Abstracts

New Mexico Mineral Symposium

The 8th annual Mineral Symposium was held November 14–15, 1987, at New Mexico Institute of Mining and Technology, Socorro. Following are abstracts from talks given at the meeting that concern New Mexico. The numbers in parentheses refer to locations on the map.

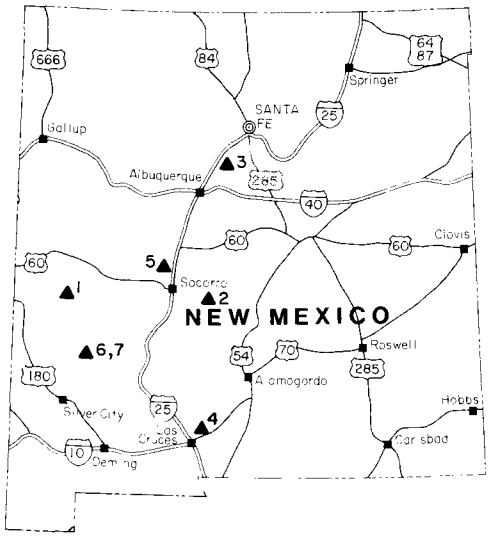
MAGNESIOFERRITE, HEMATITE, AND OTHER MINERALS FROM OLD HORSE SPRINGS, CATRON COUNTY, NEW MEXICO, by *Peter J. Modreski* and *James C. Ratté*, U.S. Geological Survey, Box 25046, MS 922, Denver Federal Center, Denver, CO 80225 (1)

An unusual suite of ferric iron–bearing minerals occurs in xenoliths within a dacite pumice breccia. The 33-m.y.-old dacite pumice and ash flow, part of the Mogollon–Datil volcanic field, crops out along NM–12 approximately 1.5 mi (2.4 km) west of Old Horse Springs. The flow is as much as 200 m thick and crops out sporadically within a north–south belt up to 5 km wide and 20 km long.

Xenoliths of pre-Tertiary sedimentary rock and cognate(?) inclusions of coarse-grained quartz monzonite are concentrated in the upper part of the pumice breccia. The most common xenoliths are of limestone altered to a red, iron-rich jasperoid. These silicified nodules, from a few centimeters to as much as 0.3 m in size, consist of variable amounts of quartz, iron oxides, and calcite. Many xenoliths show concentric banding of layers rich in quartz and iron-oxide minerals; some are composed of nearly solid masses of iron oxides. Many xenoliths are surrounded by a skarn-like reaction zone a few centimeters thick composed largely of green diopside with or without andraditic garnet, phlogopite, and clay minerals. Other iron-bearing minerals occur in fractures in xenoliths of argillaceous or calcareous sandstone and in miarolitic vugs within quartz-monzonite inclusions.

Hematite is the most obvious of the oxide minerals; it forms black, lustrous, platy crystals typically 1 mm or less in diameter. A variety of spinel-group minerals are present in the xenoliths. Magnesioferrite occurs as minute octahedral crystals about 0.5 to 200 μm in size, usually embedded in fibrous, spheroidal-textured chalcedonic quartz. Magnesioferrite, ideally $MgFe^{+3}_2O_4$, is transparent to translucent in thin section and orange brown to blood red in color; the red color of most fine-grained jasperoid is due to magnesioferrite rather than hematite. The magnesioferrite is slightly zinc bearing, ranging from about 0.1 to 4.0 wt % ZnO; a typical formula (for magnesioferrite with 0.49% ZnO) is: $(Mg_{0.98}Zn_{0.01}Ca_{0.01})(Fe^{+3}_{1.62}Al_{0.27}Mn^{+3}_{0.05}Mg_{0.05})O_{3.98}$. Less abundant is aluminous spinel, brownish-yellow in thin section, containing several percent ZnO; a typical formula (for spinel with 1.0% ZnO) is: $(Mg_{0.98}Zn_{0.02})(Al_{1.62}Fe^{+3}_{0.32}Mn^{+3}_{0.01}Mg_{0.05}Si_{0.01})O_{3.98}$. Very fine grained (one to a few μm in size) zinc-rich spinels, detected only with the microprobe, have a complex composition approaching franklinite. One analysis of a specimen containing 27.46% ZnO gives the following formula: $(Zn_{0.80}Mg_{0.15}Ca_{0.05})(Fe^{+3}_{1.03}Al_{0.42}Mn^{+3}_{0.37}Mg_{0.18}Si_{0.01})O_{3.91}$, corresponding to end-member proportions of 51% franklinite, 21% gahnite, and 28% other components.

