11th annual

NEW MEXICO MINERAL SYMPOSIUM

November 10 & 11, 1990

NMIMT Campus, Socorro, New Mexico

Welcome to

THE ELEVENTH ANNUAL

NEW MEXICO MINERAL SYMPOSIUM

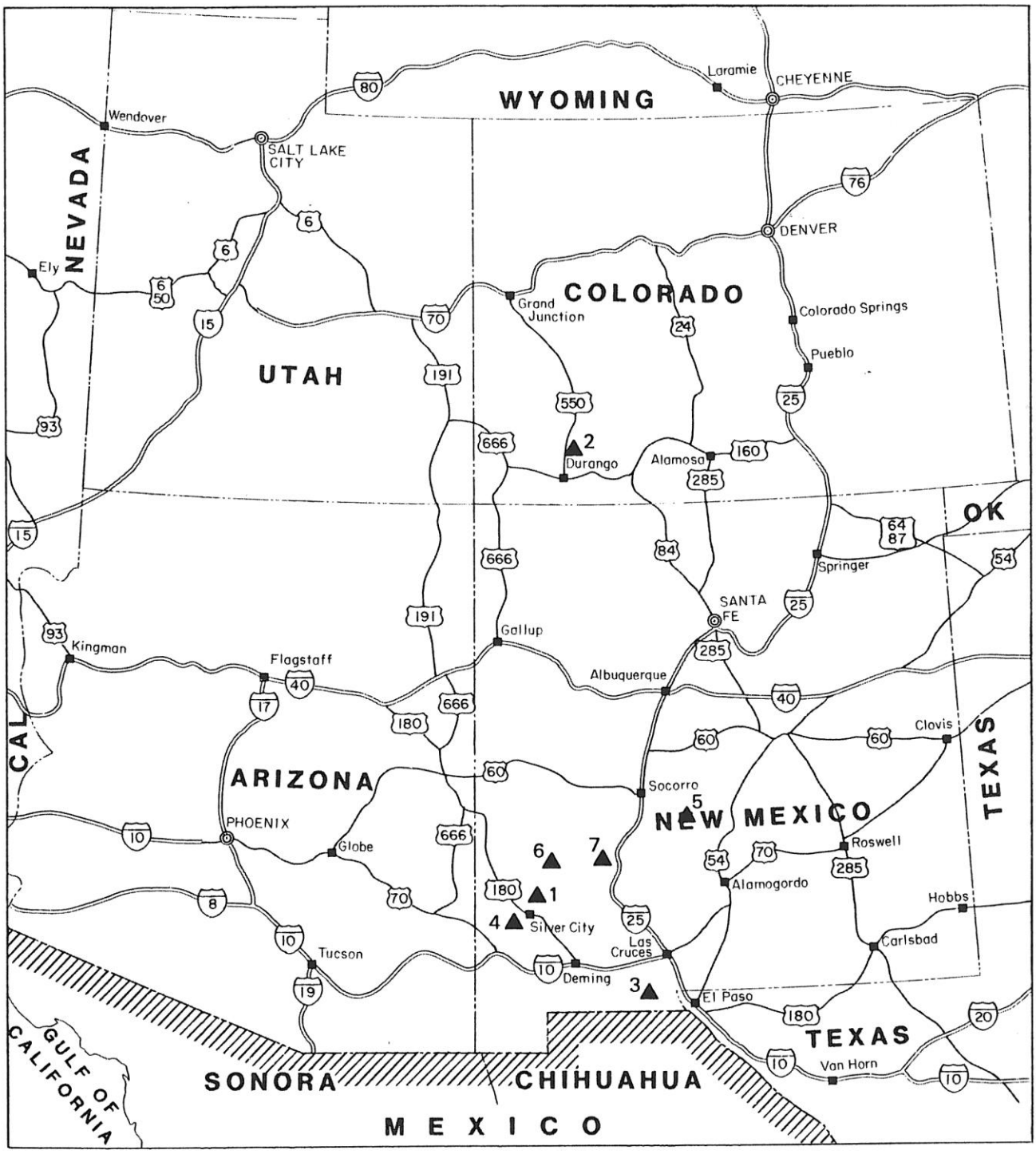
November 10 and 11, 1990

Macey Center Auditorium
New Mexico Institute of Mining and Technology
Socorro, New Mexico

sponsored by
New Mexico Bureau of Mines and Mineral Resources
Albuquerque Gem and Mineral Club
New Mexico Geological Society
Chaparral Rockhounds
Los Alamos Geological Society

The purpose of the New Mexico Mineral Symposium is to bring together for an exchange of ideas both professionals and amateurs interested in mineralogy. The sponsors hope that the Eleventh New Mexico Mineral Symposium will give both groups a forum to present their cumulative knowledge of mineral occurrences in the state. In addition to the formal papers, informal discussions among mineralogists, geologists, and hobbyists should benefit all.

Cover--MINERALS OF THE FOUR-CORNERS STATES. Scepter quartz from Kingston, New Mexico; rhodochrosite from Silverton, Colorado; topaz from the Thomas Mountains, Utah; and barite from Superior, Arizona represent the four-corners states in the cover design by Teresa Mueller.



Geographic Index Map
11th New Mexico Mineral Symposium

SCHEDULE

Numbers in parentheses refer to geographic location on index map.

Friday, November 9

6:00 pm Informal tailgating and social hour, individual rooms, El Camino Motel

Saturday, November 10

8:00 am Registration; coffee and donuts

9:00 Slide competition, Galena Room
10:10 Opening remarks, main auditorium
10:15 (1) Paragenesis of bismuth and associated silver-bearing phases, Pinos Altos district, Grant County, New Mexico--William X. Chavez, Jr.
10:40 (2) An update on the mineralogy of the San Juan Mountains, southwestern Colorado--Tom Rosemeyer

11:30 Lunch, museum tours

1:00 pm Pegmatite minerals of JeffersonCounty,Montana—Mike Gobla
1:25 (3) Kilbourne Hole maar peridot of New Mexico--John R. Fuhrbach
1:50 (4) Occurrences of phosphate minerals in southwestern New Mexico--Ron Gibbs
2:15 Coffee break
2:40 X-ray facility at New Mexico Bureau of Mines and Mineral Resources--Chris McKee
3:05 (5) Minerals of the Mex-Tex group, Bingham, New Mexico--Tom Massis
3:30 (6) Rare-earth arsenates and other rare-earth minerals from the Black Range tin district--Paul Hlava and Eugene Foord
4:05 Historic and contemporary Wyoming mineral-collecting localities--Mel Dyck

5:30 Sarsaparilla and suds: cocktail party
6:30 Dinner, Garcia Opera House with keynote address, Mineralogy of the rhodochrosite-bearing "silicate" ore-bodies of the Potosi mine, Santa Eulalia mining district, Chihuahua, Mexico, by Peter K. M. Megaw and an auction to benefit the New Mexico Mineral Symposium

Sunday, November 11

9:00 am New discoveries from the Cuchillo Negro--Ramon S. DeMark

9:25 Pink and violet micas: composition, nomenclature, and genesis of muscovite and lepidolite micas from pegmatites and metamorphic rocks in northern New Mexico and central Colorado--Peter J. Modreski

10:00 Coffee break

10:45 Laws, regulations, and policies concerning the removal of mineralogic and paleontologic specimens from public lands--Bill Jonas

12:00 Lunch

1:15 pm -3:00 Silent auction, upper lobby, Macey Center, sponsored by the Albuquerque Gem and Mineral Club

PARAGENESIS OF BISMUTH AND ASSOCIATED SILVER-BEARING PHASES, PINOS ALTOS DISTRICT, GRANT COUNTY, NEW MEXICO

(Location 1 on index map)

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Base metal (Cu-Zn) and precious metal (Au-Ag) mineralization of the Pinos Altos district comprises distinct chalcopyrite and sphalerite-rich assemblages hosted by the Pennsylvanian Syrena Formation and by the overlying Cretaceous Beartooth Quartzite. Replacement of calcareous and siliceous host rocks are common; structurally controlled mineralization is locally important, most notably in the Beartooth Quartzite.

Petrographic studies conducted on samples from the quartzite-hosted KB orebody indicate the presence of locally significant quantities of bismuth and silver mineral phases, usually associated with high-grade chalcopyrite+bornite+chalcocite assemblages or occurring in cp+bn+cc associations having hematite of hypogene(?) origin. Preliminary ore petrography has identified relatively late-stage Ag and Bi minerals from these quartzite-hosted assemblages, comprising native bismuth, bismuthinite (Bi_2S_3), stromeyerite (AgCuS), native silver, wittichenite (Cu_3BiS_3) and emplectite ($CuBiS_2$).

Paragenetic studies suggest the following sequence of mineral deposition. Early pyrite and pyrite-marcasite were followed by initial copper deposition as chalcopyrite. Zinc was introduced as sphalerite, succeeding chalcopyrite. Apparent reintroduction of copper, as cc+bn+cp, was accompanied by silver (as stromeyerite; ? and native silver?) and, subsequently, by bismuth. Apparently, early base-metal assemblages were succeeded by later introduction of Ag and Bi with attendant Cu and limited S, representing changing oxygen- and sulfur-fugacity conditions during at least two periods of mineralization.

UPDATE ON THE MINERALOGY OF THE SAN JUAN MOUNTAINS, SOUTHWESTERN COLORADO

(Location 2 on index map)

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During the last decade a number of important mineral discoveries have been made in active and inactive mines in the San Juan Mountains. Some of the minerals collected had not be reported previously from the area, while other discoveries consisted of good to spectacular crystallized groups of the more common minerals that occur in the area mines.

The Eldorado mine, located in Yankee Boy Basin in the Sneffels mining district, is a small silver mine that was first worked in the 1870's. In 1985, there was renewed interest in the mine and a new drift was driven below the old workings. Drifting on the vein disclosed small ore shoots that produced a variety of exotic and beautiful silver sulfosalts and gangue minerals. Most of the minerals occur as well-crystallized microspecimens.

