6th annual

NEW MEXICO MINERAL SYMPOSIUM

November 9 & 10, 1985

NMIMT Campus, Socorro, New Mexico

Welcome to

THE SIXTH ANNUAL

NEW MEXICO MINERAL SYMPOSIUM

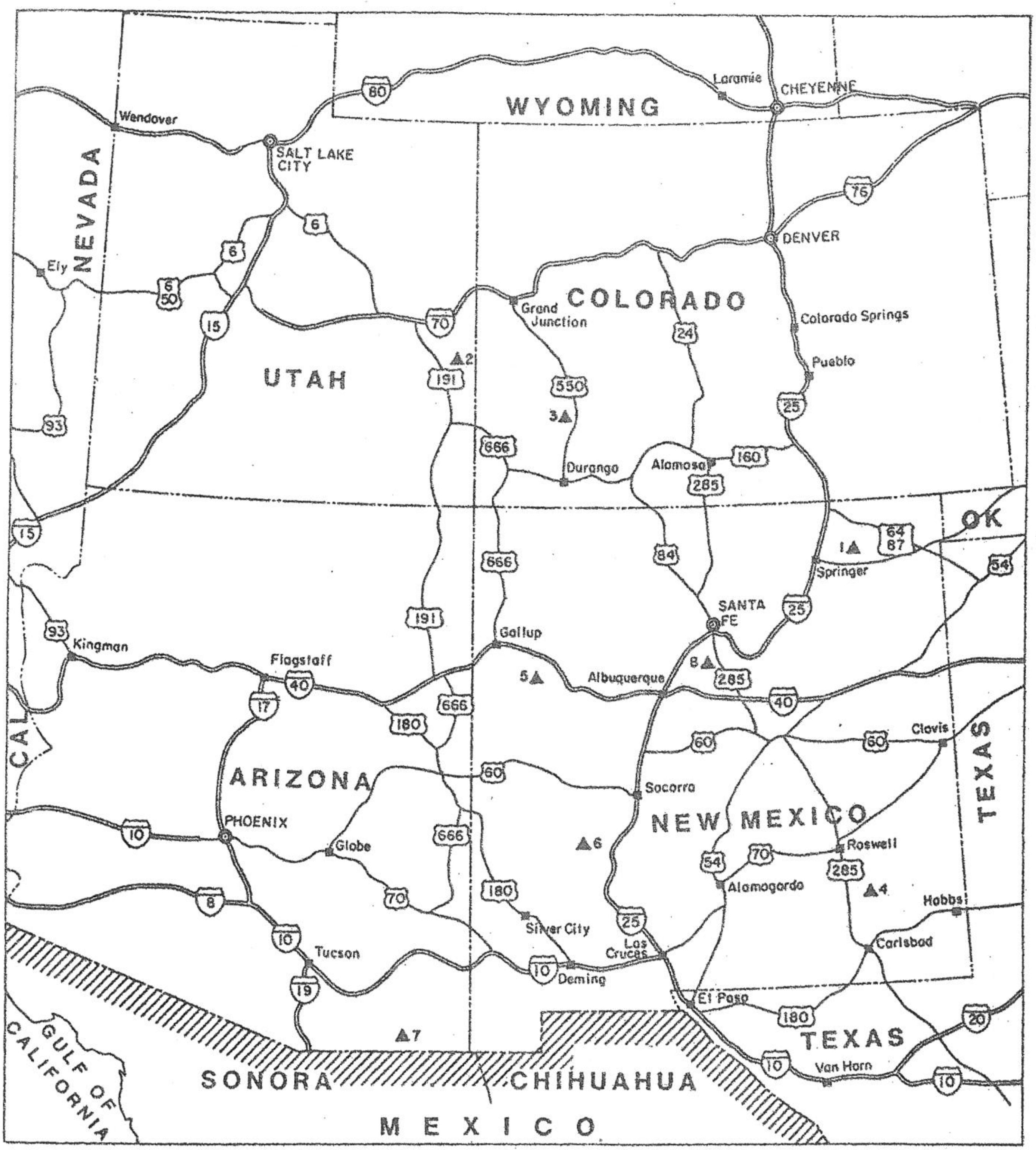
November 9 and 10, 1985

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

sponsored by
New Mexico Bureau of Mines and Mineral Resources
New Mexico Tech Mineralogical Society
Albuquerque Gem and Mineral Club
New Mexico Museum of Natural History
University of New Mexico, Department of Geology

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 Sixth 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

6th New Mexico Mineral Symposium

SCHEDULE

Numbers in parentheses refer to geographic location on index map.

