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Virginia T. McLemore

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BASE AND PRECIOUS METAL DEPOSITS IN THE ZUNI MOUNTAINS, CIBOLA COUNTY, NEW MEXICO

VIRGINIA T. McLEMORE
New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico 87801

Abstract—Three principal types of deposits containing base and precious metals occur in the Zuni Mountains: (1) veins in Proterozoic rocks, (2) stratabound, sedimentary-copper deposits (± silver, uranium) in Pennsylvanian(?)-Permian sedimentary rocks and (3) fluorite veins with minor base and precious metals in Proterozoic and Pennylsvanian(?)-Permian rocks. Total known metal production from these deposits amounts to over 30,000 pounds of copper, 260 oz of silver and 2 oz of gold, although minor production from the late 1800's was not reported and is not included in the totals. No base or precious metals have been produced from the fluorite veins, but approximately 224,000 tons of fluorite ore were produced from 1937 to 1953. At present there is no mining activity of metals in the Zuni Mountains, although a number of mining claims are still active. Production in the near future is unlikely because of discontinuity, small size and low grade. However, the area has some speculative potential for veins in Proterozoic rocks and small stratabound, sedimentary copper deposits.

INTRODUCTION

The Zuni Mountains mining districts, known variously as Copperton, Diener, Montezuma or Copper Hill, lie in the central and southern parts of the Zuni Mountains in Cibola County (Fig. 1). The earliest mining was by Indians for ornamental purposes, such as pigments and jewelry (Schrader, 1910). Subsequent production occurred in the late 1800's and early 1900's by settlers and prospectors; however, total production is unknown, but presumed small on the basis of the size of the dumps. Total production from 1923 to 1965 amounted to over 30,000 lbs of copper, 260 oz of silver and 2 oz of gold worth over $4000 (Table 1).

FIGURE 1. Regional setting of the Zuni Mountains (from Dane and Bachman, 1965).

TABLE 1. Metal production from the Zuni Mountains mining district, Cibola County, New Mexico (from U.S. Bureau of Mines Mineral Yearbooks, 1923–1965).

Year	Ore mined (tons)	Copper (lbs)	Gold (oz)	Silver (oz)	Total value ($)
1923	16	4,884	--	36	748
1925	30	3,300	--	27	487
1930	57	6,600	--	57	880
1937	59	11,000	--	88	1,399
1940	12	2,700	--	28	325
1959	withheld	--	2	12	81
1963	withheld	--	--	--	--
1965	15	2,000	--	12	901
Total (excluding withheld values)	--	30,484	2	260	4,821

No base or precious metals have been produced from the fluorite veins, but approximately 224,000 tons of fluorite ore were produced from 1937 to 1953 (McAnulty, 1978). Presently there is no mining activity except for yearly assessment work on numerous mining claims. Most of the mineralized zones are on land administered by the U.S. Forest Service, although a few patented claims occur in the area. Three types of deposits containing base and precious metals occur in the Zuni Mountains: (1) veins in Proterozoic rocks, (2) stratabound, sedimentary-copper deposits (± silver, uranium) in Pennylsvanian(?)-Permian sedimentary rocks and (3) fluorite veins in Proterozoic and Pennylsvanian(?)-Permian rocks.

GEOLOGY

Geologic setting

The Zuni Mountains trend northwest-southeast at the southern end of the San Juan Basin in the Colorado Plateau physiographic province (Fig. 1). A complex Proterozoic granitic and metamorphic terrain is exposed in five separate outliers. The Proterozoic rocks are unconformably overlain by Pennsylvanian(?) and Permian sedimentary rocks (Smith, 1958; Smith et al., 1959; Goddard, 1966). Faults partly bound and transect the Proterozoic rocks. Mineral deposits occur in the southern Zuni Mountains (Figs. 1, 2).

Veins in Proterozoic rocks

Base and precious metals occur in veins in shear and fault zones in Proterozoic granite and granite gneiss throughout the central and southern Zuni Mountains (Goddard, 1966; McLemore et al., 1986). Some of the zones are up to 245 m wide and several thousand meters long. Many of the shear and fault zones trend east-west to northwest and are steeply dipping (Schrader, 1910; Goddard, 1966). Ore minerals, including predominantly malachite, azurite and pyrite, and minor amounts of chalcopyrite, chalcocite, galena, sphalerite and quartz occur in veins, breccias and as disseminations. Assays of selected samples reportedly contained up to 3–6% copper, 10 ppm gold and 340 ppm silver (Schrader, 1910). Several areas were sampled by the author and assayed for base and precious metals (Fig. 2); the results are in Table 2. Minor amounts of uranium, zinc and lead are found in some of these veins (McLemore et al., 1986). However, mineralized portions of the zones are small lenticular pods surrounded by barren, altered brecciated rock.

