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# *Preliminary observations on the mining history, geology, mineralization of the Jicarilla mining district, Lincoln County, New Mexico*

Virginia T. McLemore, Mark Ouimette, and Robert W. Eveleth, 1991, pp. 311-316

*in:*

*Geology of the Sierra Blanca, Sacramento, and Capitan Ranges, New Mexico*, Barker, J. M.; Kues, B. S.; Austin, G. S.; Lucas, S. G.; [eds.], New Mexico Geological Society 42nd Annual Fall Field Conference Guidebook, 361 p.

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# PRELIMINARY OBSERVATIONS ON THE MINING HISTORY, GEOLOGY AND MINERALIZATION OF THE JICARILLA MINING DISTRICT, LINCOLN COUNTY, NEW MEXICO

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**Abstract**—The Jicarilla mining district comprises much of the Jicarilla Mountains in central New Mexico. The three types of mineral deposits that occur in the district are placer, quartz veins and iron skarn/replacement deposits. Production has been minor and amounts to less than 800 oz of placer gold, 800 oz of lode gold, 38,000 oz of silver, 4.2 million lbs of copper, and 3000 lbs of lead. In addition, about 8000 tons of iron ore were produced in the 1900s. Mining began two or three hundred years ago and the district was perhaps the site of the first drill-rig in New Mexico in 1881. The mineral deposits appear to be related to Tertiary intrusives that are diverse in lithology and composition. Two age dates of about 37–38 Ma were obtained on samples of the igneous rocks. The origin of the mineral deposits was a complex process of magmatic fractionation and differentiation, perhaps involving upper mantle and lower crustal sources. The placer deposits are large but low grade, and the scarcity of water prevents developments. The district has potential for gold-bearing veins and possible breccia deposits, but subsurface drilling will be required to determine their extent.

## INTRODUCTION

The Jicarilla (or Ancho) mining district is located about 18 km northeast of White Oaks in northern Lincoln County, central New Mexico (Fig. 1). The district comprises much of the Jicarilla Mountains. The geology and mineralization have been described in several reports (Jones, 1904; Lindgren et al., 1910; Wright, 1932; Griswold, 1959; Budding, 1963, 1964; Ryberg, 1968; Johnson, 1972; Segerstrom and Ryberg, 1974; North and McLemore, 1986). However, very little published information is available regarding the history of this mining district, which was one of the earliest active districts in New Mexico. The purpose of this paper is threefold: (1) to discuss the mining history of the district; (2) to briefly describe the geology, igneous petrology, and different types of mineral deposits; and (3) to relate the petrogenesis and mineralization to similar types of deposits in New Mexico. This work is based upon a literature search, field reconnaissance and preliminary petrologic and geochemical studies. These data are incomplete and the results are preliminary.

## MINING HISTORY AND PRODUCTION

Although placer mining in the Jicarilla mining district has been carried on at least since the mid-nineteenth century, total known production is disappointingly low. Some accounts indicate the placers were first worked during the Spanish occupation, two to three hundred years ago (Engineering and Mining Journal, 5/19/1904, p. 799; Bullion, 7/26/1892, p. 4). Jones (1904, p. 177) suggested that native Mexican miners were working the ground as early as 1850. Such mining was difficult at best due to the scarcity of water, and was carried on in a most primitive manner. Gold-bearing material was carried some distance to where water was available (occasionally it, too, being transported with great effort) and the material washed in "bateas," the predecessor of the gold pan. So extensive was this activity that by the time of the arrival of American prospectors around 1880, Ancho and Rico gulches were said to be honeycombed with placer diggings for 10 km (Mining World, vol. 1, no. 10, June 1881, p. 9; Jones, 1904, p. 177).

Overall grade of the placers was low but local "hot" spots were apparently found. Miguel Antonio Otero (father of New Mexico governor Miguel Otero) and his associates are said to have worked a crew of miners during the 1860 placering season and recovered some 2900 oz, worth approximately $60,000 (Bullion, 7/26/92, p. 4). The local high-grade streak could not possibly account for all this activity, however. Jicarilla gold is exceptionally fine and brought a dollar more per ounce than most other placer gold in the territory—a significant fact whether the price of the metal is $20.67 per oz (as it was in the nineteenth and early twentieth centuries) or $400 per oz. Even the slightest amount of precipitation, whether rain or snow, would bring the miners out in force to wash for the yellow metal (Mining World, June 1881, p. 9).

