 95% K-feldspar (orthoclase and are rich in hematite and locally dark purple fluorite, whereas other episyenites are sodium-rich, with plagioclase dominating over K-feldspar. Chilled margins are locally common in some episyenites. Some contacts between the episyenites and metamorphic rocks are sharp and cut across the foliation. Other contacts are brecciated and are characterized by a thin shear zone of iron oxides, clay, and carbonates. Local, small displacement faults offset the episyenites and metamorphic rocks. Thin zones (up to several centimeters wide) of red to reddish-orange, potassium-feldspar alteration

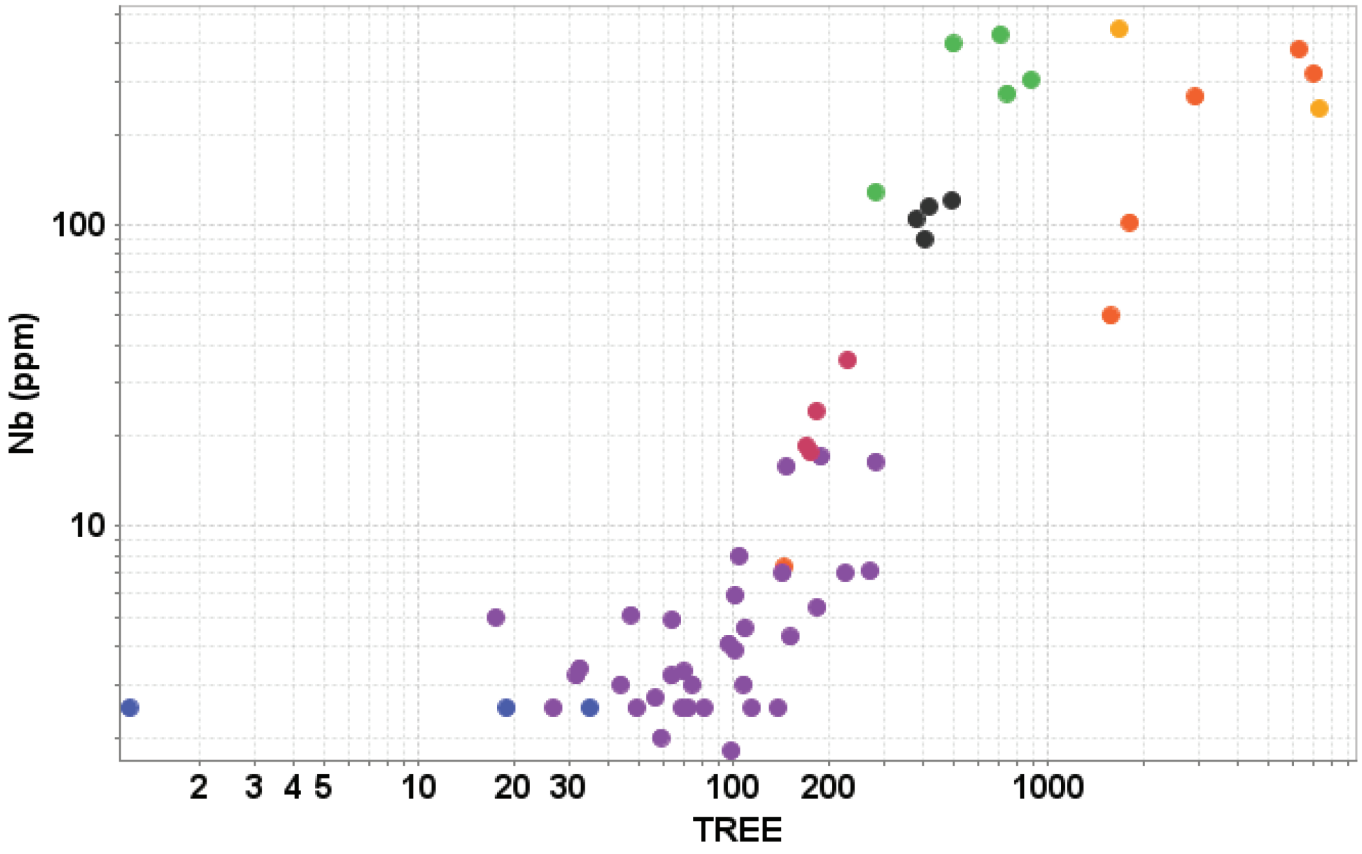


FIGURE 6. Nb vs. TREE plot. Legend in Figure 4.

occurs along fracture and joint surfaces of the metamorphic rocks. Episyenites are being mined for decorative crushed stone. Moriarty Concrete Products drilled at least 13 holes (up to 30 m [990 ft] deep) for determination of aggregate resources along Hill 6389, east of the quarry, and found that episyenites continue eastward beneath the alluvial cover and are at least (30 m) (100 ft) deep (McLemore et al., 1999). The episyenites are locally enriched in total REE (Fig. 5).