Potassic (biotite and K-feldspar) and/or phyllic (quartz, sericite, pyrite) alteration is common in these mineralized shear and fault zones. Brown-to-red quartz veins, barren of base and precious metals, also occur in these mineralized zones (Schrader, 1910). Such alteration has led several investigators to suggest the presence of porphyry-type copper deposits of possible Proterozoic age (Fulp and Woodward, 1981). Hematitization is also common.

Development of these mineralized areas consists of numerous shafts,

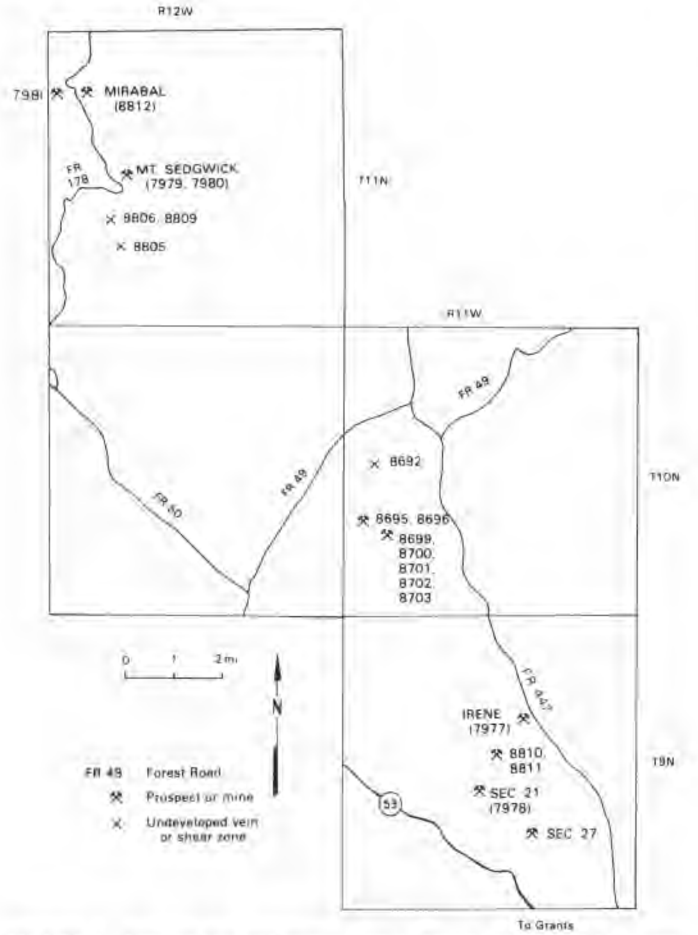

FIGURE 2. Areas of base and precious metals deposits in the Zuni Mountains.

probably less than 100 meters, short adits and prospect pits. Many of these areas are covered by active mining claims. Exploration drilling of the silicified breccia and shear zones is recommended.

Stratabound, sedimentary-copper deposits

Stratabound, sedimentary copper deposits are numerous and widespread throughout the western United States including the Zuni Mountains. Copper and associated mineralization in the Zuni Mountains typically occurs in light pink or light gray sandstone, siltstone and shale of the continental, fluvial, red-bed units of the Abo Formation (Permian) deposited on top of the Proterozoic rocks. Thin, red-brown conglomerate and arkosic sandstone beds with thin, gray limestone lenses of possible Pennsylvanian age occur in the area and are also mineralized locally. These units have been mapped as Pennsylvanian by Smith (1958) and Smith et al. (1959) elsewhere in the Zuni Mountains and are similar in lithology to other Pennsylvanian rocks elsewhere in New Mexico. Read (1951) recognizes these beds as of "problematical age." The author concurs with a Pennsylvanian age. The tabular to lenticular orebodies are small, discontinuous and low grade. Mineralized zones are typically less than a meter thick, several tens of meters wide, less than 100 m long and associated with organic material or clay lenses. Copper minerals, predominantly malachite with some azurite, chalcopyrite and chalcocite, are disseminated within the sedimentary rocks. Uranium is associated with the mineralized zones, but uranium minerals have not been identified.

Most of the production reported in Table 1 probably came from these deposits. Open pits and trenches occur throughout the area, and foundations of a mill were seen in one locality. A 2645-lb sample of hand-picked ore reportedly contained 36.5% copper and 123 ppm silver (Schrader, 1910). A sample collected by the author from sec. 7, T11N, R12W assayed 3.7% copper, no gold, 35 ppm silver and 0.005% U_3O_8 (#7981, Table 2; McLemore et al., 1986).