Diopside in the skarn rims is zoned, ranging from about 4 to 11% FeO. Green to brown andradite garnet, often in euhedral dodecahedra about 1 mm across, ranges in composition from about $Andradite_{30}Grossular_8$ to $Andradite_{63}Grossular_{34}$ with the balance in other components. Diopside also forms free-growing transparent yellow-green prisms a few tenths of a millimeter in length in



cavities in metasedimentary and monzonite nodules. Commonly present in cavities with diopside is pseudobrookite, $Fe^{+3}_2TiO_5$, as small (about 0.2 mm long) prismatic to bladed crystals. X-ray diffraction and scanning electron microscopy show that some pseudobrookite prisms are coated with an irregular layer of titanite. Forsteritic olivine occurs as inclusions in hematite crystals; it contains about 1.8 wt % total iron expressed as FeO. However, bright-red cathodoluminescence of this forsterite suggests that only ferric iron is present in it, leading to the formula $Mg_{2.09}Fe^{+3}_{0.04}Si_{0.93}O_4$; the mineral shows a consistent excess of Mg and deficiency of Si.

Mineral assemblages in the jasperoid xenoliths are unusual for their highly oxidized state—all iron in the oxide minerals appears to exist as Fe^{+3}—and the presence of zinc in the oxides. Bulk composition of the nodules ranges up to 10,000 ppm (1%) Zn, and anomalous amounts of Mn, Cu, V, Ni, and Pb are also present. A probable sequence of events for the nodules was 1) silicification of limestone beds to form iron- and zinc-bearing jasperoid; 2) stoping of silicified limestone blocks into the intruding dacite magma; 3) reaction of limestone xenoliths with the enclosing magma to form calc-silicate skarn rims (at least part of this reaction appears to have occurred after eruption because the skarn minerals surround the nodules as an undisturbed zone extending into the host dacite); 4) oxidation and recrystallization within the xenoliths to produce the present assemblage of hematite and zincian magnesioferrite, probably after eruption of the pumice breccia and contemporaneously with (3); and 5) retrograde (deuteric) development of phlogopite and montmorillonite in the skarn rims by reaction with water vapor in the cooling pumice flow.

MINING DEVELOPMENT AND MINERALS OF THE HANSONBURG MINING DISTRICT, SOCORRO, NEW MEXICO, by *Ramon S. DeMark*, 6509 Dodd Place NE, Albuquerque, NM 87110 (2)

The Hansonburg mining district,which is located in southeastern Socorro County, New Mexico, is bounded on the west by the large desert valley known as the Jornada del Muerto, and includes the northern portion of the Oscura Mountains as an eastern boundary. Remote from population centers and isolated from development by lack of water and location on the northern extension of White Sands Missile Range, the Hansonburg mining district has gained notoriety primarily because of the occurrence of rare and attractive minerals.

The district was developed initially in 1901 from a copper mine. That was followed in 1916 by the development of lead mining in the northern Oscura Mountains. The original copper mine, located 6 miles west of the lead mine in the Jornada del Muerto, ceased production in 1917, and for the next 6 decades mining activity was focused on lead (with minor silver) and barite production. From a mining perspective these decades must be viewed as marginally successful at best.

In April 1987 the mineral-producing areas of the Hansonburg mining district entered a new era. The unpatented claims previously held by mining companies were abandoned, and control was assumed by a group of individuals whose primary motivation was the recovery of minerals as specimens.

Recent activity at the Blanchard mine has centered on the Sunshine #1 tunnel that had gained instant notoriety in 1980 for yielding world-class linarite crystals. Most recently, a pocket in this tunnel has produced two-inch lavender cubes of fluorite that rival the best that the Blanchard mine produced. Additionally, some specimens of the newly approved polymorph of PbO_2, scrutinyite (J. Taggart, pers. comm.), have been found. The Sunshine #1 tunnel of the Blanchard mine is the type location for this mineral. Also of interest has been the confirmation of the mineral caledonite, which had been reported previously but not observed for more than 30 years, and the recovery of large selenite crystals more than 40 cm in length.