Proustite occurs as beautiful red translucent crystals perched on quartz crystals. It also occurs as transparent deep-red globular inclusions in wafer-thin, colorless, tabular barite crystals. Pyrargyrite occurs as very dark red crystals associated with crystallized chalcopyrite and wires of native silver. Polybasite and pearceite occur as black, tabular, pseudohexagonal crystals scattered on quartz crystals. Miargyrite occurs as thick, tabular, iron-black crystals in quartz vugs with pyrite crystals. Other minerals that occur with the sulfosalts are galena, siderite, arsenopyrite, and rhodochrosite.

The Camp Bird mine, located 5 miles southwest of Ouray, is one of the more famous gold mines of Colorado. During the last four years, rehabilitation and renewed mining has produced a number of specimens for the mineral collector and micromounter. Of interest to the micromineral collector is the occurrence of crystallized gold in quartz vugs. The gold occurs as delicate wires and distorted crystals perched on quartz crystals. Petzite also occurs in the vugs as single, shiny-black, complex crystals on quartz and as crystals perched on crystallized gold.

The most fabulous find to date at the Camp Bird mine has been a large fluorite vug containing hundreds of scheelite crystals. The crystals range from light gray to dark brown, and individual crystals are from 1 mm to 2 cm on edge. The crystals are dipyramids with the most common form being (011) and (112). The dipyramids and groups occur on and in a matrix of sugary-

textured, colorless fluorite. Other minerals that occur in the vug are chalcopyrite, pyrite, sphalerite, galena, calcite, and quartz. Secondary minerals present are ferrimolybdite, gypsum, and dickite.

The Brooklyn mine is a small gold mine located in Brown's Gulch about 6 miles northwest of Silverton, Colorado. The mine was first worked about 1900 and has since had sporadic production. From 1978 to 1981 small gold orebodies were mined on 1 and 2 level of the mine that produced beautiful specimens of leaf and wire gold. In 1980 a small orebody was mined on 2 level that produced some rare and unusual minerals. Native mercury, cosalite, and tetradymite, along with native gold, apatite, and monazite were collected.

Other finds in the San Juan Mountains in the last ten years include wulfenite at the Bandora mine near Silverton, anatase on quartz at the Ores and Metals mine near Ouray, and large milky quartz crystal groups at the Ohio mine near Ouray.

PEGMATITE MINERALS OF JEFFERSON COUNTY, MONTANA

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Located in southwest Montana, this rugged mountain area has produced pegmatite minerals for more than a century. The pegmatites, with few exceptions, are small isolated finds that are worked out in a day or two. A few deposits such as the Pohndorf mine have produced world-class mineral specimens such as amethyst scepters on smoky quartz prisms and tourmalinated smoky quartz.

The crystals are found in miarolitic cavities in the Butte Quartz Monzonite and other granitic rocks of the Boulder batholith. Although the area of occurrence is large and will produce specimens for centuries to come, finding a pocket is a difficult task that involves both physical effort and skill gained from years of experience. Minerals found to date include:

Quartz - common as smoky quartz, amethyst scarce
Microcline - common as white crystals
Albite - clevelandite scarce
Schorl - common
Almandite garnet - scarce
Epidote - common in the Toll Mountain area
Sphene - scarce
Limonite pseudomorphs after pyrite - scarce
Elbaite - rare, two small finds have been made
Danburite - rare, two crystals found in a single pocket
Beryl - rare, a few small crystals found
Axinite - two small but prolific deposits found recently
Allanite - rare, a few one-inch crystals found

In addition to the pegmatites, Jefferson County has produced fine specimens of quartz and ore minerals from the metallic veins of its many mining districts. Minerals include:

Barite - three occurrences have been prolific producers
Quartz - the Japan twins from the PC mine are spectacular
Silver - native silver and silver sulphides were common specimens found during the 1880's when much bullion was produced
Gold - placer deposits abound where the gold has accumulated in rivers and streams; hard-rock mining is still active
Cassiterite - found in the Boulder River with gold

Slides will show the pegmatite minerals in detail and the talk will conclude with an overview of Jefferson County mineral districts and outstanding mineral specimens.

KILBOURNE HOLE MAAR PERIDOT,
DOÑA ANA COUNTY, NEW MEXICO

(Location 3 on index map)

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Peridot occurs in explosion debris from a 180,000-year-old volcano as small, but brilliant gems in a wide color range. Unlike peridot found elsewhere in the Southwest, peridot in the Kilbourne Hole maar is found in elliptical "xenolith bombs" of volcanic origin ranging from 2 to approximately 40 cm long. In chemistry, color, density and hardness, optical properties and PIXE (Proton Induced X-ray Emission) analysis, the Kilbourne peridot is similar to the San Carlos, Arizona material except for the greater color range in Kilbourne material and a characteristic inclusion not heretofore described in gemological literature. The R.I.-S.G. color relationship is reviewed with regard to Mg:Fe ratio and the effect of heat treatment and irradiation. The future of this material as a source of the seldom-seen greenish-yellow "chrysolite" peridot is discussed. Comparisons made with other documented worldwide sources add to the cumulative knowledge we have concerning peridot as a gem material.

NEW PHOSPHATE OCCURRENCES IN SOUTHWESTERN NEW MEXICO

(Location 4 on index mine)

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Turquoise had been mined in southwestern New Mexico by Indians long before the first settlers arrived. After the arrival of the settlers, many deposits were mined commercially. Some of these became famous for the quality and quantity of the turquoise, such as the Azure mine at Tyrone, the mines at Hatchita, and of course, the Chino pit at Santa Rita. The introduction of open-pit mining brought many other species to light. Occurrences at the Tyrone mine were reported at the 1986 symposium, but since then several new occurrences have been noted.

The copper phosphates, libethenite and pseudomalachite, were found recently at the 85 mine near Lordsburg.

Another occurrence of phosphates was noted recently at Tyrone along the same trend that hosted an earlier suite of cacoxenite, chalcosiderite, apatite, wavellite, and torbernite. This latest occurrence also contains cacoxenite along with strengite and leucophosphite.

Several interesting occurrences have been noted at the Santa Rita mine recently. A limited occurrence of beraunite, laubmannite and leucophosphite was discovered this summer in the Townsite Island area of the pit. This may be the first reported occurrence of these species in New Mexico. In another area of the pit, South Pit, excellent specimens of libethenite, apatite, and pseudomalachite were found. Apatite crystals have also been found in the Townsite Island area.

X-RAY FACILITY AT NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES

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The New Mexico Bureau of Mines and Mineral Resources X-ray Facility operates a wavelength-dispersive, sequential x-ray fluorescence spectrometer and three powder x-ray diffractometers. Both qualitative and quantitative analyses are performed.

X-ray fluorescence spectrometry (XRF) is a rapid, nondestructive, comparative method of geochemical analysis requiring well-characterized standards. Samples are commonly prepared as briquetted powders, fused-glass disks, or loose powders. XRF is a useful and versatile analytical method.

Crystalline phases are identified by x-ray diffraction (XRD) analysis. Loose powders, briquetted powders, solid pieces of metal and ceramic, and rock slabs are routinely analyzed.

The X-ray Facility supports basic research at New Mexico Institute of Mining and Technology. The facility also accepts outside contract work and samples from the general public.

MINERALS OF THE MEX-TEX GROUP, BINGHAM, NEW MEXICO

(Location 5 on index map)

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The Hansonburg mining district, especially the mines of the Blanchard group located near Bingham, New Mexico in Socorro County, is well known to mineral collectors. Located nearby, within this district, is another series of mines not generally known to collectors called the Mex-Tex group that in the last three years has produced a large suite of superb mineral specimens that rivals those of the Blanchard group.

The Mex-Tex group of mines consists of numerous claims that were mined for barite until about 1960. More than 96% of the barite produced in New Mexico has come from the Mex-Tex group. Mining activities for ore have occurred sporadically since then with very little production. In 1987, after abandonment of the claims by Western General Mining, the Mex-Tex group was claimed by mineral collectors for specimen purposes.

The Mex-Tex group consists of two distinct areas. The first or main area running north/south for approximately one-half mile is located along the western escarpment of the northern reaches of the Sierra Oscura mountain range and has been known traditionally as the Mex-Tex mine. It is located about one mile north and slightly east of the Blanchard group. The second area, just north of the main Mex-Tex mine and across an arroyo, is better known as the Royal Flush mine.

Extensive mineralization is found primarily between a shale zone and a limestone formation, particularly along fault lines. The ore shoots are banded, crustiform, and quite vuggy. Large pockets with coarse crystals are found throughout. The main Mex-Tex group consists of many pits, adits, shafts, tunnels, and stopes along this one-half-mile stretch. Because of their shallow nature, extensive weathering has taken place and cave-ins have occurred. ALL UNDERGROUND WORKINGS ARE CONSIDERED QUITE DANGEROUS AND HAZARDOUS.

The bulk of the mineral specimens found consist of combinations of four minerals: fluorite, galena, barite, and quartz. Any of the following can also be present on the four main minerals: linarite, plattnerite, murdochite, brochantite, spangolite, cerussite, anglesite, wulfenite, caledonite, chalcopyrite, hemimorphite, calcite, and selenite. Numerous striking/aesthetic plates, groups, and clusters have been found up to 30 inches in diameter.

Fluorite from the Mex-Tex group has proved the most desirable of the minerals found. At the main Mex-Tex mine, it is seldom found as simple cubes. Complex forms prevail, with the most abundant being the hexoctahedral form. Even the cubic forms when found are highly modified, with edges rounded or other crystal faces showing. Colors include the classic "Bingham blue," surface blue (typical of Naica, Mexico fluorite), green (various shades), clear, and purple/maroon. Single fluorite crystals in combination with other minerals sometimes exceed 3 inches across.