Beach-placer sandstone deposits

Beach-placer sandstone deposits are detrital concentrations of heavy minerals that are formed by mechanical concentration (i.e., settling) of heavy minerals on beaches or in longshore bars in a marginal-marine environment. Numerous deposits are found in the San Juan Basin, but only two are close to Albuquerque: B.P. Hovey Ranch and Farr Ranch (Fig. 2) that contain high concentrations of Ti (Fig. 7), Zr (Fig. 7), REE (Fig. 5), Sc, Y, U (Fig. 4), Th, Nb (Fig. 6), Ta, Fe, and other elements. Potential sources of these deposits include Proterozoic granitic and metamorphic rocks (such as those found in the Zuni Mountains), Jurassic arc volcanic rocks, and sedimentary rocks (McLemore and Trivitt, 2026). Heavy mineral, beach-placer sandstone deposits in the San Juan Basin are generally uneconomic due to small tonnage and low to moderate grades. The elevated degree of cementation through lithification, elevated iron content, and distance to processing plants and markets further challenge the economics. However, they are generally close to the surface and with the increasing demand for some of these critical minerals, and rising value of the resources, the economics may make small-operation mining and mineral processing economic at some point in the future.

The B.P. Hovey Ranch deposit (also known as the Torreon Wash deposit) is in section 34, T17W, R4W (Fig. 2; New Mexico Meridian and Base Line). The deposit is in brown- to olive-gray, medium grained, well to moderately sorted sandstone and is approximately 100 m (32 ft) long and 0.6-1.5 m (2–5 ft) thick. There are two zones of beach-placer deposits at the B.P. Hovey Ranch locality (McLemore and Trivitt, 2026). Drilling suggests that this deposit continues in the subsurface to the northwest.

The Farr Ranch deposits, in sections 13, 14, 15, 23, 25, and 26, T. 19 N., R. 6 W. (Fig. 2, Appendix 1; New Mexico Meridian and Base Line) are in the Pictured Cliffs Sandstone. The upper zone of thick beds of yellow-gray to gray-orange, cross-bedded, fine- to medium-grained, well-sorted friable sandstone beds overlie a lower zone of alternating thin beds of yellow-brown to brown, fine-grained, sandstone to siltstone and gray to dark-gray shale (McLemore and Trivitt, 2026). The Farrr Ranch deposits have dominantly quartz and feldspar layers that contain almost no zircon to ilmenite- and anatase-rich layers with abundant zircon (McLemore and Trivitt, 2026).