The first attempts at lode mining began with the arrival of the American prospectors. Some of the earliest properties located were the Argonaut, Buckeye State, Eureka, Gold Stain (now Spring), Hawkeye, Red Rose and Zulu. Also during this period, New Mexico's very first drill-rig may have been set up. According to Mining World (Las Vegas, NM), a large boring machine was shipped from the oil regions of Pennsylvania to Las Vegas by rail and thence by teams to Jicarilla. A pipeline was constructed to Patos Mountain to obtain enough water to run the steam-driven drill and 500 cords of wood were delivered to the site for fuel. By June 1881 the derrick was erected. Some $15,000 was invested by the adventurers, but it is not known whether any drilling was actually completed (Mining World, March 1881, p. 12; June 1881, p. 8).

The most significant developments in the district came soon after the turn of the century. The American Placer Company erected a placering machine and attempted to work the gravels principally along Ancho Gulch. Contrary to popular belief, this machine was not a dredge in the strictest sense since it did not float in water. Research shows it to have been a cantilever-type placering machine manufactured by W. M. Johnston of Chicago. The machine weighed nearly 200 tons and supposedly could excavate down to 8 m. It was a brute to move, being rail-mounted on two parallel track beds. Lack of water was again a major problem, and to obtain a sufficient supply, some 6 km of pipeline was installed by the company. Wells were sunk to 980–1320 m, but regardless of the effort and investment (said to be at least $50,000), the scarcity of water and the difficulty of working the ground (2 to 7 m of overburden lay above the narrow pay streak and the machine obviously encountered difficulty here), the venture was unsuccessful (Jones, 1904, p. 177; Lindgren et al., 1910, p. 184; Griswold, 1959, p. 79; Engineering and Mining Journal, 9/01/01, p. 259, 11/03/01, p. 530).

Attempts were again made about the same time to develop the lode deposits. The Wisconsin Mining and Milling Company was perhaps the most successful in that some significant tonnages were developed and some bullion produced. What is not known is whether these efforts were profitable. Wisconsin installed a 50 ton/day Fairbanks-Morse amalgamation mill and focused their efforts on such properties as the Sally, Murphy, Apex and Gold Stain. Extensive development was carried on at the Gold Stain and Murphy, and today the largest mine dumps in the district are located on these properties (Western Mining World, 7/01/05, p. 701; Griswold, 1959, p. 79). Wisconsin's best years appear to have occurred during 1908–1909, when the Murphy was developed down to at least the 400-ft level and substantial tonnages of gold-bearing ores were treated (Western Mining World, 9/12/08, p. 420; Henderson, 1908, 1910).