Quartz crystals though small, seldom exceeding one inch in length, are quite beautiful and almost always present with other minerals as showy groups. In addition to clear quartz, both amethystine and smoky are also found. The smoky color is quite attractive, for it is almost always present on the crystal tips only and not within the body. When the smoky color is present, fluorite association is most often the classic "Naica blue" or a light-green color, a most unusual but striking combination.

Galena is always found covered with other minerals. Crystals as large as 4 inches have been collected. Many times pseudomorphs of galena completely replaced by cerussite are found. Barite blades to 12 inches have also been collected. Most recently, one or more new forms of wulfenite for the Bingham area have been found at the Mex-Tex group. Though individual crystals of the other minerals present at the Mex-Tex are small, they can cover large areas on a group. Examples are murdochite on quartz and plattnerite on quartz, fluorite, and galena.

Most if not all of the easy finds and pockets have been located. Future success will involve considerable work but may be productive. The danger in the remaining workings will limit the amount of future success for mineral specimens at the Mex-Tex mine and workings.

RARE-EARTH ARSENATES AND OTHER RARE-EARTH MINERALS FROM THE BLACK RANGE TIN DISTRICT, SIERRA AND CATRON COUNTIES, NEW MEXICO

(Location 6 on index map)

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New or rare minerals, including rare-earth element (REE) arsenates, oxides, and vanadates, have been identified from lithophysal cavities and veins with associated tin mineralization in the Black Range tin district (BRTD). These minerals occur in sparse to minute amounts but are distinctive because of their color, habit, and mineral association. Details of the mineralogy of the BRTD are given in Foord et al. (1988), in which additional pertinent references are listed.

REE arsenates occur as three separate minerals having two different crystal structures. Chernovite-(Y) is the high-temperature form of $YAsO_4$ and has the tetragonal xenotime (YPO_4) structure, as well as being isostructural with zircon ($ZrSiO_4$) and thorite ($ThSiO_4$). Gasparite-(Ce), $CeAsO_4$, has the monoclinic monazite ($CePO_4$) structure and was first described from the Italian Alps (Graeser and Schwander, 1987). Both of these minerals have been found at Squaw Creek and Paramount Canyon. The Ce-dominant analogue of chernovite has been found only at Paramount Canyon and is the third new species to be described from the BRTD, the first two being squawcreekite and maxwellite (Foord et al., in press).

Solid solution exists between chernovite (As) and xenotime (P) (Graeser et al., 1973). Our studies indicate that solid solution, approaching 50 mold substitution of P for As, also exists between gasparite (As) and monazite (P). Coupled Th-Ca substitution for REE also is present, and as much as 5 wt% ThO_2 and 1.5 wt% CaO have been detected. Si substitution for P is almost nil. Chernovite-(Y) from Squaw Creek contains as much as 5 wt% P_2O_5, 3.5 wt% ThO_2 and 0.4 wt% SiO_2. Small amounts of S substitute for As and P in both minerals.

The fourth possible permutation of the REE-As matrix, monoclinic $YAsO_4$, has not been found but should occur in nature. The high-temperature form of $REEAsO_4$ is tetragonal and the low-temperature form is monoclinic. Geologic, textural, and mineral-

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[1]Part of this work was supported by the U.S. Department of Energy under contract DE-AC04-76DP00789.

ogical evidence indicates that the depositional temperatures in the BRTD were high (300-800°C), with those at Paramount Canyon (tetragonal YAsO and $CeAsO_4$) being higher than those at Squaw Creek (tetragonal $YAs0_4$ and monoclinic $CeAsO_4$).

Associated with the REE arsenates at Paramount Canyon are species that probably are cerianite, CeO_2, and wakefieldite-(Y), YVO_4. The cerianite occurs as inclusions and segregations within the chernovite and gasparite, and the wakefieldite occurs as rims on grains of chernovite-(Y). Identification of these two species is based solely on microprobe data because the small grain size (less than several microns) precludes x-ray diffraction studies.

Other REE-bearing minerals from the BRTD include chevkinite (or perrierite) and titanite, both from Willow Spring Draw. Details on both of these minerals are given in Foord et al. (1988). The titanite is unusual because of its high content (approximately 15 wt%) of incompatible and rare elements.

The unusual combination of rare elements (e.g. Sb, Sn, As) and the absence or rarity of some more common ones (e.g. P) in the host rhyolites and later hydrothermal fluids, combined with appropriate P-T conditions, resulted in the formation of several new or rare mineral species. It is likely that more such minerals are present in the area, waiting for the diligent to discover them.

References

Foord, E. E., Maxwell, C. H., and Hlava, P. F., 1988, Mineralogy of the Black Range tin district, Sierra and Catron Counties, New Mexico: 9th New Mexico Mineral Symposium, Socorro, NM, pp. 23-27; New Mexico Geology, v. 11, no. 2, pp. 39-40.

Graeser, S., and Schwander, H., 1987, Gasparite-(Ce) and monazite-(Nd)--two new minerals to the monazite group from the Alps: Schweiz. Mineral. Petrogr. Mitt., v. 67, pp. 273-281.

Graeser, S., Schwander, H., and Stalder, H. A., 1973, A solid solution series between xenotime ($YtPO_4$) and chernovite ($YtAsO_4$): Min. Mag., v. 39, pp. 145-151.

HISTORIC AND CONTEMPORARY WYOMING MINERAL-COLLECTING LOCALITIES

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As a source of crystallized specimens for the mineral purist, Wyoming does not rank very high; it is much better known to the lapidary for varieties of agate and nephrite. There are, however, a number of interesting mineral localities throughout the state. These are generally associated with commercial mining of copper, iron, trona, and uranium or the rare earths. Some of the new minerals first discovered in Wyoming are bradleyite, shortite, loughlinite, wegscheiderite, mckelveyite, norsethite, zellerite, and metazellerite. In this talk, two principal mining areas are discussed in detail: the Sunrise iron mine in the Hartville uplift and the copper district surrounding Encampment.

The Hartville mining area began its history as a source of hematite for ceremonial paint for native Americans. Later it enjoyed a brief period as a copper mining locality when various copper ores were discovered by settlers moving west. Finally, a very large scale iron mining operation was carried out until 1981. Some of the minerals found during this mining were similar to those found in the English iron mining operations. The mines are now closed but collecting on the dumps was possible until last year when the owner, Colorado Fuel and Iron, fenced and barricaded the entire area.

The copper mining district surrounding Encampment has produced some very interesting minerals, including lorandite and sperrylite, from the New Rambler mine where copper was mined from a covellite orebody. At one time the Ferris-Haggerty mine in the Sierra Madre mountains west of Encampment boasted a 16-mile-long tramway to deliver copper ore to the smelter in Encampment. Low-level copper and rare-earth mining was carried out by the Platt family on their ranch until about 1970. Some of the minerals found in these latter operations will be described and illustrated.

MINERALS OF THE CUCHILLO NEGRO DISTRICT, SIERRA COUNTY, NEW MEXICO

(Location 7 on index map)

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Recent mineral discoveries in the Cuchillo Negro mining district indicate a virtually untapped collecting area for New Mexico mineral enthusiasts. The Cuchillo Negro district is in Sierra County southeast of the small town of Winston. The district was mined extensively in the early 1900's for lead, copper and zinc; however, most prospects were small operations and thus mine workings are generally not very large. Because little has been known about this district, few collectors have been to the area. Thus, the variety and quality of minerals will come as somewhat of a surprise to seasoned New Mexico collectors.

The mines are situated at the contact between Pennsylvanian Magdalena limestone and a Tertiary monzonite porphyry. Shafts and tunnels intercept the contact-metamorphic ore deposits. Five major groups of mines in the district were investigated. These included the Dictator, Covington, Vindicator, Black Knife, and Confidence mines. Mineral assemblages at each mine are distinctive.

At the Dictator mine, superb discoidal willemite crystals to 7 mm across were found on the dumps in recrystallized limestone. The crystals are colorless to yellow, highly lustrous and often transparent. The willemite fluoresces green under short wave while the calcite fluoresces crimson red. Willemite crystals are also found inside the main tunnel of the mine but are more typical of the species, being gray, hexagonal prisms about 1-2 mm long. Lustrous brown crystals of descloizite are also found imbedded in calcite on the dumps. Additional minerals found are mottramite, vanadinite, smithsonite, cerussite, wulfenite, azurite, malachite, galena, and sphalerite.

No noteworthy mineral specimens were found at the Covington group of mines about 0.5 km west of the Dictator mine.

The Vindicator mine at the northern end of the Sierra Cuchillo range produced very aesthetic fluorite specimens. Grass-green octahedrons to 2 cm, often coated with a thin crust of white adularia crystals, were collected from two large pockets in the main inclined shaft. Small, water-clear, sceptered quartz crystals along with very small (0.5 mm) black crystals of mottramite occur in association with the fluorite. Calcite scalenohedrons replaced by quartz and coated with olive-green, earthy

mottramite also occur here.

The Black Knife mine about 1 km south of the Vindicator mine and on the east side of the range produced unique specimens of calcite and fluorite. The scalenohedral calcite crystals are for the most part replaced by quartz and intimately associated with light-green fluorite octahedrons. The fluorite has been etched and the luster is dull, but crystals to 3 cm occur here. Olive-green to dark-green mottramite "crusts" often coat these specimens. Ramsdellite has been confirmed from this mine in 0.5-1 mm crystals in association with purple fluorite.

The Confidence mine is on the west slope of the range about 2 km due west of the Dictator mine. Wulfenite and willemite specimens are common at this mine. Bright-yellow to orange crystals of wulfenite in tabular, blocky, and pyramidal habits to 0.8 mm are found in vugs associated with cerussite and willemite. Hexagonal prisms of willemite to 0.5 mm are common, but the luster is dull and the pinkish color is not particularly attractive. Hemimorphite and vanadinite microcrystals can also be found here and, rarely, linarite and brochantite.