Friday, November 8

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

Saturday..., November 9

8:00 Registration and coffee and donuts
9:10 Opening remarks
9:15 Microprobing New Mexico minerals--Paul F. Hlava
10:00 (1) A comparison of the mineralogy of Point of Rocks Mesa, New Mexico, with that of Mont St-Hilaire, Quebec, Canada, Ilimaussaq, Greenland, and the Kola peninsula, U.S.S.R.—Peter J. Modreski
10:30 Coffee break
11:00 (2) The Blue Jay azurite deposit--Michael E. Madson
11:30 (3) Minerals of the Camp Bird mine, Ouray, Colorado--Tom Rosemeyer
12:00 Lunch
1:30 Phosphate minerals of Arkansas--Albert L. Kidwell
2:00 (4) Wulfenite and associated minerals from the Red Lake prospects, Eddy County, New Mexico--Robert M. North and Mark A. Tuff
2:30 Coffee break
3:00 (5) Mineral collecting in the eastern Zuni Mountains, Cibola County, New Mexico--Virginia T. McLemore and Robert M. North
3:30 Geology and mineralogy of the Goodsprings district, Clark County, Nevada--Walter Lombardo
5:00 Sarsparilla and suds: cocktail party, upper lobby, Macey Center
6:00 Dinner, upper lobby, Macey Center, with keynote address, Gem and crystal treasures, by Dr. Peter Bancroft

Sunday, November 10

9:00 Brochantite and other minerals from the Paoli, Oklahoma, area--Joe Loebell
9:30 (6) An occurrence of betekhtinite in New Mexico--Paul F. Hlava and Douglas Irving
10:00 Break
10:30 (7) Calcites from Bisbee, Arizona--notes on a new occurrence--Richard W. Graeme IV and Douglas L. Graeme
11:00 (8) Tungsten mineralogy of the Ortiz mine area, Santa Fe County, New Mexico--Richard W. Graeme
11:30 A micromineral collector's tour of New Mexico--Ramon S. DeMark
12:00 Lunch
1:00-2:30 Silent auction, sponsored by the New Mexico Tech Mineralogical Society

MICROPROBING NEW MEXICO MINERALS*

Paul F. Hlava

Sandia National Laboratories

Albuquerque, New Mexico

The electron microprobe x-ray analyzer has become an important tool in the study of minerals. This talk describes the-instrument and the types of data that can be obtained from it. Examples of data obtained on New Mexico minerals will be used to illustrate and explain the various functions of the probe and to show why this instrument has become almost indispensable for the study of minerals.

Like a scanning electron microscope, the probe can produce secondary electron images that allow us to look at the morphological details of minute crystals and aggregates and their surfaces. Because of the large depth of field, these images are much sharper than those obtained from optical microscopes and, because of the shorter wavelengths of electrons, the magnification can be much greater. Unfortunately, the images are only available in black and white.

Both machines can also produce images from back-scattered electrons, images that tell us something about the composition of the minerals examined. Minerals with higher atomic-number elements show up brighter than the other minerals with which they are associated. This is something no optical microscope can do.

By far the most important function of the probe is analyzing the x-rays given off by a material and thereby determining qualitatively and/or quantitatively which elements are present. When a material is bombarded by electrons, x-rays are produced that are characteristic of the elements present. Determining the energy (or wavelength) of the x-ray peaks tells us which elements are there. By comparing the intensity of the x-rays from the sample with those from suitable standards, the probe can give us very good quantitative analyses of very small volumes. Alternatively, the probe can scan the beam over an area and produce an x-ray map showing how an element is distributed on our sample.

*This work was performed at Sandia National Laboratories and was supported by the U.S. Department of Energy under Contract #DE-AC04-76DP00789.

A COMPARISON OF THE MINERALOGY OF POINT OF ROCKS MESA, NEW MEXICO WITH THAT OF MONT ST-HILAIRE, QUEBEC, CANADA ILIMAUSSAQ, GREENLAND AND THE KOLA PENINSULA, U.S.S.R.

(Location 1 on index map)

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Point of Rocks Mesa, in Colfax County, northeastern New Mexico, is formed by a 100-m-thick phonolite sill of mid-Tertiary *age.* The relatively high abundance of sodium, fluorine, zirconium, niobium, thorium, and other elements in this silica-poor igneous rock has led to the formation of at least 45 different minerals both in the matrix of the rock and as free-growing crystals in small (typically a few centimeters in diameter) miarolitic cavities.

The host rock and the suite of minerals at Point of Rocks are similar to those of a number of well known mineral localities throughout the world. These localities have in common the presence of silica-undersaturated igneous rock that is rich in alkalies, volatile components (water, carbon dioxide, fluorine, chlorine), and rare metals. The host rocks typically include varieties of nepheline syenite, of which phonolite is the fine-grained equivalent, and they contain some or all of the following as major rock-forming minerals: orthoclase, albite, nepheline, sodalite, analcime, aegirine (acmite) or aegirine-augite (acmite-augite), and arfvedsonite. The accessory minerals that make these rocks mineralogically distinctive include eudialyte, cancrinite, titanite, astrophyllite, catapleiite, elpidite, epididymite, lorenzenite, murmanite, narsarsukite, neptunite, polylithionite, rinkite (mosandrite), steenstrupine, and many others.