Other attempts at lode and placer mining were made during this

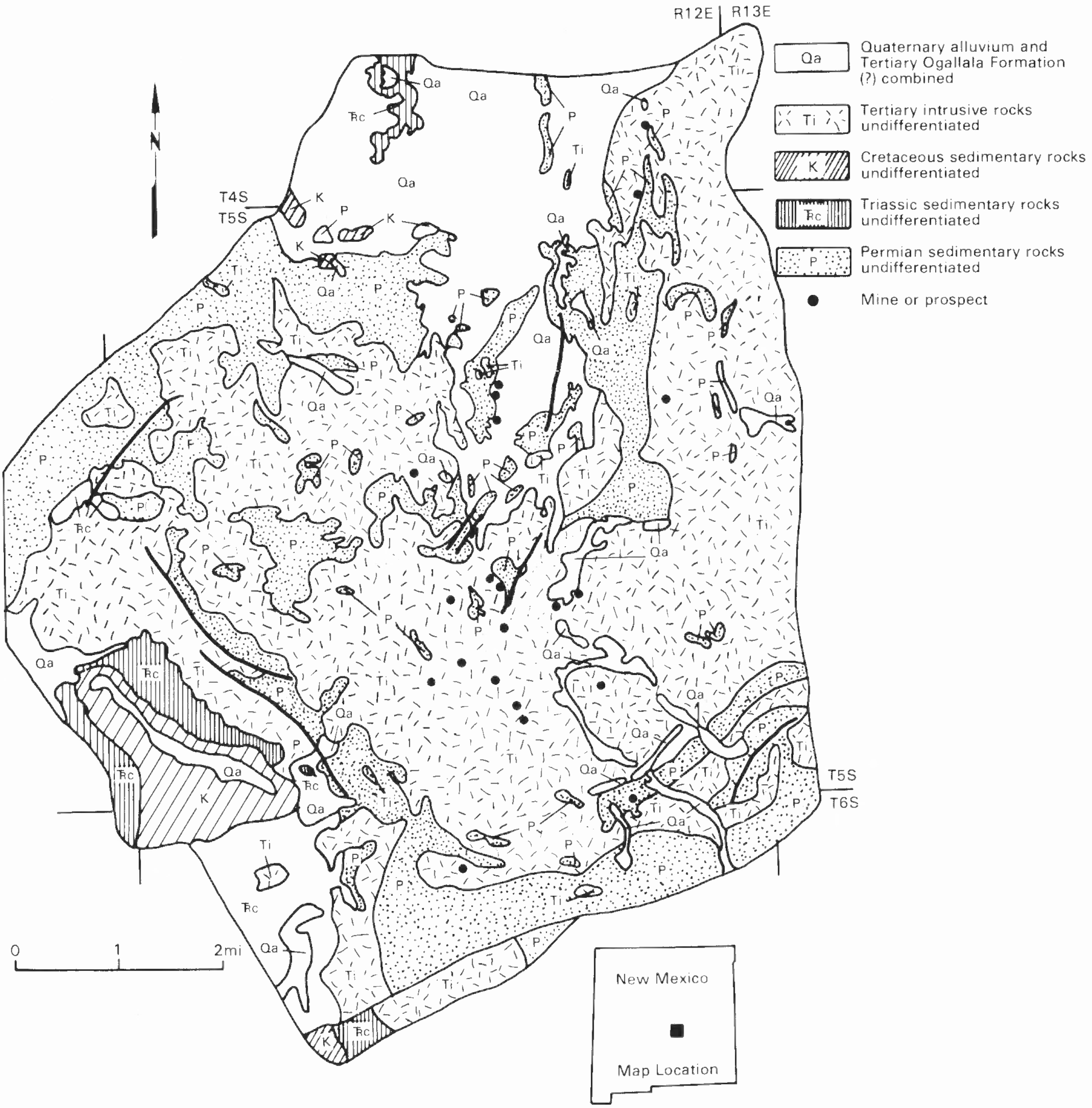

FIGURE 1. Geologic map of Jicarilla mining district (simplified from Segerstrom and Ryberg, 1974).

period by such companies as the Revenue Gold Mining Co. (appropriately misnamed), Rincon Mining and Milling Co., Rico Mining Co., Fleming-Fox Copper Co., Mitchell Gold Co., and others (NMBM&MR file data; Western Mining World, 6/24/05, p. 673; 7/01/06, p. 701; 9/12/08, p. 420). All appear to have been marginally successful at best. The last lode mining took place in the Jicarilla district during 1933, when the Lucky Strike and a few other small prospects shipped 130 tons of gold ore (Anderson, 1957, p. 91).

The devaluation of the dollar in 1934 and the attendant rise in gold price to $35 per ounce encouraged some rather large-scale attempts to mine the placers in 1935. Heavy equipment (shovels, etc.) was moved in but operations again proved a failure and lasted only briefly (Metzger, 1938, p. 59). All gold operations ceased activity by order of the War Production Board in 1942 and the district was essentially idle through 1957 (Howard, 1967, p. 123, 124).

The Jicarilla district has been examined and evaluated in considerable detail over the past several decades (Segerstrom and Ryberg, 1974) in an effort to locate precious metal deposits of an economic grade sufficient to sustain mining operations. None of these attempts were successful.

The total mineral production of this district is not known precisely. Gold production prior to 1900 is unverifiable; through 1931 it is inconsequential and is estimated at $90,000 (Table 1; Lasky and Wooton, 1933). A total of $72,125 in gold, silver and copper production is credited to the district since then, making a total of $162,125. Estimated and known base and precious metals production is tabulated in Table

TABLE 1. Precious and base metal production from the Jicarilla mining district, Lincoln County, New Mexico. Compiled from U.S. Bureau of Mines Mineral Yearbooks, Segerstrom and Ryberg (1974) and Johnson (1972). [a]Total gold placer production is estimated. [b]Includes some placer silver production.