PINK AND VIOLET MICAS: COMPOSITION, NOMENCLATURE, AND GENESIS OF MUSCOVITE AND LEPIDOLITE MICAS FROM PEGMATITES AND METAMORPHIC ROCKS IN NORTHERN NEW MEXICO AND CENTRAL COLORADO

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Red-tinted, lithium-bearing micas are prominent and readily visible mineral components of pegmatites in some of the pegmatite districts in Precambrian rocks of New Mexico and Colorado. Although pink or red colors are often characteristic of lithium-bearing micas, the presence of the lithium ion itself (Li^{+}) has no direct effect on the color, which is due to manganese as the weakly colored Mn^{2+} ion or the more intensely colored Mn^{3+}. Aside from pegmatites, certain manganese-rich metamorphosed sedimentary rocks also contain pink- or violet-colored micas.

The following table of lithium-bearing and related mica species shows the ideal chemical formulas written to distinguish the octahedrally coordinated ions (Li^{*},Mg^{+2},Mn^{+2}, Fe^{2+}, Al^{+3}) from the tetrahedrally coordinated ions (Al^{3+}, Si^{4+}). Muscovite, lepidolite, biotite, and zinnwaldite occur in granitic pegmatites and in granites (zinnwaldite does not appear to have been reported from New Mexico). In contrast, the higher-lithium mica, polylithionite, is found in alkaline igneous rocks (such as the nepheline syenite of Mont St-Hilaire, Quebec, and the phonolite at Point of Rocks, Colfax County, New Mexico). Taeniolite (again not known from New Mexico) is likewise a mineral occurring in alkali syenites rather than granitic pegmatites. The rare, manganese-rich lithium mica, masutomilite, is known from only four localities worldwide (two in Japan, associated with topaz, schorl, and in one case, cassiterite, plus Czechoslovakia and Idaho); no micas from New Mexico pegmatites are rich enough in manganese to be classed as masutomilite. The lithium-bearing micas commonly show high-fluorine contents, in contrast to the low-fluorine contents of common muscovite and biotite in most igneous and metamorphic rocks.

Species name	Ideal Formula					Ideal wt%
Muscovite	K	Al_2	$[AlSi_3]$	O_{10}	$(OH,F)_2$	0.00
Lepidolite	K Li	$Al_{1.5}$	$[Al_{05}Si_{35})$	O_{10}	$(F,OH)_2$	3.77
Polylithionite	K Li_2	Al	$[Si_4]$	O_{10}	$(F,OH)_2$	7.66
Taeniolite	K Li	Mg_2	$[Si_4]$	O_{10}	$(F,OH)_2$	3.69
Masutomilite	K Li	$Mn^{2+}{}_2$	$[AlSi_3]$	O_{10}	$(F,OH)_2$	3.42
Zinnwaldite	K Li	$Fe^{2+}{}_2$	$[AlSi_3]$	O_{10}	$(F,OH)_2$	3.41
Biotite	K	$Fe^{2+}{}_3$	$[AlSi_3]$	O_{10}	$(OH,F)_2$	0.00

In New Mexico, the Harding pegmatite near Dixon in Taos County and the Pidlite pegmatite in the Rociada district, Mora County are the outstanding examples of deposits that contain a variety of colored Li-bearing micas, ranging from reddish pink to lilac and violet. At the Harding pegmatite mine, true lepidolite ranges from lilac to wine red and purple and typically contains approximately 3.5-4.5 wt% Li_2O and approximately 1 wt% MnO. In contrast, lithian muscovite ranges from rose to lilac to gray and pale green and may contain from about 0.2 to several weight percent Li_2O, and typically only a few tenths of a percent MnO. Some reddish-purple, relatively hard, massive mineral material is often mistakenly assumed by visitors to the mine to be lepidolite, but it is actually microcline feldspar showing an incipient alteration to lepidolite; the bulk of the material is still feldspar, as evidenced by its cleavage and hardness. Lithium-bearing micas in pegmatites are not usually of primary magmatic origin, and hence are not found in "simple" pegmatites, but occur in zones that were subject to 'hydrothermal alteration during crystallization and cooling in "complex" zoned pegmatites. The hydrothermal, postmagmatic formation of Li-micas is evidence of the increasing concentration and chemical activity of Li, F, Mn, and other chemical components in the evolving hydrothermal fluids.

Other occurrences of reddish-colored micas in New Mexico include sparse reported occurrences of rose muscovite in the Petaca pegmatite district, Rio Arriba County. Pale-violet to lilac-colored muscovite near Pilar, Taos County, is associated with piemontite or with piemontite + thulite + vesuvianite + grossular in manganese-rich layers in schist of the Picuris Range. This metamorphic mica contains approximately 0.2-0.8 wt% MnO and little or no lithium.

The most prominent occurrence of lepidolite in Colorado is the Brown Derby pegmatite in Gunnison County. However, lepidolite is also known from the Meyers pegmatite near Royal Gorge, Fremont County; the Chief Lithia pegmatite near Texas Creek, also in Fremont County; the Bald Mountain pegmatite east of Mount Evans in Clear Creek County; and the Kings Kanyon pegmatite in the Crystal Mountain district, Larimer County. There are a few other minor or unverified reports of lepidolite in Colorado. In addition to the "pink" micas referred to in the title of this paper, the brown, lithium- and iron-bearing mica, zinnwaldite, is common in the miarolitic pegmatites of the Pikes Peak batholith. Zinnwaldite resembles biotite, but is a lighter, reddish-brown color, especially in the interior of color-zoned crystals.

LAWS, REGULATIONS, AND POLICIES CONCERNING THE REMOVAL OF MINERALOGIC AND PALEONTOLOGIC SPECIMENS FROM PUBLIC LANDS

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The purpose of this paper is to identify and provide interpretation of policies, regulations, and statutes concerning the scientific, recreational, and commercial removal of mineral specimens, lapidary materials, and gemstones from public lands. The scope will focus on federal lands, federally reserved minerals, and lands managed by the State of New Mexico. Recent developments in regulations concerning the removal of paleontological specimens from federal lands will also be discussed briefly.

Although there is much controversy over what rights mineral collectors have on public lands, there do exist numerous laws and decisions that either directly or indirectly address the removal of specimens and lapidary materials from public lands. Three critical factors determining these rights focus on the location, the mineral in question, and the intent of the collector.

Location and land status

Identifying ownership of a parcel of land is generally much easier than determining what one's rights are on those lands. It is recommended that one first locate the site in question on a U.S. Geologic Survey topographic map using natural land forms, survey markers, compass, or transit. Often relic or active mining features are identified on the larger scale maps. Official Mineral Surveys of Mining Districts (generally for mining claim patents) and Mineral Survey Notes executed or approved by the "former" U.S. General Land Office (GLO) or the U.S. Bureau of Land Management (BLM) are often helpful.

Topographic maps may then be correlated to BLM land status maps and U.S. Forest Service (USFS) maps. It should be noted here that the BLM sells both surface-ownership and surface/mineral-ownership maps. Unless one is collecting paleontologic specimens, and solely for their fossil attributes, the surface/mineral-ownership maps are recommended. If significant risk is involved in respect to trespass or investment, verify the status of the land using legal records. This is recommended because the "popular" BLM land status maps and the USFS maps have inherent errors, especially since they are not routinely revised. In addition, many older BLM land status maps fail to show private lands within the U.S. forests and show many private lands as state lands.

The BLM is the official record keeper of land status information for essentially all federal lands. It is also responsible for executing or approving all surveys of public lands. Official Land Survey Plats and Notes are available in the state offices (NMSO). More relevant are the Master Title Plats maintained by the BLM.

Master Title Plats (MTPs) only "cartoon" Land Survey Plats, in respect to the actual geometry of survey lines, but they identify the current status of all federal lands (some BLM offices have not amended plats for Wilderness Areas and Wilderness Study Areas). MTPs also show how and when lands left or were received into federal ownership. It should be recognized that MTPs only show who originally received lands from the government and do not document subsequent transactions, such as when the state sells land to private individuals. MTPs provide serial numbers and a Historical Index so that the original records of the grants, leases, sales, patents, etc., may be examined. A two-page explanation sheet, which includes a legend and "explanatory township," is available to aid in the interpretation of these plats. Where errors or omissions occur, MTPs generally do not supersede actual documents or law, but may provide support for innocent trespass.

The BLM also keeps records of inactive and active unpatented mining claims. These mining claims are indexed on microfiche under four titles; Claimant (which should more rightfully be called addressee because the BLM rarely adjudicates the ownership of claims), Claim Name, Date of Location, and Geographic Location (by township and range). The indexes generally identify a reference by the book and page of the location notice as it is recorded in the appropriate county courthouse. Each mining-claim filing, recorded with the BLM, generally contains a map of the claim(s) sufficient to locate it on the ground. Unpatented mining claims are not identified on the MTPs or the land status maps, only patented claims are identified.

State lands and their encumbrances may be identified best by reviewing the Tract Books located in Santa Fe at the New Mexico State Land Office. These Tract Books are sectioned into Surface Leases, Oil and Gas Leases, Mineral Leases, etc.. Documents, leases, and files noted in the Tract Books are available upon request.

In addition to state- and public-land records, most counties, if not all, have tax-assessment records for property. These records may or may not be readily available depending upon the state, but property-tax maps or files typically are available for public inspection. These tract maps are also "cartoons" of actual survey lines and the counties give no guarantee of their accuracy. Taxation-type maps or files identify the individual or corporate owners of parcels and will usually identify federal or

state lands. It is recommended that county taxation maps only be used to identify the owners of private lands. While the rights retained by the federal government may be readily identified by reviewing MTPs, the types of titles that are held by private entities and states may be determined only by carefully reviewing both the original documents that passed the lands out of federal ownership and any subsequent transfers of the property. (The scope of this discussion is New Mexico, but the situation throughout the western United States is similar.)