The best known North American locality of this type is Mont St-Hilaire, Quebec, a 9-km^2 composite intrusion of gabbro, nepheline syenite, and sodalite syenite. It is one of about ten alkalic plutons forming the Monteregian Hills, an alignment of Late Cretaceous (about 110 m.y.) intrusions along a 200-km east-west trend in southern Quebec lying in the Ottawa graben at its intersection with the St. Lawrence continental rift zone. The unusual minerals at Mont St-Hilaire are most abundant in pegmatitic veins that cut the syenite and in miarolitic cavities as much as 2 m in diameter. New minerals were produced by hydro-thermal alteration of the primary minerals, leading to a total of more than 150 known species.

About 20 plutons of late Precambrian age lie within a 180- by 80-km region along the coast of southwest Greenland centered near Julianehaab. These plutons compose the 1,000- to 1,250-

m.y.-old Gardar igneous province. They include alkali gabbros, syenites, and alkali granites. Three areas within the region are notable for their diverse mineral suites. 1) At Ivigtut, about 130 km west of Julianehaab, a small cryolite-siderite body is associated with explosive brecciation of a peralkaline granite stock. 2) The Ilimaussaq intrusion is about 25 km north of Julianehaab and covers about 135 km^2; it is cut in two by Tunugdliarfik Fjord, and its southern half lies at the head of Kangerdluarssuk Fjord. It is a composite, layered intrusion including augite syenite, "naujaite" (sodalite nepheline syenite), "kakortokite" (mafic acmite-arfvedsonite-eudialyte nepheline syenite), "lujavrite" (trachytic arfvedsonite-acmite nepheline syenite), quartz syenite, and alkali granite. The unusual minerals are most abundant in pegmatites that cut the nepheline syenites and in zones of pneumatolytic or hydrothermal alteration. Kvanefjeld, on the northwestern edge of the Ilimaussaq intrusion, is one site at which many minerals have been found. 3) The Igdlerfigssalik intrusion, covering about 150 km^2, is about 30 km farther to the northeast, at the head of Tunugdliarfik Fjord, near the town of Igaliko. One notable mineral site in this intrusion is Narsarsuk, a level plain on the side of Igdlerfigssalik Mountain. The intrusion is composed of augite syenite and nepheline syenite, and the minerals are most abundant in pegmatitic segregations in the augite syenite. At least 50 different minerals have been found in the Igdlerfigssalik-Narsarsuk area, and about 35 at Ilimaussaq.

The Kola Peninsula lies mostly above the Arctic Circle in the northwestern part of the U.S.S.R. It is composed mainly of Precambrian rocks, within which are two large, alkalic intrusions of late Paleozoic (Hercynian, 290 m.y.) age. The Khibina (Khibiny) massif, occupying 1,327 km^2, is in the central part of the peninsula, about 150 km south of the port of Murmansk. Just east of the Khibina massif is the Lovozero massif, covering 650 km^2. A smaller, satellite intrusion (Soustova, 38 km^2) lies just south of the Khibina. The Kola Peninsula also contains a number of older alkaline ultramafic and gabbroic igneous complexes of middle Proterozoic and of Caledonian (middle Paleozoic) ages.

The Khibina massif is composed of multiple, concentric intrusions of nepheline syenite, alkali syenite, "khibinite" (coarse-grained, eudialyte-bearing nepheline syenite), "rischorrite" (nepheline syenite with poikilitic texture of nepheline enclosed in microcline perthite), alkalic pegmatites, alkali gabbros, lamprophyres, and others. The Lovozero massif, which is interpreted as a layered intrusion rather than a ring complex like that of Khibina, includes nepheline-, sodalite-, nosean-, and analcime-bearing syenites, "lujavrites," alkalic pegmatites, and lamprophyre dikes. Rare minerals in the two massifs are developed in pegmatites or pegmatitic segregations, in several stages of pneumatolytic or hydrothermal alteration, and in altered zones near the outer contacts. About 200 mineral species are known from the Lovozero intrusion, and probably somewhat fewer have been found at Khibina.

In comparison to these other alkalic intrusives, the Point of Rocks phonolite takes a relatively subordinate position; it is thinner, less extensive (approximately 8 km^2), and younger (about 20 m.y.), and its mode of emplacement as a near-surface sill also differs. The composition and volatile content of the phonolite caused it to develop a diverse suite of minerals, but the relatively rapid cooling and crystallization of this near-surface body kept it generally fine-grained, restricting the size of the iniarolitic cavities, preventing the development of late-stage pegmatites, and limiting the extent of hydrothermal alteration. Point of Rocks is part of the Chico Phonolites,,a complex of flows, sills, and dikes with an aggregate exposed area of about 65 km^2, situated within a larger province of basalt flows, trachytes, andesites, and dacites. It is reasonable to assume that the source of the phonolites was a larger body of alkalic magma that crystallized deep below the surface, and that the next few hundred million years of erosion of this part of the High Plains may well expose an alkaline intrusive complex to rival those of Quebec, Greenland, and Kola.