| Year | Ore (short tons) | Copper (lbs) | Gold lode (oz) | Gold placer (oz) | Silver[b] (oz) | Lead (lbs) |
|---|---|---|---|---|---|---|
| Prior to 1902[a] | --- | --- | --- | 4,500 | --- | --- |
| 1902-1911[a] | --- | --- | --- | 646 | | |
| 1912 | --- | --- | --- | 48.6 | --- | --- |
| 1914 | 11,009 | 387,211 | 1,861 | 44 | 5,376 | 2,027 |
| 1915 | --- | 1,747,090 | 2,104 | 63 | 24,570 | --- |
| 1916 | 20,195 | 1,077,492 | 1,911 | 31 | 7,401 | 638 |
| 1917 | 15,558 | 731,894 | 1,137 | 218 | --- | --- |
| 1918 | 6,210 | 253,405 | 247 | 99 | --- | --- |
| 1919 | 205 | 4,382 | 4 | --- | 25 | --- |
| 1933 | 130 | --- | 82.62 | 236.02 | 50 | --- |
| 1934 | --- | --- | --- | 327.81 | 26 | --- |
| 1935 | --- | --- | --- | 309.09 | 21 | --- |
| 1936 | --- | --- | --- | 289.40 | 20 | --- |
| 1937 | --- | --- | --- | 184.2 | 16 | --- |
| 1938 | --- | --- | --- | 162.2 | 11 | --- |
| 1939 | --- | --- | --- | 203 | 13 | --- |
| 1940 | --- | --- | --- | 178 | 14 | --- |
| 1941 | --- | --- | --- | 178 | 14 | --- |
| 1942 | --- | --- | --- | 36 | 4 | --- |
| 1946 | --- | --- | --- | 1.0 | --- | --- |
| 1948 | --- | --- | --- | 1.0 | --- | --- |
| TOTAL[a] | 53,307 | 4,201,474 | 7,347 | 7,755 | 37,561 | 2,665 |

1. In addition, approximately 8000 tons of iron ore was produced from the district between the periods 1918 to 1921 and 1942 to 1943 (Kelley, 1949; Griswold, 1959).

## GEOLOGY

The Jicarilla Mountains consist of an incomplete sequence of Permian through Cretaceoous sedimentary rocks (Table 2) that have been intruded by a series of Tertiary igneous intrusives (Fig. 1). Remnants of the Ogallala Formation (Tertiary) occur throughout the area (Budding, 1963, 1964). The sedimentary rocks are described elsewhere in this guidebook and the reader is referred to those articles for more information.

TABLE 2. Stratigraphic units in the Jicarilla Mountains (from Budding, 1963, 1964; Segerstrom and Ryberg, 1974). Specific units are described elsewhere in this guidebook.

Recent
    Alluvial fan and stream deposits

Pliocene
    Ogallala Formation (stream and mudflow deposits)

Oligocene-Eocene
    Basaltic dikes
    Intrusive rocks

Cretaceous
    Mesaverde Group
    Mancos Shale
    Dakota Group

Triassic
    Chinle Formation
    Santa Rosa Formation

Permian
    Artesia Formation(?)
    San Andres Formation
    Glorieta Sandstone
    Yeso Formation

The igneous rocks in the Jicarilla Mountains are complex and quite diverse in lithology and composition. More detailed petrographic and geochemical work is needed. Preliminary data (V. T. McLemore, field data, 1990) and reports by Budding (1963, 1964), Ryberg (1968) and Segerstrom and Ryberg (1974) indicate the Jicarilla Mountains contain a lithologic diversity of porphyritic stocks and dikes. Compositions range from syenite to quartz syenite to quartz monzonite to granite (Table 3; De la Roche et al., 1980). The porphyry phenocryst assemblage includes medium-grained plagioclase, hornblende, biotite and quartz. X-ray diffraction studies indicate the groundmass is composed mostly of microcrystalline orthoclase and quartz. The plagioclase is euhedral and present as monomineralic glomerocrysts and single grains. Most phenocrysts have moderate normal zoning. Unzoned phenocrysts are optically sodic-andesine. Alteration in plagioclase is limited to sericite occurring along cleavage planes and at cleavage intersections. Hornblende is euhedral, pleochroic green to brown, and is locally altered to chlorite. Biotite occurs as euhedral to subhedral plates with limited chloritic alteration. Quartz phenocrysts are sparsely distributed as subhedral grains, typically showing resorption surfaces. The groundmass is microgranular orthoclase laths with anhedral, interstitial, quartz grains. In some quartz monzonites and tonolites, xenoliths of foliated, garnet-bearing amphibolite have been observed by Allen and Foord (1991, this volume).