It is often very important to the collector, especially if commercial intent is involved, to know exactly what rights are held by a private land owner. This is because the federal government, and sometimes a private or state entity, will reserve all or part of the mineral estate when lands are transferred. There are tens of millions of acres in the western United States where the federal government reserved minerals when the surface estate was patented to a private party. On the majority of these lands, those patented under the Stock-raising Homestead Act, a prospector may enter the private surface and execute reasonable activities in the exploration and location of locatable minerals without permission from the surface owner (43 CFR 3814.1(b); see Appendix 1 for explanation of legal citations). A list of patents issued by the federal government with the reservation of "all" or some portion of the mineral estate is provided in Table I. It should be noted that confirmed Spanish and Mexican land grants often reserve gold, silver, and mercury to the federal government (43 CFR 3581). Explanations and interpretations of these statutes as well as other statutes that affect the availability of mineral resources may be found in American Law of Mining, edited by the Rocky Mountain Mineral Law Foundation and revised annually, or Mineral Title Examination by Terry Maley (1984).

Mineral in question

What is a mineral? Although this seems trivial, especially to those who have taken Geology 101, a brief review of judicial decisions will make many sorry they asked. The definition of the word mineral, in property and mining law, has been and will continue to be in a state of flux. Admittedly, the definition is firm for traditional commodities such as copper, gold, and silver deposits that can be economically recovered only through underground mining, but there have been some cases where surface-minable deposits of recognized mineral commodities are considered surface resources and are not part of a property's mineral estate. This has been a very troubling issue regarding uranium and lignite in Texas and sand and gravel across most of the United States. Unfortunately, many of the mineral resources sought by the collector fall within these gray and vague interpretations.

In a legal sense, two criteria are generally applied to distinguish whether an inorganic substance is a mineral:

> ...(1) the substance must be recognized by the standard authorities as a mineral, and (2) it must have commercial value. (subsec. 8.01 [2], American Law of Mining, 1990)

Thus, the legal definition generally includes a broad scientific definition combined with economics. Deviations from this definition are all too common when surface minable minerals or commodities of lesser demand are involved. Often the definition of "mineral" or the categories making up "minerals", are dependent on whether the lands are, or were, owned by the federal government, the state government, or by a private entity. In addition the specific authority under which an action is taken may determine the definition of "mineral." In a specific case, it often depends on the intent of a legislative body, an administrative body, or a private entity and is usually bound by exact wording in a legal instrument, such as a patent or deed. For a comprehensive discussion of this subject see chapter 84 of the American Law of Mining (1990).

Under federal law there are three categories of minerals: leasable, salable, and locatable. Through the evolution of the mining laws the categories and members of these categories have changed. At one time federal lands valuable for coal and lead were sold outright. Now coal is leased and lead is either located or leased, depending on the land involved. At one point in American history, oil, which is now only leased, could be located and appropriated through placer claims.

Leasable minerals are defined by a cadre of federal statutes. Leasable minerals on all public lands include coal, oil, oil shale, "gilsonite," gas, geothermal resources, and deposits of sodium, potassium, and phosphates. Sulphur is leasable on federal lands in Louisiana and New Mexico. The term "leasable" simply means that a lease must be executed with the federal government if the minerals are to be appropriated. All minerals are leasable on federal lands within Indian reservations. All minerals, except common-variety minerals, are leasable on "acquired" federal lands (this includes most eastern forests). Gold, silver, and mercury are leasable on most confirmed Spanish and Mexican land grants.

Salable minerals are currently referred to as common-variety mineral materials. They were originally defined by the Materials Sales Act of 1947 (ch. 406, 61 Stat. 681), and have been further defined by administrative and judicial decision. The Surface Resources Act, also referred to as Public Law 167 (ch. 375, 69 Stat. 367), amended the Material Sales Act. The Surface Resources Act provides for the sale of:

> ...mineral materials (including but not limited to common varieties of the following: sand, stone, gravel, pumice, pumicite, cinders and clay)...

The act also withdrew these "common varieties" of mineral from location under the general mining laws. The phrase "...including but not limited to..." opened the door to the addition of many other commodities through interpretations made by the Administration and the Judicial Branch. Generally, minerals are held to be common varieties when they: are of widespread occurrence, have no unique property, have no distinct and special value, are of common use, and only command a typical market price (8.01[4][a][ii], American Law of Mining, 1990).

Petrified wood is not defined specifically as a common-variety mineral but is salable and was withdrawn from the mining laws (76 Stat. 652).

Locatable minerals are those that may be appropriated through the location, development, and purchase of mining claims. The basic procedure was established when the 1872 Mining Law was enacted (ch. 152, 17 Stat. 91). Currently, locatable minerals include all commercial mineral deposits that are not leasable, are not common varieties of mineral materials, and have not been otherwise specifically withdrawn from location. The vast majority of the different types of mineral deposits are still subject to location on the majority of the public domain. The term public domain

> ...denotes those lands which are or were subject to the public land laws of the United States. It includes lands initially acquired by the United States by cession, purchase, and treaty, as well as lands acquired by other methods where the latter have expressly been declared by Congress to be public lands or public domain. (subsec. 3.02[3], American Law of Mining, 1990)

It should be noted here that millions of acres of existing public domain have been withdrawn from location under the mining laws by legislative and administrative actions. In most cases, these withdrawals are documented on BLM Master Title Plats. A discussion of lands and mineral types that are open to location is provided in 43 CFR 3810. Regulations concerning location procedures are found in 43 CFR 3833.

The definition of locatable minerals generally encompasses intrinsically valuable and industrial minerals. With the exception of uranium, they typically do not include minerals sought for energy purposes or early 20th-century explosive production.

Some early cases held that gemstones and ornamental minerals were locatable: diamonds (14 Op. Atty. Gen. 115 (1872)); marble (Pacific Coast Marble Co. v. Northern Pacific Railroad Co., 25 LD

233 (1897)); and. onyx (Utah Onyx Dev. Co., 38 LD 504 (1910)). Two relatively recent cases held that mineral specimens are locatable if they are shown to be marketable at a profit (U.S. v. Rodgers, 32 IBLA 84 (1977) and U.S. v. Slater, 34 IBLA 31, (1978)). The test of profitability does not include enhancement or manufacturing of the mineral but relates to the value of the raw material as it is extracted (U.S. v. Stevens, 14 IBLA 380 (1974)). Other cases held that geodes were locatable (U.S. v. Bolinder, 28 IBLA 192 (1976)), but obsidian was not (U.S. v. Mansfield, 35 IBLA 95 (1978)). It should be recognized here that these decisions do not imply that all geodes are locatable, or that all obsidian is not. They are decided on the merits of the specific cases based on certain underlying principles of case law. (For a discussion of these cases, see Maley (1985) pages 306-310.)

One category of locatable minerals is the "uncommon varieties" of mineral materials. This category is addressed by implication in the Surface Resources Act. The Act states:

> 'Common varieties' as used in this Act does not include deposits of such materials which are valuable because the deposit has some property giving it distinct and special value...

Currently accepted standards that a deposit must meet in order to qualify under the law as a deposit of an uncommon variety of mineral materials are:

> 1. There must be a comparison of the mineral deposit in question with other deposits of such minerals generally;
> 2. The mineral deposit in question must have a unique property;
> 3. The unique property must give the deposit a distinct and special value;
> 4. If the special value is for uses to which ordinary varieties of mineral are put, the deposit must have some distinct and special value for such use;
> 5. The distinct and special value must be reflected by the higher price which the material commands in the market place, or by reduced cost or overhead so that the profit to the claimant would be substantially more. (Maley (1985) quoting the Interior Board of Land Appeals in Massirio v. Western Hills Mining Association, 78 IBLA 155 (1983))

One interesting mineral worthy of specific mention is jet. Jet is a compact form of lignite often used for lapidary purposes. The Director of the BLM stated in a memorandum during the mid-1980's that, despite the fact that it is genetically a form of coal, jet is considered by the BLM to be a semi-precious gemstone that is subject to the location laws. Unfortunately, some of the best areas for jet exploration were withdrawn from location by the recent El Malpais Wilderness designation.

The unique characteristics of the location laws are that: 1) rights are self initiated and 2) once an individual has substantiated a discovery of economically recoverable, locatable resources and has made $500 worth of improvements toward developing the property, a patent application may be filed (43 CFR 3860). Once the BLM determines a "discovery" of locatable minerals has been made, the land is adequately described, the applicant's chain of title is complete, all adverse claims are resolved, and a few other minor requirements are completed, the applicant may purchase the land encompassed by the claim for a few dollars per acre.

The fact that a very valuable deposit may be purchased under the mining laws for a few dollars creates furor in some forums. Admittedly, with the exception of treasure troves, locatable mineral exploration is the last remaining use of public lands that may result in a substantial financial windfall. Since the passage of the location laws in the 1800's, various political groups have attacked the 1872 Mining Law as amended as a "give away" of public lands. Defenders of the Act are aware of the incentive it imparts to venture capitalists in the pursuit of often-elusive deposits. Defenders are also aware of the mire of red tape that typically surrounds federal management of discretionary leasing programs. Coal leasing on federal lands in New Mexico has been at a stand still for almost 20 years because of problems associated with discretionary decisions. Criticism is constantly directed at the New Mexico State Land Office for its failure to make leases of hardrock minerals available in a timely and responsible manner. In addition, it should be recognized that if tax deductions are minimized, almost half of any royalties levied on these resources would be recovered through corporate taxes on profits. Lack of a royalty also fosters conservation of resources because deeper or lower-grade resources, which would be uneconomic after additional costs of appropriation, can be profitably mined. At present, hearings are taking place in the U.S. Congress concerning the amendment or repeal of this bastion of American free enterprise.

Paleontologic specimens, which are predominantly valuable for their fossil attributes, are considered surface resources and are not available for location (Earl Douglass, 44 LD 325 (1915)). Archeological and "significant" paleontological and natural history materials on federal lands are protected under the Antiquities Act of 1906 (16 USC 431 et seq), the National Historic Preservation Act (16 USC 470 et seq), the Archeologic and Historic Preservation Act (16 USC 469 et seq), the Archeologic Resources Protection Act of 1979 (16 USC 470aa et seq), etc.

Intent of the collector

The intent of a mineral collector is pivotal to the rights and responsibilities he, or she, has on public lands. Activities are either commercial or noncommercial.