THE BLUE JAY AZURITE DEPOSIT

(Location 2 on index map)

Michael E. Madson
Bendix Corporation
Grand Junction, Colorado

The Blue Jay (or Eureka) claim is one of the 17 patented claims that compose the Big Indian mine near La Sal, Utah. The mine has been an important source of copper ores, particularly so in the late 1940's and 1950's. The Big Indian properties are owned by Big Indian Resources of Englewood, Colorado. The Blue Jay claim was leased by Mike Madson Minerals in 1982 expressly for the recovery of collectible malachite and azurite.

The occurrence of collectible mineral specimens at the Big Indian mine was first noted in the summer of 1980 by a Mesa College (Grand Junction) geology student. Subsequently, several mineral collectors recovered small crystal groups and small nodules of azurite. In the spring of 1981 significant numbers of azurite nodules were recovered from a roadside deposit on the Blue Jay claim. The minerals recovered during the 1981 excavations were marketed as "Blue Grotto" material. These excavations ended when the collectors encountered a "pinch-out" on the azurite-bearing shear zone in the Brushy Basin Member of the Morrison Formation.

Lease acquisition and subsequent geologic mapping made possible the identification of three additional areas of potential for the recovery of collectible minerals. The most significant of the three areas proved to be an unanticipated extension of the 1981 shear zone, which was not visible to surface exploration. The 1983 excavation of the Blue Jay claim exceeded all previous recoveries. Nearly 1,200 yds^3 of azurite-bearing vein materials were sorted on site during the October through November excavation. The azurite-bearing zone exhibits strong structural and lithologic controls. Minerals recovered in 1983 supplied a diversity of products including pigment, geodes, jewelry, and fine specimens. This excavation yielded in excess of 20,000 individual azurite geodes, as well as many hundreds of unusual azurite-malachite groups. The 1983 yield, in addition to the yields recovered earlier in the 1980's, identify the Blue Jay claim as one of the most important occurrences of azurite in the United States, perhaps the world, within the last several decades.

MINERALS OF THE CAMP BIRD MINE
OURAY, COLORADO

(Location 3 on index map)

Tom Rosemeyer
P.O. Box 586
Ouray, Colorado

The Camp Bird mine, located 5 mi south of Ouray, Colorado, was discovered in 1896 by Thomas Walsh and was developed into one of the major gold producers in the state. Many fine specimens of native gold and large groups of milky-quartz crystals were recovered during the early mining operations. During the 1970's Pb-Zn-Cu replacement ores were mined from the Telluride conglomerate (Tertiary). The replacement orebodies produced many fine specimens of Pb-Zn-Cu sulfides and gangue minerals.

The lecture and slide presentation covers the history of the mine and the general geology and mineralogy of the ore deposits.

PHOSPHATE MINERALS OF ARKANSAS

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A variety of phosphate minerals occurs in highly folded siliceous Paleozoic rocks of the Ouachita Mountains in west-central Arkansas. Most of the area is in the Ouachita National Forest and is open to collecting except on valid mineral claims.

The iron phosphates typically are confined to the lower and middle members of the Arkansas Novaculite (Devonian). They occur with iron and manganese oxides filling fractures in the brittle novaculite in prospects where fresh rock has been exposed. Five important occurrences and many minor ones are known throughout an east-west distance of approximately 40 mi.

The earliest mineralization was ferrous-ferric phosphates: dufrenite, rockbridgeite, laubmannite, lipscombite, and beraunite; next came the ferric phosphates: kidwellite, strengite, phosphosiderite, cacoxenite, and an amorphous, red, iron phosphate. A new, undescribed mineral is probably a higher hydration product of kidwellite. Nonphosphate minerals occurring in these deposits are hyalite opal, goethite, cryptomelane, and other unidentified manganese oxides.

Aluminum phosphates are generally found in the Big Fork chert ,(Ordovician) and consist of wavellite, crandallite, variscite, metavariscite, gorceixite, turquoise, and planerite. The two principal localities are at Avant (Buckville) and the county road quarry at Mauldin Mountain, near Mt. Ida, but mineralization is widespread in other areas. Gorceixite is a rare barium-aluminum phosphate that occurs sparingly as white, fibrous coatings along fractures in novaculite. The principal turquoise locality is the Mona Lisa mine, where the turquoise occurs with kaolinite in hydrothermally altered novaculite. The mineral planerite, recently redefined by Foord, occurs at many places as fracture fillings in novaculite as well as in the Big Fork chert.