Chemically (Table 3), the porphyries are diverse in being subalkaline to alkaline, and peraluminous but not heavily silica-saturated (8 to 18% normative quartz; Fig. 2). The porphyries plot as trachydacites based on total alkali versus silica (Fig. 3; Le Bas et al., 1986) compared to their extrusive equivalents.

Two age dates of rocks from the Jicarilla Mountains are reported in the literature. Segerstrom and Ryberg (1974) reported a K-Ar age of 37.3 ± 1.5 Ma on biotite from a monzonite. A second age of 38.2 Ma (recalculated using new constants) was reported in Isochron/West (1979, no. 26, p. 25). These ages are among the oldest for Tertiary igneous rocks in Lincoln County, and are similar to some of the volcanic and pluton rocks of the Sierra Blanca complex (Allen and Foord, 1991, this volume).

## MINERAL DEPOSITS

Three types of mineral deposits occur in the Jicarilla Mountains: placer, gold-bearing quartz veins and iron skarn/replacement deposits. All three types of deposits have been productive; however, the most significant production has come from the gold placers.

### Placer deposits (late Tertiary to Quaternary)

Placer gold occurs in gravels, sands and silts of the Ogallala Formation. Some high-grade gold streaks occur in weathered zones overlying the Tertiary igneous intrusives (Segerstrom and Ryberg, 1974). Gold placers also occur in poorly sorted, unconsolidated fanglomerate and alluvial deposits that are less than a few meters thick. Gold assays are typically low, but range as high as 17 ppm. Gold is less than 2 mm in diameter. The placers consist of gold, scheelite, magnetite, hematite, hornblende, epidote, augite, sphene, apatite, zircon and pyrite (Griswold, 1959; Segerstrom and Ryberg, 1974). The gold is most likely derived from gold-bearing quartz veins as well as gold-rich zones within the intrusives (Johnson, 1972).

### Gold-bearing quartz veins

The gold-bearing quartz veins in the Jicarilla district have been classified as Great Plains margin (GPM) deposits by North and McLemore (1986). GPM deposits in New Mexico lie along, or near, the border of the Great Plains with the Southern Rocky Mountains or Basin and Range provinces (McLemore, 1991, this volume) and include gold-bearing breccia pipes and quartz veins, copper and/or lead/zinc skarns and iron skarns. They are typically associated with alkalic rocks and with de-

TABLE 3. Chemical analyses of selected samples from Jicarilla Mountains. Samples J22.1, J27.2, J27.3 collected by senior author and analyzed by Chris McGee (NMBM&MR, X-ray Laboratory). Samples J1, J11, J15, J17, J19, J53 from Segerstrom and Ryberg (1974). [a]Total iron reported as $Fe_2O_3$. [b]Lithology from discriminant diagram of De la Roche et al. (1980).