Commercial activities are those activities that have a financial profit as the primary aim and generally involve the sale or exchange of services, goods, or commodities (City of Anchorage v. Berry, 145 F.Supp. 868 (D.C. Alaska) and Lanski v. Montealegre, 361 Mich. 44, 104 N.W.2d 772).

By reverse implication, noncommercial activities are those activities that do not have financial profit as a primary aim, although a nominal amount of services, goods, or commodities may be sold or exchanged. Noncommercial activities include hobby collecting, scientific investigations, administrative actions, and religious ceremonies. Administrative activities, those actions taken by employees of a land management agency, and religious ceremonies are not within the scope of this paper. (It should be noted here that many actions taken by nonprofit organizations are noncommercial, although nonprofit organizations may act as market participants and actively pursue commercial activities. I believe that, with the exception of the nonprofit free use of coal and mineral materials, organizations acting as market participants must essentially conform to the mining laws in the same manner as commercial operators, but I am admittedly confused about the interface between nonprofit organizations and the mineral location and leasing laws.)

Because no definition exists in the federal land and mining laws or regulations for the concept of "hobby collecting," the term "hobby" may be defined best by reviewing decisions concerning taxation. The Fifth Circuit Court of Appeals, in reviewing a case where a mining engineer deducted a loss from a small orange grove at his residence, ruled that the dominant motive in a "business venture" is the realization of a profit, while the objective of a "hobby" is pleasure or relaxation (Coffey v. Commissioner of Internal Revenue, 141 F.2d. 204 (1944)). (Some may question this interpretation; many of us have participated in mineral-collecting trips for nonprofit motives that tested the limits of human endurance!) In determining whether the orange grove was a hobby or .a business, the court relied heavily on the fact that the orange grove only produced a profit of $167.71 in 1937, then either had no income or showed a loss for three subsequent years. The court also apparently relied on the fact that the citrus-grove owner had been employed as a mining engineer since 1911. A time-adjusted value for the $167.71 figure from 1937, using gold as an index, would be approximately $1750 today. By reverse implication, one may argue that mineral collecting by professional geologists or mining engineers, must then fall in the realm of commercial activity. I disagree with

this argument on the grounds that it conflicts with the freedoms protected by the U.S. Constitution. I also find fault with the court for putting forth the implication that lesser business ventures involving occupations outside of one's predominant occupation are merely hobbies and should not be considered as commercial ventures. It is assumed that the definition of a hobby as used by taxation agencies only relates to the taking of business deductions because any income is generally required to be reported. Clearly, some notion concerning the amount of profit or value of exchange is appropriate in distinguishing intent.

Scientists, students, and other similarly motivated individuals who remove minerals from unappropriated lands as part of nonprofit scientific investigations are not subject to the mineral laws and are considered to be noncommercial surface-resource users.

Laws and regulations controlling activities

Private lands

Rights to remove minerals for commercial or noncommercial purposes on private lands are simple. If you own the surface and mineral estate, you can remove or authorize others to remove the resources. This right is inherent in the right to private property as defined in the U.S. Constitution. Of course, one has to comply with state licensing requirements, safety regulations, environmental regulations, etc. Land owners are expected to thwart trespassers so that conflicting interests such as adverse possession or prescriptive easements are not acquired. It should be noted here that patented mining claims are private lands. The recommendation is to ask permission, not forgiveness.

Split-estate lands

Often in the western United States, the mineral estate of a particular parcel of land was previously reserved by the government or another private entity. In the cases I am aware of, no reservation has been noted that allows for the removal of minerals for noncommercial purposes. Certainly, if a mineral under quest is covered in a reservation, and a collector has acquired the right to that resource through lease or other appropriate means and has taken all necessary actions to make required compensations to the surface owner, the collector may remove the mineral under commercial intent through exploration or mining. It is generally held throughout the country that the mineral estate is dominant over the surface estate, and unless explicitly stated otherwise in reservations, the surface estate must take a subordinate role when reserved mineral resources are developed.

The different types of split-estate situations that exist are too numerous to elaborate in this paper. All should realize that the titles to the surface and mineral resources of a parcel may involve any combination of private, state, or federal ownership. The major principles in determining one's rights generally depend on the specific wording of the reservations, the fact that surface-estate titles are subordinate to mineral-estate titles and that the courts tend to rule that the rights of the federal government are sovereign over state and private interests. This last point means that gray areas of the law are generally construed in favor of the public interest (Watt v. Western Nuclear, 103 S.Ct. 2218 (1983)).

One of the largest groups of federal land patents was issued under the Stock-raising Homestead Act (39 Stat. 864, 43 U.S.C. 299). These patents reserved "all" minerals to the United States and are open to location under the mining laws. There are tens of millions of acres of these types of patents in the western United States. These lands may be entered at all times by any legitimate prospector exploring and removing samples with commercial intent without prior permission from the land owner (43 CFR 3814.1(b)). Once a claim is located, the prospector/claimant must acquire permission from the surface owner or post bond with the BLM before reentering the lands (43 CFR 3814.1(c)). One important interpretation concerning this group of lands is that the Federal government did not reserve the right of ingress and egress across parcels to access deposits on other parcels patented under the Act. Caution is advised because very few surface owners are aware of the prospector's rights.

Unpatented mining claims

Properly located and recorded mining claims impart to the claimant rights very similar to those accorded a private land owner. This is especially so for claimants who located prior to the enactment of the Surface Resources Act on July 23, 1955 (69 Stat. 367) and who have not had their surface rights waived under procedures outlined in the Act (43 USC 3710). Claimants who have rights vested prior to this legislation can bar the public from entering their claim or removing any resources whatsoever. Generally, the only areas where certain surface rights were waived involved areas near cities, within areas of high recreational use, and within timber-sale areas. Claimants who located after passage of the Surface Resources Act or who have waived their prior vested rights must allow reasonable access across their claims and to the surface resources on their claims. As previously noted, the Surface Resources Act also withdrew common-variety minerals from location. Thus noncommercial collectors may remove common-variety minerals and paleontologic specimens from claims located after the Act without prior permission from the claimant(s) as long the surface is under federal ownership. The BLM may also authorize the scientific removal of paleonto-

logic specimens from claims with no rights vested prior to the Act.

The BLM is prohibited from making disposals of common-variety minerals from all claims by regulations in 43 CFR 3601.1-1(a) (1), yet the USFS is authorized to execute commercial and noncommercial disposals of mineral materials from claims (see 36 CFR 228.41(b)(3)). This deviation in the application of the same statutes reflects differences in departmental legal advice and managerial policy.

Claimants holding properly located and recorded mining claims have sole right to the minerals and ore-bearing rock that were open to location at the time the claim was located. Any removal of the locatable minerals is at the discretion of the claimant. Unauthorized removal of locatable minerals from a valid claim is punishable under state law (69-3-24,25,26 NMSA (1990)). Claimants have no authority, however, to sell permits for the collection of mineral specimens, and such permits may not be used as evidence to determine the validity of a claim (U.S. v. Stevens, 14 IBLA 380 (1973)). It is relevant to note that claimants may lease all or portions of their claims for locatable mineral exploration and extraction, and I could not find a decision that addresses the minimum term, conditions, or value of a commercial lease.

State lands (New Mexico)

The vast majority of lands owned by the State of New Mexico are managed by the New Mexico State Land Office. These lands are managed under strict guidelines for the benefit of public schools, colleges, and other specific public institutions. Recently the Commissioner of Public Lands (lead supervisor of the New Mexico State Land Office) executed SLO Order 1990-1, putting into effect SLO Rule 19, which allows the issuance of single-day recreation permits during the latter half of the year. These permits are designed to authorize activities such as hiking, biking, picnicking, photography, and other activities that do not involve camping or resource removal. These permits do not authorize the removal of mineral or paleontologic specimens (State Land Office, personal communication 1990). No authority exists that allows noncommercial collection of minerals or fossils from state lands for hobby purposes. It is possible that a specific action could be executed by the commissioner, if properly petitioned, to allow noncommercial collecting, but it would be unlikely unless the request concerned the scientific study of resources by an institution or noteworthy association.

Because state agencies now have limited enforcement capabilities, one may feel the risk of trespass is minimal. Everyone should be aware that essentially all the surface of state lands, and most of the areas of high mineral potential, are leased to

private entities, and that these lessees are liable for trespasses on those lands (19-6-3,4,5 NMSA 1990). Thus, through liability, the State of New Mexico has created an army of enforcement "officials." Even the surface lessees have no legal right to remove or authorize the removal of mineral specimens. Holders of mineral leases apparently may authorize the removal of specimens of minerals they have under lease as long as all regulations are followed and the appropriate royalties are paid to the state.

All leases and sales of minerals by the Commissioner of Public Lands are discretionary. With respect to the commercial removal of mineral specimens, procedures are well documented. If the commissioner determines that the mineral under quest falls within the state's definition of a "common variety," a direct sale may be executed. Otherwise the property may be made available only through competitive sale, which requires nominating tracts and offering tracts. The state's leasing program for hard-rock minerals is notably slow, unresponsive, and unpredictable. In the case of small operations, the existing bonding requirements are usually prohibitive to economic operation.

Some state lands in New Mexico are managed by the New Mexico State Parks and Recreation Division. Although mineral or fossil collecting is strictly prohibited in most state parks, one park was established specifically and is managed for mineral collecting, namely Rockhound State Park at Deming.

The Harding pegmatite deposit at Peñasco is managed by the Geology Department of the University of New Mexico. Noncommercial collecting on a modest scale requires a permission-release form, which may be obtained from the department chairman prior to the trip.