A unique locality for phosphates, as well as other rare minerals, is the Umetco vanadium mine at Potash Sulphur Springs, Arkansas. This is a complex of alkaline igneous rocks intruding Paleozoic sediments. Cacoxenite, strengite, wavellite, and some rare-earth phosphates occur near the edge of the intrusive.

The virtual restriction of the phosphate minerals to specific formations or parts of formations suggests that the phosphorus was indigenous to either the siliceous host rocks or the adjacent shales. It seems likely that phosphorus was leached out and redistributed in fracture zones by hot waters similar to those currently issuing as hot springs.

ARKANSAS PHOSPHATE MINERALS

Ferrous-Ferric Iron

Rockbridgeite	$(Fe^{2},Mn)Fe^{3}_{2}(PO_4)_3(OH)_5$
Laubmannite	$Fe_3^{2}Fe_6^{3}(PO_4)_4(OH)_{12}$
Lipscombite	$(Fe^{2},Mn)Fe_2^{3}(PO_4)_2(OH)_2$
Dufrenite	$Fe^{2}Fe_4^{3}(PO_4)_3(OH)_5 \bullet 2H_20$
Beraunite	$Fe^{2}Fe_5^{3}(PO_4)_4(OH)_5 \bullet 4H_2O$

Ferric Iron

Kidwellite	$NaFe_9(PO_4)_6(OH)_{10} \bullet 5H_2O$
Strengite	$FePO_4.2H_20$
Phosphosiderite	$FePO_4.2H_20$
Cacoxenite	$Fe_9(PO_4)_4(OH)_{15} \bullet 18H_2O$

Aluminum

Wavellite	$Al_3(PO_4)_2(OH,F)_3 \bullet 5H_2O$
Variscite	$A1(PO_4) \bullet 2H_20$
Metavariscite	$A1(PO_4) \bullet 2H_20$
Turquoise	$CuAl_6(PO_4)_4(OH)_6 \bullet 5H_2O$
Planerite	iron aluminum phosphate
Gorceixite	$BaA1_3(PO_4)_2(OH)_5 \bullet H_2O$
Crandallite	$CaAl_3(PO_4)_2(OH)_5 \bullet H_2O$

WULFENITE AND ASSOCIATED MINERALS FROM THE RED LAKE PROSPECTS, EDDY COUNTY, NEW MEXICO

(Location 4 on index map)

Robert M. North and Mark A. Tuff
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The Red Lake prospects are located in the west half of section 29, T178, R28E, about 12 mi east of Artesia, New Mexico. The area has produced some copper and a few ounces of silver and may have produced lead and zinc. E. C. Anderson refers to the area as the Caprock escarpment, and he reported small amounts of lead, zinc, copper, gold, and, silver in New Mexico Bureau of Mines and Mineral Resources Bulletin 39 (p. 44).

Mineralization in the area is restricted to breccias in the Rustler Formation (Permian) and perhaps the Salado Formation (Permian). No primary minerals have been found, and the mineralization observed was formed by oxidation of an unobserved deposit of unknown size and distance from the present deposits. The primary deposit might have been deposited from brines formed in or adjacent to the Permian Basin, probably during Permian time. If this hypothesis is true, the deposits observed represent an oxidized expression of a Mississippi Valley-type deposit.

The area was explored by means of several prospect pits and an open cut measuring approximately 50 ft long, 20 ft wide, and 15 ft deep. The open cut contains copper mineralization consisting of chrysocolla in a gangue of quartz and dolomite.

The prospect pits in the area have Pb-Zn mineralization consisting of wulfenite, hemimorphite, anglesite, and descloizite in a gangue of quartz, dolomite, barite, goethite, calcite, and kaolinite. The wulfenite occurs as blades in vugs and frozen in a goethite matrix. The crystals are reddish-orange to yellow and have a maximum length of about 1 cm. The hemimorphite blades are colorless and reach a length of approximately 5 mm.

MINERAL COLLECTING IN THE EASTERN ZUNI MOUNTAINS
CIBOLA COUNTY, NEW MEXICO
(Location 5 on index map)

Virginia T. McLemore and Robert M. North
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The Zuni Mountains near Grants, in northwestern New Mexico, are not well known as a mineral-collecting locality even though some nice specimens of fluorite, barite, and copper oxides have been found there. The eastern mountains contain Precambrian veins and Paleozoic stratabound sedimentary copper deposits that have produced more than 30,000 lbs of copper, 260 oz of silver, and 2 oz of gold. However, the most important production in this area came from veins that produced more than 192,000 tons of fluorspar ore from 1909 to 1962. Thus, the eastern Zuni Mountains contain one of the largest fluorspar districts in the state.

Fluorite with subordinate amounts of quartz, calcite, and, rarely, barite and galena occurs in veins up to 7 ft wide and several thousand feet long. The veins typically intrude Precambrian gneissic granite, although a few fluorite veins intrude Paleozoic sedimentary rocks. The veins are concentrated in two major areas, one near the mines in sections 21 and 27 and the other at the Mirabel mine in Diener Canyon.