A rare opportunity to visit the Hansonburg copper mine on October 2, 1987, was made possible by Jim Eckles, Public Affairs Officer for White Sands Missile Range. Specimens collected on this visit confirm that the primary ore mineral at this mine was tennantite as reported by Samuel G. Lasky (1932, The ore deposits of Socorro County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 8). More recent reports had refuted the occurrence of tennantite at the Hansonburg copper mine, but these determinations were made without the benefit of sample analysis. Secondary copper arsenates along with azurite were also found, and preliminary analysis (microprobe) indicates that olivenite and conichalcite are the predominant minerals.

The recent discovery of superb smoky quartz crystals with chrysocolla and lustrous bright-green microcrystals of antlerite has stimulated the search for new species and attractive specimens. The Blanchard mine has a long history of producing excellent mineral specimens. Today the mine is open to collectors on a fee basis for the surface areas (no underground collecting permitted), and in the foreseeable future the present owners intend that this rich collecting area will remain open for the enjoyment of all mineral collectors.

Hansonburg mining district chronology

1872—First attracted attention of prospectors. Apparently discovered by Pat Higgins. Received name from old prospector Hanson.

1885–1901—Copper deposits were worked at frequent intervals.

1901—Hansonburg copper mine property developed by *Alcazar Copper Company*. One carload of ore shipped.

1916—*Western Mineral Products Company* took over Hansonburg lead mine and erected a 50-ton dry mill on property to extract galena.

1916–17—Fifteen carloads of ore shipped from the Hansonburg copper mine.

1917—Several carloads of lead concentrates shipped from Hansonburg lead mine.

1917–33—Hansonburg district inactive.

1938—*Louis & Halstead* shipped a small, unknown amount of lead-silver ore. ☞

1939—*Globe Mining Company* shipped nine tons of lead-silver ore.
1943—F. L. Blanchard of Roswell assumed ownership of six unpatented claims in area of Hansonburg lead mine.
1947—*Portales Mining Company* worked the Hansonburg lead mine (Blanchard mine).
Dec. 1947—Mex–Tex and Royal Flush Nos. 1 and 2 claims were located.
1948—*Portales Mining Company* built a mill approximately 1 mile east of San Antonio and hauled ore to it by truck.
Feb. 1949—Royal Flush Nos. 3 and 4 added to other Royal Flush claims and sold to Ben B. Scott, who organized the *Scott Mineral Company*. Shipped two or three carloads of lead ore to El Paso smelter.
1949—*Mex–Tex Mining Company* of Artesia began work on 30 claims north of the Hansonburg lead mine.
Late 1949—Royal Flush group was sold by *Scott Mineral Company* to *Erwin & Bishop* of Houston.
Early 1950—*Erwin & Bishop* purchased the Mex–Tex group and added it to their Royal Flush claims. *Mex–Tex Mining Company* name was retained.
1950—*Portales Mining Company* processed and marketed 14,377 tons of lead ore at San Antonio mill. *Mex–Tex Mining Company* constructed a 200-ton/day barite mill near San Antonio.
1952—*Portales Mining Company* and the *Mex–Tex Company* trucked (from open pits) about 150 tons/day to their respective mills in San Antonio.
1952—*Hurlow Mining & Milling Company* erected a mill on the northeast end of the district. Clarence Barrett from Portales operated surface workings above and south of Blanchard claims. Legal conflict with the Blanchards developed.
1954—*Portales Mining Company* mill in San Antonio burned down.
Nov. 1958—*Sunshine Mining Company* began exploratory drilling, drifting, crosscutting, and raising in the vicinity of Hansonburg lead mine.
July 1959—*Atomic Mineral Corporation* purchased the Mex–Tex property (Galber, Inc. of Carlsbad, operated). Company produced 812 tons of barite in 1959 and 1960.
June 1960—*Sunshine Mining Company* completed operations (six adits containing cross drifts, raises, and winzes). Linear footage excavated totaled approximately 2,300 ft. No ore marketed.
Early 1960's—*Galber, Inc.* mined and explored the Mex–Tex, Royal Flush, Mountain Canyon, and Malachite mines; several carloads of lead concentrate were shipped by truck and rail to the ASARCO smelter in El Paso.
1960–66—Sporadic mining and exploration continued.
1968—Ora Blanchard passed away.
1972—*Basic Earth Science Systems, Inc.* conducted exploration, including core drilling, for several years.
1977—*Hansonburg Mines, Inc.* began extensive exploration. Ore reserves estimated at one million tons contained an average of 6% galena, 20% barite, and about 10% fluorite.
1979—*Hansonburg Mines, Inc.* constructed mill projected to handle 400 tons/day with recovery of silver, galena, barite, and fluorite.
1980—World-class linarite specimens recovered from Sunshine #1 tunnel of the Blanchard mine.
1983—Wayne Thompson and Delma Perry under contract from *Western General Resources, Inc.* mine Sunshine #1 tunnel for mineral specimens. Operation closed down by OSHA.
1984–85—Exploratory drilling of 1,000-ft holes conducted by *Ozark–Mahoney Mining Co.*
Jan. 1987—Hansonburg district claims were abandoned and reverted to public domain.
April 1987—Blanchard, Mex–Tex, and Royal Flush properties claimed by private individuals interested in the recovery of mineral specimens.