TABLE 2. Chemical analyses of selected samples from veins in Proterozoic rocks and mineralized Permian sandstones, Zuni Mountains, Cibola County (from McLemore et al., 1986). No platinum was detected in any samples. *Trace = less than 0.69 ppm Au.

Sample No.	Name	Location	Cu%	Au ppm*	Ag ppm	Type of sample
8811	Fool's Gold Canyon	sec 15 T9N R11W	26 ppm	0.00	0.00	dump
8810	Fool's Gold Canyon	sec 15 T9N R11W	62 ppm	0.00	0.68	dump
8692	--	sec 18 T10N R11W	3.62	0.00	0.00	shear zone
8695	--	sec 30 T10N R11W	7.41	trace	143	shear zone
8696	--	sec 30 T10N R11W	0.41	0.00	14	quartz vein
8699	--	sec 30 T10N R11W	6.24	trace	49	dump
8700	--	sec 30 T10N R11W	0.91	0.00	10	vein
8701	--	sec 30 T10N R11W	3.83	0.69	214	vein
8702	--	sec 30 T10N R11W	1.02	0.00	0.00	dump
8703	--	sec 30 T10N R11W	2.56	0.00	129	dump
8805	Diener Canyon	sec 29 T11N R12W	--	0.00	10	vein
8806	Diener Canyon	sec 20 T11N R12W	2.94	0.00	47	vein
8809	Diener Canyon	sec 20 T11N R12W	1.14	trace	25	vein
7979	Mt. Sedgwick	sec 17 T11N R12W	4.55	0.00	38	dump
7980	Mt. Sedgwick	sec 17 T11N R12W	3.50	0.00	25	shear zone
8812	--	sec 7 T11N R12W	103 ppm	0.00	16	dump
7977	Irene	sec 15 T9N R11W	--	0.00	10	dump-fluorite
7978	Sec. 21	sec 21 T9N R11W	--	2.00	145	dump-fluorite
7981	--	sec 7 T11N R12W	3.70	0.00	10	sandstone (Abo Formation)

Fluorite veins

The Zuni Mountains contain one of the state's largest fluorite-producing districts. Fluorite veins occur along northeast-trending faults and brecciated zones in Proterozoic granite and granite gneiss and Pennylsvanian(?)-Permian sandstones (Goddard, 1966). Albitization, quartz veining and hematitic alteration preceded fluorite mineralization (Messenger, 1979). Most of the fluorite veins do not contain sulfide minerals (Goddard, 1966; Messenger, 1979); however, trace amounts of copper minerals, galena and sphalerite are present locally. Two samples were assayed, and one grab sample of a fluorite vein (#7978, Table 2, Fig. 2) contained 145 ppm silver and 2 ppm gold (McLemore et al., 1986). None of the fluorite veins have been explored at depths greater than about 100 meters, and base and precious metals could possibly occur at depth.

AGE AND ORIGIN

The oldest deposits are probably veins in Proterozoic rocks. The age of these base and precious metals deposits is unknown but presumed Proterozoic since the mineralized zones occur only in Proterozoic shear and fault zones (Goddard, 1966; McLemore et al. 1986). Reactivation of these Proterozoic shear and fault zones may have occurred periodically since their formation. The deposits are probably hydrothermal deposits, possibly related to a porphyry-type copper deposit (Fulp and Woodward, 1981).

The age of the stratabound, sedimentary copper is Permian or younger. Copper and associated metals were transported in solution at low temperatures through permeable sediments and along faults. Oxidizing waters could leach metals from: (1) Proterozoic vein deposits, (2) Proterozoic rocks enriched in these metals and (3) clay minerals and detrital grains within the host rocks (LaPoint, 1976, 1979). Precipitation occurred at favorable oxidation-reduction interfaces in the presence of organic materials, H_2S-rich waters or clay zones.

The fluorite veins in the Zuni Mountains district are similar in emplacement, geology and mineralogy to sedimentary-hydrothermal deposits found throughout New Mexico (McLemore and Barker, 1985; North and McLemore, 1986) and are in part analogous to Mississippi Valley-type deposits (Ohle, 1980). Sedimentary-hydrothermal deposits are open-space filling with little or no replacement and differ from magmatic hydrothermal deposits by the absence of volcanic or intrusive source of ions, fluid and heat (Dunham and Hanor, 1967). Recent fluid-inclusion studies of barite-fluorite deposits in south-central New Mexico by North and Tuff (1986) suggest that sedimentary-hydrothermal deposits have salinities from 0.1 to 8 eq. wt.% NaCl, whereas magmatic hydrothermal deposits have salinities of less than 1.5 eq. wt.% NaCl. The Zuni Mountains fluorspar deposits have variable salinities similar to sedimentary-hydrothermal deposits in south-central New Mexico (Emanuel, 1982). These deposits were formed between 140° and 200°C (Emanuel, 1982). Basin brines from the San Juan Basin (Fig. 1) could have migrated along faults and formed these deposits.