Blue, purple, green, and colorless cubes of fluorite up to 1/2 inch across are common in both areas. Specimens of small stacked fluorite cubes sometimes exhibit an iridescent or pearly luster. Massive, banded, blue and green fluorite provides nice slabbing material and can be found in veins near the sections 21 and 27 mines. Some banded fluorite also occurs at the Mirabel mine. Clusters of bladed pink- to salmon-colored barite, occasionally with fluorite, occur near the Mirabel mine. Some of the specimens near the Mirabel also contain blades of malachite with fluorite and barite.

Many of the fluorspar deposits occur on national forest land and are readily accessible to the public. Mineral collectors should be careful, however, because many of the underground workings are extremely hazardous. Good material can be obtained from mine dumps and shallow open trenches.

GEOLOGY AND MINERALOGY OF THE GOODSPRINGS MINING DISTRICT, CLARK COUNTY, NEVADA

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The Goodsprings (Potosi; Yellowpine) mining district is one of the larger districts in southern Nevada. Goodsprings is located at the southern end of the Spring Mountains, approximately 30 air mi southwest of Las Vegas. The district is relatively unknown to mineral collectors because there has been no activity there since World War II. Many fine specimens were found when the mines were operating, and the old mines and dumps still contain good specimens, especially for the micromineral collector.

The first orebody in the district was discovered by Mormon missionaries in 1856 although large-scale mining did not begin until the 1890's. Mining activity was at its peak from 1906 to 1917, with moderate activity in 1924-28 and in 1943-44. Lead, zinc, and copper minerals were the principal ores produced, along with some gold, silver, vanadium, cobalt, and platinum. Exploration for uranium was carried out in the 1950's, and recent exploration has focused on the potential for gold.

The geology of the Goodsprings district is complex. The Spring Mountains in this area consist of approximately 13,000 ft of Paleozoic and Mesozoic sediments, which were folded and faulted during orogenic events in the Late Jurassic to Early Tertiary. Thrust faults And high-angle faults are common. Sills and dikes of granite porphyry and lamprophyre were emplaced, and dolomitization of some of the limestone occurred. The ore mineralization probably occurred in the Early Tertiary. The orebodies are found almost exclusively in the Monte Cristo limestone (Mississippian), with the Yellowpine member accounting for approximately 85% of the ore mined in the district. The orebodies are tabular where parallel to bedding and where they cut across the beds. The primary sulfide minerals, galena, sphalerite, and chalcopyrite, have been highly oxidized and, with the exception of galena, are rarely found in the ore.

More than 50 minerals have been found in the Goodsprings district. Best known to collectors are superb specimens of fluorescent and crystallized hydrozincite, textbook orthoclase crystals (including Baveno and Carlsbad twins) from the granite porphyry, and the rare cobalt oxide, heterogenite. Other minerals of interest to collectors include wulfenite, pyromorphite, vanadinite, cerussite, anglesite, plattnerite, malachite (including pseudomorphs after azurite), dioptase, dolomite, hemimorphite, and mottramite.

BROCHANTITE AND OTHER MINERALS FROM THE PAOLI, OKLAHOMA, AREA

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Well crystallized brochantite was discovered in 1981 in northern Garvin County near the community of Paoli. The deposit is particularly interesting mineralogically because of its assemblage of copper-bearing minerals in a "red bed" occurrence.

The host rocks for the copper mineralization are Permian sandstones belonging to the Garber formation. These sandstones occur throughout much of northern Texas and some southwestern states, as well as Oklahoma, and contain copper minerals in isolated locations. Many of these other deposits may contain similar mineral groupings if favorable formation conditions exist.

The brochantite was formed within 3 ft of the present land surface on the underside of a sandstone ledge containing barite cement. Other specimens of brochantite developed on sulfide nodules embedded within a clay layer beneath. Meteoric water undoubtedly played a major role in the creation of the deposit, particularly the development of the brochantite.

The brochantite crystals are stubby, small (less than 1 mm), and cover from 10 to 90% of the rock surfaces. The crystals are sometimes intergrown to form a botryoidal surface several mm thick.

Other minerals found in the area include malachite, azurite, chalcanthite, chrysocolla, barite (cement, radial balls, "rose rocks," and claystone geode fillings), hematite, silver minerals, calcite, aragonite, goethite, cuprite, pyrite, chalcocite, and several unknown minerals (probably copper sulfates).

The area was mined around the turn of the century, but the very small, open-pit copper mines were not profitable. Silver was mined profitably in the region about 70 years ago. Limited prospecting for copper minerals was begun in the region around 1980.