Federal lands

Ample legislation, regulations, and case law exist that address the procedures for a commercial mineral dealer to acquire rights to remove specimens and lapidary material with little risk of adverse action by a land management agency if the land status and the legal classification of the mineral is known. This is the result of years of attention focused by the mining industry on legislative and regulatory proposals and industry's will to pursue legal remedies. The main problem faced by the commercial collector often concerns whether a mineral is locatable or salable, and it often depends on the efforts of the collector to "create" a market to establish whether a specific mineral is locatable (U.S. v. Rodgers, 32 IBLA 84 (1977)). Regulations relating to the commercial appropriation of mineral specimens and lapidary materials on lands managed by BLM and USFS may be found in 36 CFR 228 and 43 CFR 3500, 3600, 3700, and 3800.

Regulations governing the commercial appropriation of minerals on BLM and USFS lands are essentially the same except for regulations concerning surface protection. This similarity exists because the BLM has authority over the final disposition of virtually all minerals on USFS lands except for salable minerals and some aspects of leasable minerals. The BLM is also the official record keeper for actions taken on USFS lands. This relationship came about because most USFS lands are withdrawn public lands and the federal government did not want to create a duplication of effort.

BLM regulations allow "casual use" activities on all lands open to location without prior notification or approval (43 CFR 3809.1-2). "Casual use" is defined as activities which result in only "...negligible disturbances..." and "...do not involve the use of mechanized earth moving equipment or explosives or do not involve the use of motorized vehicles in areas designated as closed to off-road vehicles..." (43 CFR 3809.0-5(b)). BLM also allows locatable-mineral activities that impact less than five acres per year to proceed on BLM lands by simply filing a notice with the BLM 15 days before commencing operations (43 CFR 3809.13 and 3809.1-4(b)). An operator may commence activities in a timely manner under a notice without securing prior approval from the BLM. A notice also constitutes authorization to operate vehicles in areas closed to off-road vehicles under 43 CFR 8340. Higher levels of activities and noncasual activities in designated environmentally sensitive areas require the filing and prior approval of a plan (3809.1-4(b)).

In contrast to the BLM's regulations, the USFS regulations tend to be more strict. USFS regulations state that the requirement to submit a notice of intent or plan of operations for locatable mineral activities shall not apply:

> (i) To operations which will be limited to the use of vehicles on existing public roads or roads used or maintained for National Forest purposes,
>
> (ii) to individuals desiring to search for and occasionally remove small mineral samples or specimens,
>
> (iii)to prospecting and sampling which will not cause significant surface resource disturbance and will not involve the removal of more than a reasonable amount of mineral deposit for analysis and study,
>
> (iv)to marking and monumenting a mining claim...
>
> (v) to subsurface operations which will not cause significant surface resource disturbance...[and to] ..... operations which will not involve the use of mechanized earthmoving equipment such as bulldozers or backhoes and will not involve the cutting of trees. (36 CFR 228.4(a)(1) and (2))

No commercial activity whatsoever may take place in a National Park (36 CFR 9) or Wilderness (43 CFR 8560.1-2(a), 8560.4-6 and 36 CFR 293.14) in the pursuit of mineral resources unless one has a "grandfathered" or vested right prior to the

park's establishment. (A few of these areas may still be open to leasing or location due to specific wording in their designating legislation.) Any action to remove minerals with commercial intent from these or other withdrawn areas will be pursued as trespass.

The nonadministrative removal of any resources whatsoever is prohibited from taking place in National Parks. This prohibition is outlined in 36 CFR 2.1(a) which states:

> (a) Except as otherwise provided in this chapter, the following is prohibited:
> (1) Possessing, destroying, injuring, defacing, removing, digging, or disturbing from its natural state...
> (iii) Nonfossilized and fossilized paleontological specimens...
> (iv) A mineral resource or cave formation or the parts thereof.

The authority for this regulation is derived from the wording in 16 USC 1 that states:

> The service...shall promote and regulate the use...by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

As evidence of the restrictions on parklands, recent proposals to increase the acreage of more than 200 National Parks and the formation of more than 100 new parks, drew sharp criticism from June Culp Zeitner of the Lapidary Journal staff (see "Is the Rock Collector an Endangered Species?" July 1988 edition of the Lapidary Journal).

Although there are no current regulations for USFS or BLM Wilderness Areas that prohibit the noncommercial removal of mineral specimens or "common" fossils, there are also no regulations for USFS lands that do provide authorization for their removal. Also of concern to me is that the Wilderness legislation incorporates wording that is very similar to the above-referenced National Park legislation. The 1964 Wilderness Act (78 Stat. 890, 16 USC 1131) states:

> ...these shall be administered for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness...

The only security the noncommercial-collecting community may gain in respect to access to these lands will be through convincing the land management agencies that mineral collecting is a "use and enjoyment of the American people" that will leave the lands

"unimpaired for future use and enjoyment as wilderness."

Although there are no specific authorities identifying mineral collecting as a legal use of USFS Wilderness Areas, or for any USFS lands as a whole, the Federal Magistrate in Alamogordo recently ruled that minor excavations into vugs of exposed country rock and surrounding soil in the Sierra Blanca Wilderness Area to noncommercially collect smoky quartz was not a violation of USFS regulations concerning the removal or damage of natural features under 36 CFR 261.9 (Mark Wilson, personal communication, 1990). Thus it is implicit, at least from that Federal Judge's opinion, that the noncommercial collection of mineral specimens is legal in USFS Wilderness Areas. I was told in recent conversations with a Smokey the Bear Ranger District employee that one could only pick up specimens exposed on the surface in the Sierra Blanca Wilderness, but any excavations, whatsoever, were prohibited. My experience indicates that the USFS has failed to develop a national policy of any kind concerning noncommercial collecting. The BLM is guilty of the same lack of consistency in policy for Wilderness Areas.

The BLM, however, has made efforts to clarify this issue of noncommercial mineral and fossil collecting on BLM-managed lands. Currently, regulations in 43 CFR 8365.1-5 state:

> (a) On all public lands, unless otherwise authorized, no person shall:
>
> (2) Willfully deface, remove or destroy plants or their parts, soil, rocks, or minerals, or cave resources, except as permitted under paragaph (b) or (c) of this paragraph; or
>
> (3) Use on the public lands explosive, motorized or mechanical devices, except metal detectors, to aid in the collection of specimens permitted under paragraph (b) or (c) of this paragraph.
>
> (b) Except on developed recreation sites and areas, or where otherwise prohibited or posted, it is permissible to collect from public lands reasonable amounts of the following for noncommercial purposes:
>
> ([1])--
>
> (2) Nonrenewable resources such as rocks, Mineral specimens, common invertebrate fossils and semiprecious gemstones;
>
> (3) Petrified wood as provided under Subpart 3622 of this title;
>
> (4) Mineral materials as provided under Subpart 3621 of this title...
>
> (5)...
>
> (c) The collection of renewable or nonrenewable resources from the public lands for sale or barter to commercial dealers may be done only after obtaining a contract or permit from an authorized officer in accordance with Part 3610 or 5400 of this title.

I believe that these regulations also apply to BLM Wilderness

Areas because 43 CFR 8365.1-5 states that the "...rules in this subsection shall apply to the use and occupancy of all public lands under the jurisdiction of the Bureau of Land Management." These regulations were finalized on August 10, 1983 and appear in the Recreation Management Group of Title 43 of the CFR. It should be recognized that 43 CFR 8365.1-5(c) does not prohibit the sale or barter of a nominal amount of specimens to other noncommercial collectors or to the public at large.

Everyone should also note that the wording at 43 CFR 8365.1-(a)(3) does not authorize the use of suction dredges. Suction dredges apparently must only be used with commercial intent on lands open to location or lease unless some other form of land-use permit can be acquired. This implies that suction dredging can not legally take place in any Wilderness Areas. A permit to operate suction dredges in most drainages also requires the prior approval of the Army Corps of Engineers.

Some of the concepts in these recreation regulations were taken from the ill-fated proposed "Geologic and Hobby Mineral Materials" regulations that appeared in 47 FR 35914 (August 17, 1982). These proposed regulations attracted approximately 1,200 comments from organizations and the public at large. Much of the controversy focused on fossil collecting and conflicts with locatable-mineral laws. Although little has occurred in respect to mineral collecting, except for the cited recreation regulations, efforts to develop regulations for the commercial and noncommercial removal of fossils are proceeding (54 FR 48647 (November 24, 1989)). Draft regulations prepared through a negotiated process that included members of all aspects of fossil collecting are now circulating in BLM offices (Ed Heffern, BLM NMSO, personal communication, 1990). It is anticipated that proposed rules soon will be published in the Federal Register for comment. Currently, anyone who desires to remove fossils with commercial intent or who plans to execute significant activities in the scientific removal of specimens must acquire a discretionary land-use permit from the administrating Federal agency.

Well-defined procedures for collecting petrified wood were written in response to intense pressure from the public to preserve this resource. BLM regulations concerning petrified wood may *be* found in 43 CFR 3622 and USFS regulations may be found in 36 CFR 228.62(e).

What can collectors do to develop and protect their rights on public lands?

(1) Join or organize nonprofit groups to provide a visible, unified front.
(2) Comment on all proposed policies, regulations, and statutes, and whenever possible participate in their formulation.
(3) Lobby federal and state legislators who have special inter-

est in these subjects.

(4) Participate in planning processes that are required by the Federal Land Policy and Management Act of 1976 (90 Stat. 2743, 43 USC 1171) for essentially all discretionary actions taken by federal land-management agencies.

(5) Petition agencies to set aside lands for mineral collecting under the recreation and public land laws. There are some recreation areas specifically set aside by the BLM for mineral collecting, such as Ruby Peak in Colorado and Topaz Valley in Utah. Nonprofit organizations, universities, and local governments may also request leases or patents under the Recreation and Public Purposes Act to lands for the purposes of mineral collecting (see procedures in 43 CFR 2740). These actions are likely to conflict with the desires of commercial collectors.

(6) Request to be added to the mailing lists of agencies which affect the resources and lands within your area of interest.