| Wt % | J22.1 | J27.2 | J27.3 | J27.4 | J1 | J11 | J15 | J17 | J19 | J53 |
|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 65.4 | 54.5 | 63.5 | 70.4 | 64.2 | 64.6 | 56.0 | 57.7 | 61.8 | 60.9 |
| $TiO_2$ | 0.51 | 0.54 | 0.53 | 0.52 | 0.47 | 0.26 | 0.77 | 0.72 | 0.82 | 0.70 |
| $Al_2O_3$ | 16.4 | 16.5 | 16.0 | 16.8 | 15.8 | 17.5 | 15.9 | 15.8 | 16.7 | 16.2 |
| $Fe_2O_3$ | 3.34[a] | 3.36[a] | 3.9[a] | 1.78[a] | 2.3 | 2.2 | 4.7 | 4.8 | 2.0 | 3.4 |
| FeO | -- | -- | -- | -- | 2.3 | 0.84 | 2.8 | 3.1 | 2.6 | 2.8 |
| MnO | 0.06 | 0.05 | 0.06 | 0.01 | 0.06 | -- | 0.10 | 0.12 | 0.07 | 0.06 |
| MgO | 1.09 | 1.09 | 1.21 | 0.47 | 1.7 | 0.57 | 2.00 | 3.7 | 1.8 | 2.6 |
| CaO | 4.5 | 3.41 | 3.67 | 0.63 | 2.20 | 0.89 | 3.7 | 4.0 | 3.3 | 3.9 |
| $Na_2O$ | 4.6 | 5.97 | 6.07 | 6.49 | 4.80 | 4.90 | 5.70 | 5.3 | 5.4 | 4.7 |
| $K_2O$ | 2.86 | 3.18 | 3.25 | 1.14 | 3.00 | 6.80 | 3.00 | 2.9 | 3.2 | 3.0 |
| $P_2O_5$ | 0.32 | 0.32 | 0.32 | 0.31 | 0.27 | 0.14 | 0.53 | 0.5 | 0.37 | 0.23 |
| LOI | 0.95 | 0.78 | 1.51 | 2.12 | -- | -- | -- | -- | -- | -- |
| $H_2O^+$ | -- | -- | -- | -- | 1.5 | 0.9 | 1.2 | 0.82 | 0.45 | 1.1 |
| $H_2O^-$ | -- | -- | -- | -- | 0.59 | 0.40 | 0.15 | 0.38 | 0.55 | 0.42 |
| $CO_2$ | -- | -- | -- | -- | 0.58 | 0.08 | 3.4 | 0.05 | 0.34 | 0.05 |
| TOTAL | 100.03 | 99.99 | 100.02 | 100.67 | 99.77 | 100.08 | 99.95 | 99.89 | 99.40 | 100.06 |
| CIPW NORM | | | | | | | | | | |
| Apatite | 0.71 | 0.71 | 0.70 | 0.66 | 0.60 | 0.31 | 1.71 | 1.30 | 0.83 | 0.52 |
| Ilmenite | 0.98 | 1.03 | 1.01 | 0.95 | 0.91 | 0.49 | 1.47 | 1.40 | 1.60 | 1.36 |
| Magnetite | 2.44 | 2.66 | 2.83 | 1.24 | 3.38 | 1.95 | 6.86 | 7.14 | 2.98 | 5.05 |
| Orthoclase | 16.99 | 18.84 | 19.16 | 6.4 | 17.94 | 40.05 | 17.81 | 17.54 | 19.35 | 18.13 |
| Albite | 39.14 | 50.67 | 51.24 | 52.75 | 41.11 | 41.34 | 48.46 | 45.92 | 46.78 | 40.67 |
| Anorthoclase | 15.74 | 8.86 | 7.80 | 1.06 | 9.26 | 3.49 | 8.98 | 11.01 | 12.16 | 14.57 |
| Diopside | 3.97 | 5.17 | 6.90 | -- | 5.17 | 7.98 | 5.32 | 5.28 | 1.84 | 3.23 |
| Hypersthene | 1.27 | 1.00 | 0.54 | 0.83 | 3.46 | 0.93 | 1.95 | 5.11 | 3.28 | 4.01 |
| Corundum | -- | -- | -- | 8.63 | -- | 6.58 | -- | 2.64 | -- | 1.59 |
| Quartz | 17.85 | 10.27 | 8.26 | 25.97 | 7.79 | 7.70 | 3.18 | 4.11 | 9.24 | 10.94 |
| Hornblende | 0.30 | 0.85 | -- | -- | -- | -- | -- | -- | -- | -- |
| TOTAL | 99.08 | 99.21 | 98.51 | 98.85 | 97.10 | 98.70 | 95.20 | 98.64 | 98.06 | 98.49 |

posits of iron, molybdenum, rare-earth elements, fluorite, tungsten and niobium.

Quartz veins in the Jicarilla district strike predominantly northwestward, but some strike north-south or northeastward and all are steeply dipping. Minerals associated with the veins include hematite, pyrite (rarely arsenopyrite), chalcopyrite, sphalerite, galena and gold (Lindgren et al., 1910; Segerstrom and Ryberg, 1974).

Additionally, some areas contain disseminations of gold and quartz stockworks within the igneous intrusives. Silicification is common and sericitization occurs locally. Veins range in width up to 10 m (Lindgren et al., 1910), but very little information derived during the lode mining period (ca. 1880–1910) has been preserved and little is known regarding the extent and grade of these deposits.