AN OCCURRENCE OF BETEKHTINITE IN NEW MEXICO*

(Location 6 on index map)

Paul F. Hlava
Sandia National Laboratories
Albuquerque, New Mexico

Douglas F. Irving
Chapman, Wood, and Griswold, Inc.
Albuquerque, New Mexico

The rare mineral betekhtinite, a sulfide of copper, lead, and iron, occurs in significant amounts in the St. Cloud copper-silver deposit located near Winston in the Chloride mining district, Sierra County, New Mexico. The mine, situated on the eastern slopes of the Black Range approximately 40 mi west of Truth or Consequences, is owned and operated by the St. Cloud Mining Co.

The St. Cloud and adjoining Atlanta and Mayflower lode mining claims were located in 1884. A few tons of hand-sorted oxidized copper-silver ore were shipped from near-surface workings on the Atlanta-St. Cloud claims in the 1880's and early 1890s. Drilling by the Goldfield Corp. in 1968 on the St. Cloud-U.S. Treasury vein intercepted ore-grade copper-silver mineralization at a depth of 450 ft. Subsequent drilling established the presence of two ore deposits, the St. Cloud and the U.S. Treasury.

The St. Cloud ore deposit is a mesothermal vein-type deposit occurring in a strong northwesterly striking fault structure. Host rocks are the Madera Limestone (Pennsylvanian) and andesitic flows and sills (Tertiary). The fault zone and vein structures are 20-60 ft wide. Ore-grade mineralization is typically 10-20 ft wide and occurs as ore shoots within the structure. Mineralization appears to favor those areas where the vein structure has limestone on one wall and andesite on the other.

Mineralization, which is often massive, contains (in decreasing order of abundance) sphalerite, bornite, betekhtinite, galena, chalcocite, and stromeyerite in a siliceous breccia. The outer portions of the orebodies contain some chalcopyrite. Pyrite, although common in the wall rocks, is noticeably less abundant in the ore. Late-stage calcite is common. Oxidation in the upper parts of the deposit created very minor amounts of native copper, curite, and copper carbonates.

Betekhtinite was first described in 1955 as a Cu-Pb-Fe sufide from veins in the Mansfeld "Kupferschiefer" (copper shales) of East Germany. Since then it has been found in Europe, Asia, Africa, South America, and Australia. In 1982 betekhtinite was identified in concentrates from the St. Cloud mine. We believe that this is the first reported occurrence of the mineral in North America.

Chemically, the New Mexico betekhtinite is a Cu-Pb-Fe sufide with minor amounts of silver, but microprobe analyses indicate that the published formula—$Cu_{10}(Pb,Fe)S_6$--is in error. In the literature on this mineral, the formula has undergone a number of changes, partly because the silver and iron may be assigned to either the Cu site or the Pb site. Analyses from the present study and from many literature sources seem to best fit a formula of $Cu_{13}(Pb,Fe,Ag)_2S_9$.

*A portion of this work was performed at Sandia National Laboratories and was supported by the U.S, Department of Energy under Contract #DE-AC04-76DP00789. The authors would like to acknowledge the cooperation and assistance of the St. Cloud Mining Co.

CALCITES FROM BISBEE, ARIZONA—NOTES ON A NEW OCCURRENCE

(Location 7 on index map)