GEOLOGY AND MINERALOGY OF THE SAN PEDRO MINE, SANTA FE COUNTY, NEW MEXICO, by *Robert M. North*, New Mexico Bureau of Mines & Mineral Resources, Socorro, NM 87801 (3)

The San Pedro mine is located approximately 2.1 air miles southeast of the town of Golden, in the western San Pedro Mountains, New Placers mining district, Santa Fe County, New Mexico. The mine was discovered in 1840 and was operated intermittently until 1982. Although total production is unknown, published lode production for the New Placers district from 1904 to 1938 was 203,965 short tons of ore yielding 11,402.57 troy ounces of gold (0.056 oz/ton), 242,791 troy ounces of silver (1.19 oz/ton), and 9,773,773 pounds of copper (2.4%). Most of this production came from the San Pedro mine.

The ores of the San Pedro mine are contact metasomatic (skarn, tactite) deposits in the upper limestone beds of the Pennsylvanian Madera Group. The dip of the Madera beds in the vicinity of the mine is about 15° to the east. The tabular orebodies are localized beneath a rhyolite sill, locally known as the Puzzle sill. Heat and accompanying mineralizing solutions probably emanated as a late stage from the underlying monzonite porphyry laccolith that forms the core of the western part of the San Pedro Mountains.

At least three stages of skarn formation are recognized. First, limestone was metamorphosed to andradite garnet with minor epidote. Reduction in volume during the alteration of limestone to garnet resulted in a vuggy, porous garnet bed. These pores were partially filled by a second mineralizing event consisting of chalcopyrite, bornite, pyrite, pyrrhotite, calcite, specular hematite, quartz, and chlorite. The final mineralizing event filled the larger cavities with calcite, quartz, pyrite, chalcopyrite, scheelite, and adularia. Wire gold was deposited locally along the edges of these large vugs and has been recovered recently as beautifully contrasting specimens of gold in calcite.

Other minerals of interest to collectors include chalcopyrite, Japan-law twin quartz crystals, twinned scalenohedrons of calcite (rarely sixlings), and rarely amethyst, scheelite, native copper with cuprite, and pyrite pseudomorphs after calcite. Large chalcopyrite crystals (up to 3 inches on an edge) were collected for many years from the district. They are commonly coated with a dusting of malachite. Recently, limonite-coated Japan-law twins were collected that exhibit unusual scepter terminations. Gold in calcite and occasionally on garnet and pyrite were collected in 1984 by Wayne Holland of Albuquerque. These specimens came from a restricted zone of abundant calcite (possible an extremely vuggy area) discovered some time earlier by Ira Young.

TELLURIUM MINERALS OF THE ORGAN DISTRICT, DOÑA ANA COUNTY, NEW MEXICO, by, *Virgil W. Lueth, Philip C. Goodell, Ramon Llavona, Heidi Mertig, and William Sharp*, Department of Geological Sciences, University of Texas (El Paso) El Paso, TX 79968 (4)

The Organ district has long been known to contain tellurium mineralization associated with base-metal sulfides. The tellurium minerals, occurring as carbonate replacements in favorable beds, are confined generally to areas in the district where galena is the primary ore mineral. The minerals occur as discrete, macroscopic grains and as inclusions in other sulfide minerals, usually galena or sphalerite. Interestingly, tellurium mineralization appears to be confined to areas above 6,000 ft elevation (except at the Memphis mine where tetradymite is reported in the Roos workings). A short description of the individual minerals and their mode of occurrence in the district follows.