However, the Zuni Mountains fluorspar deposits differ from most sedimentary-hydrothermal deposits in that basalt flows and cinder cones occur in the vicinity. The age relationship between the Recent volcanic rocks and the fluorite veins is uncertain, but it is probable that the fluorite deposits are older since there are no fluorite veins in the basalt or cinder. In contrast, Messenger (1979) suggests that the fluorite veins are related to buried sodic intrusives of Tertiary age.

SUMMARY

Three periods of mineralization emplaced three types of base and precious metals deposits in the Zuni Mountains. The most important type of base and precious metals deposits is probably veins in Proterozoic rocks, although production from these deposits in the near future is unlikely because of discontinuity, small size and low grade. Small stratabound, sedimentary copper deposits may exist in Pennylsvanian(?)-Permian sedimentary rocks that could be amenable to small, solvent-extraction electrowinning plants. Detailed sampling and drilling of the fluorspar veins is required to access their potential.

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REFERENCES

Dane, C. H. and Bachman, G. O., 1965, Geologic map of New Mexico: Denver, U.S. Geological Survey, scale 1:500,000.

Dunham, A. C. and Hanor, J. S., 1967, Controls on barite mineralization in the western United States: Economic Geology, v. 62, p. 82–94.

Emanuel, K., 1982, A geochemical, petrographic, and fluid inclusion investigation of the Zuni Mountains fluorspar district, Cibola County, New Mexico [M.S. thesis]: Albuquerque, University of New Mexico, 161 p.

Fulp, M. S. and Woodward, L. A., 1981, Precambrian metallic mineralization in New Mexico: New Mexico Geology, v. 3, p. 33–36, 41–42.

Goddard, E. N., 1966, Geologic map and sections of the Zuni Mountains fluorspar district, Valencia County, New Mexico: U.S. Geological Survey, Miscellaneous Geologic Investigations Map I-454, scale 1:31,680.

LaPoint, D. J., 1976, A comparison of selected sandstone copper deposits in New Mexico: Oklahoma Geological Survey, Circular 77, p. 80–96.

LaPoint, D. J., 1979, Geology, geochemistry, and petrology of sandstone copper deposits in New Mexico [Ph.D. dissertation]: Boulder, University of Colorado, 333 p.

McAnulty, W. N., 1978, Fluorspar in New Mexico: New Mexico Bureau of Mines and Mineral Resources, Memoir 34, 64 p.

McLemore, V. T. and Barker, J. M., 1985, Barite in north-central New Mexico: New Mexico Geology, v. 7, p. 21–25.

McLemore, V. T., Broadhead, R. F., Roybal, G., Chenoweth, W. L., Barker, J. M., North, R. M., Bowie, M. R., Hingtgen, J. S., Murray, D., Klein, K., Brown, K. B. and Austin, G. S., 1986, A preliminary mineral resource potential of Cibola County, northwestern New Mexico: New Mexico Bureau of Mines and Mineral Resources, Open-file Report 230, 268 p.

Messenger, H. M., III, 1979, Geology and fluorspar deposits of the southern Zuni Mountains fluorspar district, Valencia County, New Mexico [M.S. thesis]: El Paso, University of Texas, 135 p.

North, R. M. and McLemore, V. T., 1986, Silver and gold occurrences in New Mexico: New Mexico Bureau of Mines and Mineral Resources, Resource Map 15, 32 p.

North, R. M. and Tuff, M. A., 1986, Fluid-inclusion and trace-element analyses of some barite-fluorite deposits in south-central New Mexico: New Mexico Geological Society, Guidebook 37, p. 301–306.

Ohle, E. L., 1980, Some considerations in determining the origin of ore deposits of the Mississippi Valley type—part II: Economic Geology, v. 75, p. 161–172.

Read, C. B., 1951, Stratigraphy of the outcropping Permian rocks around the San Juan Basin: New Mexico Geological Society, Guidebook 2, p. 80–84.

Schrader, F. C., 1910, Valencia County: U.S. Geological Survey, Professional Paper 68, p. 134–140.

Smith, C. T., 1958, Geologic map of Inscription Rock fifteen-minute quadrangle: New Mexico Bureau of Mines and Mineral Resources, Geologic Map 4, scale 1:48,000.

Smith, C. T. et al., 1959, Geologic map of Foster Canyon quadrangle, Valencia and McKinley counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Geologic Map 9, scale 1:48,000.

Acoma Sky City; photograph by Mark Nohl, courtesy of New Mexico Economic and Tourism Department.