(7) One last and radical option is to petition the Secretary of Interior to invoke 16 USC 482. This federal code authorizes the President to unilaterally remove lands from USFS withdrawals and return them to the management of the BLM if the Secretary of Interior determines that their highest and best use is for mineral-resource development and not agricultural purposes. To my knowledge this authority has never been invoked despite the vast acreages of lands with known highest and best use for mining that are located in National Forests. Of course this action would only be beneficial to the collector if BLM regulations are acknowledged to be less restrictive than those of the USFS.

References

Coco, Al, 1982, Finding the law: a workbook on legal research for laypersons: U.S. Bureau of Land Management, U.S. Government Printing Office (580-590-1982), 272 pp.

Maley, Terry S., 1984, Mineral title examination: Boise, Idaho, Mineral Land Publications, 396 pp.

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Rocky Mountain Mineral Law Foundation, editors, 1990, The American law of mining: Boulder, Colo., Matthew Bender, revised annually, 987 pp.

TABLE 1: ACTS RESERVING MINERALS TO THE FEDERAL GOVERNMENT

Acts Reserving Specific Minerals

Act	Date Enacted	Statute Citation (US CODE)

Coal Lands Act of 1909	March 3, 1909	ch. 270, 35 Stat. 844 (30 USC 81)
Coal Lands Act of 1910	June 22, 1910	ch. 318, 36 Stat. 583 (30 USC 83)
Agricultural Entry Act of 1914	July 17, 1914	ch. 142, 63 Stat. 509 (30 USC 122)
Agricultural Entry Act Amendment of 1933	March 4, 1933	ch. 278, 72 Stat. 1570

Acts Where the Federal Government Must or Mav Reserve All Minerals

Act	Date Enacted	Statute Citation (US Code)
Pickett Act of 1910	June 25, 1910	ch. 421, 36 Stat. 847
Act Authorizing Sale of Pickett Act Lands	Jan. 26, 1921	ch. 27, 41 Stat. 1089
Stock-raising Homestead Act	Dec. 29, 1916	ch. 9, 39 Stat. 862 (43 USC 299)
Forest Exchange Act	March 20, 1922	ch. 105, 42 Stat. 465
Forest Exchange Act Amendment of 1925	Feb. 28, 1925	ch. 375, 43 Stat. 1090
Color of Title Act of 1925	Feb. 19, 1925	ch. 268, 43 Stat. 951 (43 USC 993)
Color of Title Act of 1928	Dec. 22, 1928	ch. 47, 45 Stat. 1069 (43 USC 1068)
Color of Title Act of 1932	Feb. 23, 1932	ch. 52, 47 Stat. 53 (43 USC 178)
Color of Title Act Amendment of 1953	July 28, 1953	ch. 254, 67 Stat. 277 (43 USC 1068)
Recreation and Public Purposes Act of 1926 (R&PP)	June 14, 1926	ch. 578, 44 Stat. 741
Recreation and Public Purposes Act Amendment of 1954	June 4, 1954	ch. 263, 68 Stat. 173 (43 USC 869)
Federal Irrigation Land Sale Act of **1930**	May 16, 1930	ch. 292, 46 Stat. 1930 (43 USC 424)
Federal Irrigation Land Sale Act of 1950	March 31, 1950	ch. 78, 64 Stat. 39 (43 USC 3756)

TABLE 1 (cont'd)

Act	Date Enacted	Statute Citation (US Code)
Taylor Grazing Act of 1934	June 28, 1934	ch. 865, 48 Stat. 1272
Small Tract Act of 1938	June 1, 1938	ch. 317, 52 Stat. 609
Small Tract Act Amendment	June 8, 1954	ch. 270, 68 Stat. 239
Oklahoma Land Disposal Act of 1946	August 7, 1946	ch. 772, 60 Stat. 872
Oklahoma Land Disposal Act of 1955	August 3, 1955	ch. 449, 69 Stat. 447
Mining Claim Occupancy Act	October 23, 1962	76 Stat. 1127
Mining Claim Occupancy Act Amendment	October 23, 1967	81 Stat. 311
Public Land Sale Act of 1964	Sept. 19, 1964	78 Stat. 988
Federal Land Policy and Management Act (FLPMA)	October 21, 1976	43 Stat. 2743
Forest Service Conveyance Act of 1983	January 12, 1983	96 Stat. 2535

APPENDIX I

Sources of legal citations

Laws are published in a chronologic format in the United States Statutes-at-Large. Citations from the United States Statutes-at-Large appear as follows:

form: x Stat. y where x = volume number and y = page number

example: 17 Stat. 91

The state publication analogous to this is Laws of the State of New Mexico.

Current legislation on a topic may be best found by reviewing the United States Code. This provides a compilation, by subject matter, of all laws in force as of a given date. It should be recognized that upon codification a single statute may be broken into several different sections and under several different titles. Citations from the United States Code appear as follows:

form: x USC y where x = title number and y = section number

example: 30 USC 21

A publication similar to the United States Code is the United States Code Annotated (USCA). USCA is a privately consolidated and published reference that follows the framework of the United States Code but also provides brief summaries and references to administrative decisions, judicial decisions, legislative histories, and other case law by section. When reviewing the United States Code and USCA, care should be taken to ensure that any appropriate changes appearing in the attached cumulative supplements are acknowledged. Citations from the United States Code Annotated appear as follows:

form: x USCA y where x = title number and y = section number

example: 30 USCA 21

The state document analogous to the United State Code Annotated in New Mexico is the New Mexico Statutes Annotated.

The New Mexico Statutes Annotated are cited as:

form: w-x-y NMSA (z) where w = chapter number
x = article number
y = section number
example: 69-3-1 NMSA (1990) z = year

Under current procedures, regulations promulgated by agencies are announced in the Federal Register. Typically, proposed regulations are announced first to allow public participation in the rule-making process. Both proposed and final regulations are cited the same way as follows:

form: x FR y (z) where x = volume number
y = page number
and z = publication date

example: 47 FR 35914 (August 17, 1982)

Current regulations are compiled annually by agency and subject and are published in the Code of Federal Regulations. It must be recognized that each Title ("volume") of the Code of Federal Regulations has a revision date on its first page. Proper understanding of current regulations requires the review of all Federal Register announcements that have been published subsequent to the revision date. Citations to the Code of Federal Regulations appear as follows:

form: x CFR y where x = title number
and y = numerical location
in Title*

example: 43 CFR 3833.1-2(b)(5)(iii)

* may represent subchapter, group, part, subpart, section, paragraph, etc. depending on detail given

In addition to the above sources of regulations, the federal government also publishes circulars. Circulars are pamphlets limited to one set of related rules and are available, free of charge, from the agency responsible for its enforcement.

Quasi-judicial decisions, commonly referred to as administrative decisions, of the Department of Interior have been rendered under various procedures since it was established. Currently, the primary source of these types of decisions comes from cases heard by the Interior Board of Land Appeals (IBLA). The general form for citing IBLA Decisions is as follows:

form: a v. b, x IBLA y (z) where a v. b = parties involved
x = volume number
y = page number
z = year

example: United States v. Rodgers, 32 IBLA 84 (1977)

Other published decisions of the Department are cited in the same form as above except in place of IBLA, LD and ID are used to represent Land Decisions and Interior Decisions, respectively.

Unpublished decisions of the Department are cited as follows:

form: a v. b, A-x (y) where a v. b = parties involved
x = serial number
y = date

example: U.S. v. Denison, A-29884 (April 24, 1964)

The Department's Solicitor's Office, which provides legal counsel for the Secretary, occasionally puts forth opinions. These opinions are cited in a format similar to the unpublished decisions above, except they reference a subject title as opposed to parties involved and the serial number is prefixed by an M as opposed to an A.

Judicial decisions involving the mining laws are rendered both by state and federal courts. Issues arising in state court generally concern leases, trespass, or other conflicts between private parties. Issues arising in federal court tend to focus on conflicts between federal agencies and private parties. The majority of cases involving mining laws that are handled in the federal courts concern appeals from administrative decisions of the Department. Of course all cases, whether originating in administrative hearings, state courts, or federal courts, may require ultimate resolution by the United States Supreme Court. The form for Federal judicial decisions is as follows:

form: a v. b, x S.Ct. y (z) where a v. b = parties involved
x = volume number
y = page number
z = court that issued decision and year*

example: Watt v. Western Nuclear, 103 S.Ct. 2218 (1983)

*when the referenced court is the Supreme Court, only the date is provided within the parenthesis

The abbreviation S.Ct. represents the Supreme Court Reporter. The Supreme Court Reporter and the United States Reports publish decisions of the US Supreme Court. Decisions of US Circuit Courts are published in the Federal Reporter and the Federal Reporter Second Series. Decisions of Federal District Courts are published in the Federal Supplement. Citations of decisions from these courts follow the format presented immediately above except that the following abbreviations are used for the following documents:

U.S.	United States Reports
S.Ct.	Supreme Court Reporter
F2d	Federal Reporter Second Series
F.	Federal Reporter
F.Supp.	Federal Supplement

Decisions from state courts are found in numerous private compilations. New Mexico decisions are generally available in the Pacific Reporter and Pacific Reporter Second Series. The Pacific Digest provides cross references to New Mexico decisions, beyond what is presented in the New Mexico Statutes Annotated, through thousands of individual subjects and concepts.

A few private treatises on the Mining Law exist and are very helpful because of the complexity of the case law and statutes of this subject. American Law of Mining, annual editions by the Rocky Mountain Mineral Law Foundation, is an excellent comprehensive treatment of the American mining law. Terry Maley's recent publications (1984, 1985) Mining Law from Location to Patent and Mineral Title Examination, are excellent quick references for most typical issues. Additionally, Maley discusses laws and decisions involving common-variety minerals, mineral specimens, and lapidary materials not covered by Rocky Mountain Mineral Law Foundation.

The premier source of decisions and recent changes in the mining laws is published by the Gower Federal Service as their Mining Service. Unfortunately, it is very expensive and hard to find in public or college libraries. This reference may be found in New Mexico in only a few Federal offices.

A Bureau of Land Management reference, Finding the Law by Al Coco (1982), is very helpful for tracking citations.