Altaite (PbTe)—a white-gray mineral that usually occurs as cleavage masses associated with black shale contacts and with tremolite where it is paragenetically earlier than the sulfides. Microscopic grains have been observed in galena and sphalerite and associated with pyrite. Common in the Hilltop mine, reportedly with native tellurium.

Rickardite (Cu_3Te_2)—occurs as a purple metallic mineral (similar to tarnished bornite) when observed macroscopically (rare) with pyrite and sphalerite. Reported at Hilltop mine and most common at the eastern-most of the Rickardite claims. Occurs occasionally as microscopic inclusions in sphalerite. It is recognized by its fire-orange reflections with crossed polars under reflected light.

Tetradymite (Bi_2Te_2S)—fairly common with sphalerite and galena at the Memphis mine. Occurs as microscopic inclusions in galena and sphalerite at other deposits where it is galena-white and anisotropic under reflected light. It is the most widely distributed telluride in the district where it also occurs in veins along rhyolite dikes on the west slope of San Agustin Peak. The largest grains of the mineral occur in the Memphis mine as cleavage flakes or radiating masses.

Precious-metal mineralization occurs in the Little Buck workings associated with high-tellurium assays. A quartz-gold orebody is reported in the Hilltop mine. No precious-metal mineral phases have been recognized other than isolated occurrences of free gold. Precious-metal telluride systems are notable for their wide variety of telluride mineralogies. The presence of gold and silver tellurides is suspected, and attempts to document these minerals are underway. Tennantite was observed at the Little Buck (new occurrence for this mine) and is considered a potential precious-metal phase.

Tellurium mineralization is associated most commonly with silicified zones that resemble hot-spring deposits. Preliminary fluid-inclusion homogenization temperatures in this quartz fall between 230 and 240°C. Sulfide zoning appears opposite that suggested by earlier workers in the district. The accepted zoning pattern is concentric (Cu–Zn–Pb) from the Organ batholith. The recent recognition of a porphyry copper deposit north of the town of Organ provides a better "center" or source of the mineralizing fluids and, correspondingly, zoning appears best reconciled in an opposite direction than previously postulated. The distribution of tellurium mineralization can also be used to define distal zoning along with proximal porphyry-skarn zoning. The origin of the tellurium and precious-metal hot-spring system may be: 1) part of the porphyry copper-skarn system, 2) superimposed on the porphyry-skarn system as a retrograde phase of that mineralization, or 3) a completely different mineralizing event.

MINERALOGY OF THE LEMITAR CARBONATITES, SOCORRO, COUNTY, NEW MEXICO—A PETROGRAPHIC, CA-

THODOLUMINESCENCE, AND ELECTRON MICROPROBE STUDY, by *Virginia T. McLemore*, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801, and *Peter J. Modreski*, U.S. Geological Survey, Box 25046, MS–922, Denver Federal Center, Denver, CO 80225 (5)

Carbonatites are unique carbonate-rich rocks of apparent magmatic origin that are characterized by a distinct but variable mineralogy, composition, and associated alteration. In the Lemitar Mountains, central New Mexico, Paleozoic carbonatite dikes (minimum age 449 ± 16 m.y.) intrude Precambrian granites, diorite/gabbro, metamorphic rocks, and amphibolite dikes. They contain greater than 50% carbonate minerals (calcite, dolomite, and ankerite) and varying amounts of apatite, magnetite, biotite, and other accessory minerals.

Cathodoluminescence (CL) is the characteristic visible radiation (color) produced in a mineral subjected to a bombardment of electrons. Many features of a sample observed under CL are not seen using either standard optical petrographic techniques or using an electron microprobe; this is especially true of carbonatites. Luminescence as observed under a CL stage is manifested as different colors and intensities than are seen under the electron microprobe. This is a consequence of the different current densities of the electron bombardment, about 0.1 to 1 A/m^2 for typical CL-stage operation compared to 10^2 A/m^2 (10 μm diameter beam) to 10^4 A/m^2 (1 μm beam) on the microprobe. Thus, quartz, which exhibits no CL, appears orange pink under the microprobe whereas normally red CL calcite appears to show only weak luminescence under the microprobe.