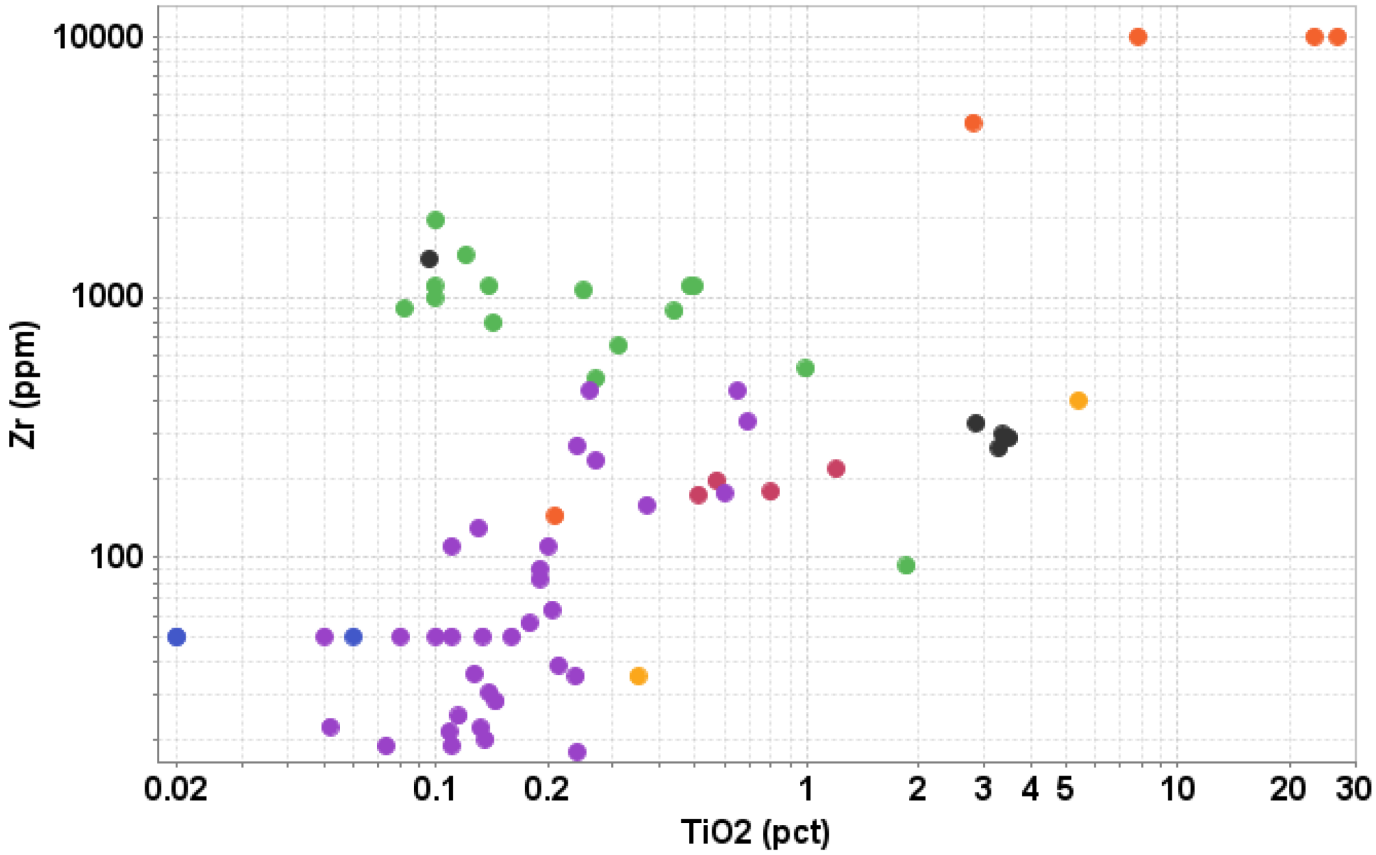


FIGURE 7. Zr vs. TiO_2 plot. Legend in Figure 4.

Samples from beach-placer deposits are enriched in total REE, Nb, TiO_2, Zr, and Fe_2O_3 (Figs. 4–6). The heavy mineral, beach-placer sandstones are found in several beds forming low bluffs, up to 2 m (6 ft) thick, striking N 240º, and contain U, Th, REE, Ti, Fe, and Zn. The main heavy minerals that are present are zircon, ilmenite, hematite, monazite, and anatase. The ilmenite- and anatase-rich layers have ~2.85% total REE whereas the quartz and feldspar layer has less than 0.2%. One sample contained 10.23% TiO_2 and 12.98% Fe_2O_3 (Appendix 1). The largest deposit is approximately 1,066 m (0.66 mi) long and 46 m (151 ft) wide (McLemore and Trivitt, 2026).

Lithium in Brines and Sediments in Playa Lakes

Lithium is a critical mineral used in many industrial products, such as lubricating grease, manufacturing glass, glazes for ceramics, health products, and batteries for cars, cellphones, and other devices. In addition, lithium is alloyed with copper and aluminum to fabricate lighter components in airplane frames (Bradley and Jaskula, 2014; McLemore, 2021). Today, most lithium comes from subsurface brines and playa lakes located in closed basins, where it exists primarily as soluble lithium chloride and high-lithium clays, such as hectorite and bentonite (Asher-Bolinder, 1991; Goonan, 2012). In arid regions, subsurface brines are pumped into a series of surface ponds where water evaporates, further concentrating lithium chloride (Bradley et al., 2017). The lithium chloride is then calcined with sodium carbonate to form lithium carbonate (Li_2CO_3; Goonan, 2012). Brine deposits in the world account for an estimated 58% of the world's lithium resources (Bradley et al., 2017). No lithium has been produced from lithium deposits in New Mexico.

Estancia Basin, Torrance County

Several National Uranium Resource Evaluation (NURE) water samples collected near a playa lake in the northern Estancia Basin, Torrance County contained anomalously high lithium concentrations (as much as 624 ppb Li; McLemore, 2021). The Estancia Basin is a closed basin bounded on the east by the Pedernal Hills and on the west by the Sandia and Manzano Mountains. Additional mapping, geochemical, and drilling studies are required to determine if there is an economic lithium resource in the Estancia Lake region.