### Iron-skarn/replacement and vein deposits

Numerous iron-skarn/replacement and vein deposits occur throughout Lincoln County and are spatially associated with Tertiary igneous intrusives (Kelley, 1949; Harrer and Kelly, 1963; Griswold, 1959; McLemore, 1991, fig. 1). The deposits in the Jicarilla Mountains are small and low grade (less than 40% Fe). They consist of a series of iron-ore replacement bodies and veins in limestones of the San Andres or Yeso Formations. Ore minerals consist of magnetite and hematite in a gangue of calcite, quartz, fluorite, and locally pyrrhotite, chalcopyrite and purite (T. B. Thompson, written comm., 1991). Pyroxene, tremolite, actinolite, epidote and phlogopite are also present. The presence of calc-silicate minerals and proximity of the iron-ore deposits to the igneous intrusives suggest a magmatic origin for the mineralization. However, detailed petrographic, mineralogic and geochemical data are needed to determine the origin of these deposits.

## DISCUSSION

The Tertiary intrusives of the Jicarilla Mountains range in age up to at least 37–38 Ma (younger intrusives are present but have not been dated). These rocks represent part of the early stage of Tertiary magmatic activity that ultimately formed the Lincoln County porphyry belt. Some of the Jicarilla intrusives are subalkalic to alkalic (Fig. 3); however, not all of the intrusives in the Jicarilla Mountains have been studied. A younger magmatic event occurred in Lincoln County around 28–26

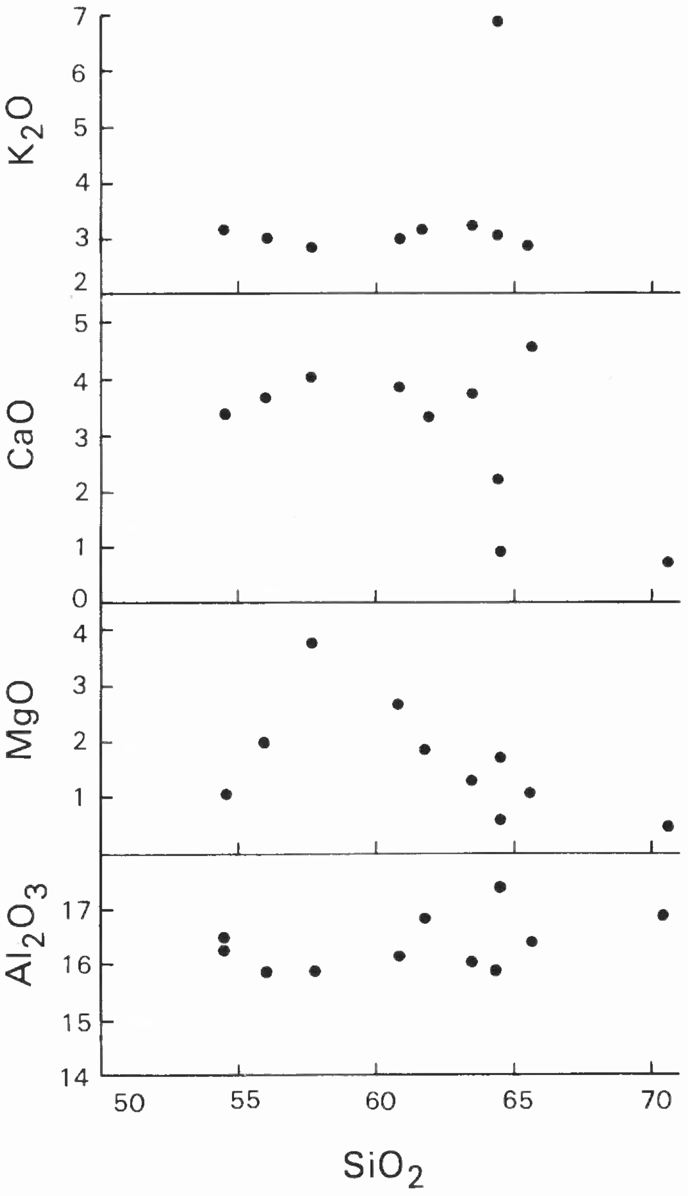

FIGURE 2. Variation diagrams of oxides versus silica for samples from Jicarilla district. Chemical analyses are in Table 3.