Richard W. Gramme, IV, and Douglas L. Graeme

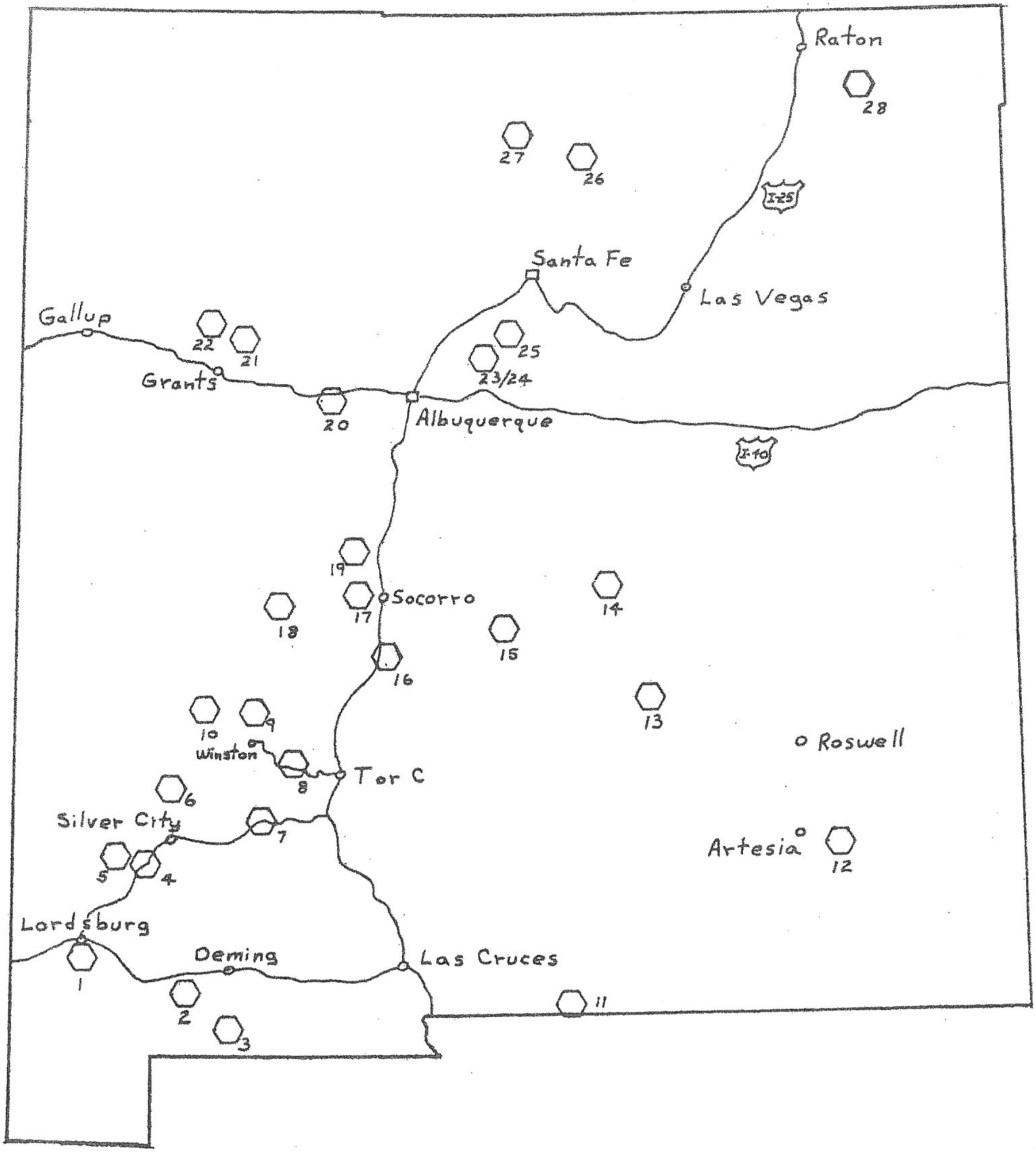
Calcite from Bisbee, Arizona, has been prized by collectors worldwide for its diversity of form and color. Unfortunately, little information concerning the modes of occurrence has been recorded. A recent study of a long known, but not investigated, occurrence fills this void. The study allows several different depositional environments to be defined and also allows speculation on coloring mechanisms in calcite.

TUNGSTEN MINERALOGY OF THE ORTIZ MINE AREA
SANTA FE COUNTY, NEW MEXICO

(Location 8 on index map)

Richard W. Graeme
Gold Fields Ltd.
Cerillos, New Mexico

The occurrence of tungsten-bearing minerals in the Ortiz area has been recognized for many years. During the 1950's, fruitless efforts were undertaken to develop an economic scheelite concentrate from the very ores that are successfully mined today for gold. While several tungsten minerals have been found in the area, scheelite is by far the most abundant and the only one to produce collector-quality specimens.



New Mexico Micromineral Locations

A MICROMINERAL COLLECTOR'S TOUR OF NEW MEXICO

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The mines and mountains of New Mexico offer the micromineral collector a diversity of mineral species that will delight and fascinate both the beginning and the advanced collector. From the micromounter's perspective, much of New Mexico is untouched or unexplored, and new discoveries await the diligent collector. My intent in this talk is to briefly describe some of the well known, lesser known, and virtually unknown locations that exist in New Mexico. This compendium is not meant to be an all-inclusive presentation because there are far too many mines, outcrops, and prospect pits to describe in one talk.

Twenty-eight different mines, pits, outcrops, etc., will be described in this presentation, starting in the southwest corner of the state and concluding in the northeast at Point of Rocks Mesa. While it is unlikely that all these sites could be visited on a single trip, many could be encompassed during a visit of one week. The locations to be discussed will be divided arbitrarily into five sectors:

<u>Southwest</u>

1. Lordsburg mining district
2. Victorio mining district
3. Mahoney mining district
4. Tyrone pit
5. Alhambra mine
6. Gila River zeolites
7. Hillsboro
8. Willow Creek
9. Iron Mountain
10. Paramount Canyon

<u>South-central</u>

11. Wind Mountain
12. "Turquoise" mine
13. Allanite claim
14. Red Cloud mines
15. Blanchard mine
16. San Marcial quarry
17. Socorro Peak
18. Lynchburg mine
19. Lemitar Mountains

<u>Central</u>

20. Cerro Colorado
21. East Grants Ridge
22. Poison Canyon
23. Carnahan mine
24. San Pedro mine
25. Ortiz gold mine

<u>North-central</u>

26. Harding
27. La Madera

<u>Northeast</u>

28. Point of Rocks Mesa

Although many of the locations noted above are on public land and readily accessible to the mineral collector, others are on private or restricted land and approval should be obtained before entering the area.