Other Mining Districts

Historic mining districts in the San Pedro, Ortiz, Sandia, and Manzano Mountains and elsewhere in the Albuquerque area once produced silver, barite, fluorite. Additional critical minerals are known to occur (McLemore, 2017), but these areas have limited future potential because of small tonnages, low concentrations, and proximity to residential or wilderness areas (Table 1). Fluorspar is a critical mineral and there are known fluorspar (fluorite) deposits in Tijeras and Coyote Canyons near Albuquerque, but these deposits are small (less than 500,000 tons) and low grade (McLemore and Austin, 2017). Additional mapping and geochemical studies are required to determine if there is an economic resource in the subsurface in these areas.

WHAT ARE THE CHALLENGES IN PRODUCING CRITICAL MINERALS?

There are many challenges in producing many of the critical minerals. The economic viability of these mineral deposits, including those that contain critical minerals, is fundamentally controlled by grade (concentration) and tonnage (Otoo et al., 2025). Even where critical minerals are present, concentrations must exceed a minimum threshold, referred to as a cutoff grade, which is determined by the total project economics, including the costs of mining, processing, environmental compliance, water resources, and reclamation (Otoo et al., 2025). Low-grade material may be uneconomic if the cost of extraction and metallurgical recovery exceeds the value of the contained metal. Conversely, high-grade deposits with limited tonnage may not sustain long-term production or justify the capital invested in the mining operation because of fluctuating supply, price, and demand. Financing for both exploration/mining and development of new mines is competitive on a global scale.

Another important challenge is water availability for mining and processing. Water resources are vital for mining, agriculture, industry, and communities and there may not be enough water supplies to meet the demand for all uses.

Producing REE deposits is challenged by their chemical and physical properties. Geochemically, the 17 elements are similar to one another and commonly occur together in complex mineral assemblages, making it difficult to separate them individually during mineral processing. Rare earth elements deposits locally occur with small quantities of uranium and thorium. The uranium and thorium concentrations are too low to be economically recovered but are in high enough concentrations to be of an environmental concern in the radioactive waste rock remaining after mining and processing.

There are additional challenges to overcome in producing critical minerals that include lengthy periods for permitting and fluctuations in the price of the various commodities. While demand is increasing, near-surface resources are being depleted and exploration is extending to deeper or nontraditional deposits. In the past, mining companies would respond to an increase in demand and shortage in supply by increasing production, but today, mining companies may not always be able to respond to changes in supply and demand. For some critical minerals, this is becoming an issue of national security.

Social issues also can be challenging, especially where communities located near a potential mining project are concerned about the effects of mining and mineral processing on their quality of life. Other mineral resources are near or within wilderness areas, national parks, or other land withdrawn from mineral entry. Similar geologic processes that form mineral deposits also form the landscapes that society treasures and wants to protect. Mining companies must engage the local community and obtain community support (termed a social

license to operate) and address issues of sustainability. Without community support, production delays are inevitable.

Mining companies must also operate to meet stringent environmental and other regulatory standards, at the federal and state level. Mining companies, regulating agencies, universities, and the public are now recognizing the shortage in trained personnel as the aging, experienced workforce is retiring (McLemore and Trivitt, 2026). Planning for natural disasters (volcanic activity, earthquakes, droughts, floods, and wildfires) and climate changes is becoming harder, but lowering environmental standards is not an option.

KEY TAKEAWAYS

New Mexico has a wealth of mineral resources, including critical minerals, and some of these deposits are found in the Albuquerque and surrounding area. Numerous deposits in New Mexico have been and are being explored for potential critical minerals resources in recent years. Additional regional and district geologic mapping, along with geophysical and geochemical studies, are needed to properly define exploration drilling programs. There are currently ongoing efforts with mining companies, regulating agencies, universities, and the public to address the shortage in trained personnel through education, recruitment and public outreach (McLemore and Trivitt, 2026).

In the Albuquerque area, the known and more favorable areas for critical mineral exploration occur in the sandstone uranium-vanadium deposits in the Grants uranium and Red Basin districts and REE in the carbonatites and episyenites at Lobo Hill and Monte Largo. Other areas with potential critical mineral resources include lithium in the Estancia Basin.

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Appendices can be found at
https://nmgs.nmt.edu/repository/index.cfml?rid=2026006