Ma and is represented by the Capitan pluton and younger rocks of the Sierra Blanca igneous complex (Thompson, 1972; Allen and Foord, 1991, this volume). These two magmatic events may represent two separate events or they may represent one single period of magmatic activity. There are not enough geochronologic data to distinguish between a single long event or two separate events in the Lincoln County porphyry belt. A detailed geochronologic study in this area would provide the information needed to answer this question.

The mineral deposits in the Jicarilla Mountains are similar to other mineral deposits in the western United States that occur near or along the margin of the tectonically stable Great Plains and the more tectonically active Basin-and-Range and Rocky Mountains provinces. Tertiary deposits in New Mexico that occur along this margin have been called Great Plains margin (GPM) deposits (North and McLemore, 1986; McLemore, 1991, this volume). The intersection with the west-north-west-trending Capitan lineament appears to have periodically leaked magma and perhaps controlled mineralization in Lincoln County since about 33 Ma (McLemore, 1991).

A magmatic origin for these deposits is unproven, but there is evidence to support such an origin. The close proximity of iron-skarn/replacement deposits and gold-bearing quartz veins to the Jicarilla intrusives suggests a magmatic derivation. The presence of some gold placers in the weathered zones on top of the Jicarilla intrusives suggests that gold may be disseminated within the intrusives. Other evidence from other GPM deposits supporting a magmatic origin is summarized by Allen and Foord (1991, this volume) and McLemore (1991, this volume).

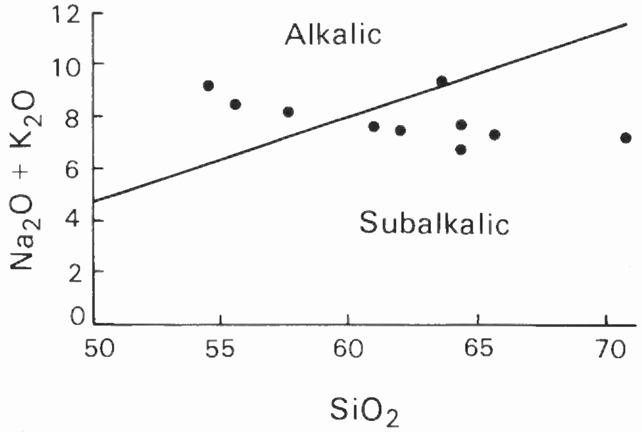

FIGURE 3. Plot of $Na_2O + K_2O$ versus silica for samples from Jicarilla district. Chemical analyses are in Table 3.

The origin of the mineral deposits in the Jicarilla district and elsewhere in Lincoln County is complex, as it is elsewhere along the Great Plains margin. The diversity in lithology, composition and age of the intrusives indicates a complex process of differentiation and fractionation of magmas, perhaps involving upper mantle and lower crustal sources. Much work remains to be done, including geochemical, isotopic and geochronological studies.

## MINERAL RESOURCE POTENTIAL

The Jicarilla district is known to host a placer gold resource, perhaps the largest remaining in New Mexico (about 5.4 million $yd^3$), but the grade is low (0.02–0.04 oz/yd; Segerstrom and Ryberg, 1974). However, due to the low grade and scarcity of water, this resource is uneconomic in today's market. The widely disseminated placer-gold deposits might be indicative of a buried mineralized deposit. This potential has not been investigated by drilling and is speculative. GPM deposits locally host gold-bearing breccia deposits, such as at Ortiz (Maynard et al., 1990). Similar deposits could exist in the Jicarilla district, but detailed mapping followed by subsurface drilling are required to verify this.

The iron deposits are small and low grade and are not economic in today's market. Certainly if a small steel mill were built in Lincoln County, these deposits should be re-examined for their iron resource.

Occasionally, the Jicarilla district has been promoted more upon the supposed presence of platinum group metals (PGMs) than upon gold. The NMBM&MR has analyzed many samples from this district over the last 30 yrs or so. No PGMs have ever been detected in samples from the district (McLemore et al., 1989). Economic deposits of PGMs typically occur in ultramafic rocks; these rocks have not been identified from the Jicarilla district. Although alkalic rocks similar to those found in the Jicarilla district may have the potential for the occurrence of PGMs, the potential for economic concentrations from this area is poor (McLemore et al., 1989).

## ACKNOWLEDGMENTS

Many thanks to Tommy B. Thompson and George Ryberg for reviewing an earlier version of this manuscript. Darren Dresser is acknowledged for assistance in sample preparation and in compiling Fig. 1.

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