The Lemitar carbonatites exhibit bright-red CL, characteristic of carbonatites elsewhere in the world. The bright-red luminescence is due to compositional variations in fine-grained carbonate minerals. For example, calcites that luminesce red contain variable FeO and 1–2% MnO; nonluminescing dolomites contain variable FeO and 0.03–0.8% MnO. Color zonation in vein calcite under CL is related to variation in MnO from no detectable MnO in lighter orange CL calcite to 0.5% MnO in bright-red CL zones. Apatites luminesce blue to green-gray to gray in carbonatites and are typically zoned whereas apatites in unaltered country rock luminesce yellow. Electron microprobe studies reveal that bright-blue apatites are enriched in SrO (about 1.8% SrO) relative to gray luminescing apatites (about 0.4% SrO) and yellow luminescing apatites (no detectable SrO). Other elements (such as rare-earth elements) in addition to Sr may cause the difference in luminescence color of apatite when exposed to CL.

Cathodoluminescence and electron microprobe studies of opaque grains reveal complex intergrowths of magnetite, ilmenite, rutile, leucoxene, calcite, and quartz; zoning within the magnetite is evidenced by red CL of the inclusions. Additional minerals detected by the electron microprobe include Nb-bearing rutile, Nb-bearing titanite, chalcopyrite, and pyrite or pyrrhotite. Cathodoluminescence reveals zoning of fluorite that is not seen with the normal petrographic microscope.

MINERALS FROM THE SQUAW CREEK TIN MINE, BLACK RANGE TIN DISTRICT, BLACK RANGE, CATRON COUNTY, NEW MEXICO, by *Patrick E. Haynes*, P.O. Box 1531, Cortez, CO 81321 (6)

In September 1984 I was searching the Taylor Creek mining district for tin prospects that might be hosts for the mineral durangite. Access to most of the prospects is via forest roads connected to NM–59, sometimes referred to as the "Beaverhead Highway." I was investigating the Squaw Creek tin mine, located in sec. 34, T9S, R11W, when I saw microscopic red crystals in both outcrop and randomly scattered loose rock near the mine's upper portal. Any assumptions that the material was durangite were subsequently proved incorrect by Paul Hlava's microprobe analyses and Eugene Foord's x-ray diffraction results. Research showed that the red crystals were a new durangite-like arsenate. In the same material was found a new cassiterite-like oxide, recently named squawcreekite, and a new yellow chernovite-like arsenate. Chernovite ($YAsO_4$) was also identified in the groundmass of the rhyolite.

In the weeks following the initial analyses I collected a significant amount of rhyolite that had specimen potential. It was eventually broken up and checked under a microscope. In addition to the three new minerals, the following minerals were observed: cassiterite, hematite, pseudobrookite, quartz, tridymite, mordenite, heulandite, and stellerite.

Field identification of the new minerals is difficult because of their small grain size and color similarity. Generally, the new red arsenate resembles cassiterite in color but has a slight orange tint compared to a dark blood-red, almost purplish tint, for the cassiterite. The crystals can be recognized by their monoclinic morphology. The red arsenate also tends to form euhedral crystals in lithophysae; the cassiterite tends to form aggregates on or near seams. The red arsenate is altered more easily by ground-water activity and sometimes may resemble cassiterite when it is altered. Hematite is present in most of the samples, but when hematite crystals are in contact with cassiterite, the cassiterite tends to smear/spread out over the crystals; the red arsenate does not exhibit this characteristic. It is also common to have squawcreekite crystals growing on tiny hematite crystals. The squawcreekite can have an epitaxial overgrowth of Fe–Sb-rich cassiterite. Apparently, the higher tin content, be it from the amount present in the squawcreekite or from a cassiterite overgrowth, does affect the overall color. A darker color probably indicates a high amount of tin. Squawcreekite is less common than the red arsenate and tends to be amber to root-beer brown in color. Generally, the finer grained the squawcreekite is, the lighter is its color. For example, an aggregate of squawcreekite may be a golden-brown color, but a single tiny crystal sitting adjacent to it may be a light amber color (yellow with brown tints). Tiny, easily recognizable tetragonal crystals, resembling natrolite in form, are quite rare. The new yellow arsenate is apparently similar in color to chernovite, but chernovite is apparently rarer and hence not likely to be seen. The chernovite-like arsenate is strictly lemon yellow in color, very fine grained, and usually found as grains in the groundmass. Generally, if a tiny yellow grain has any hint of a brown tint, then it is likely to be the more prolific squawcreekite and not the new yellow arsenate.

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THREE NEW MINERALS FROM SQUAW CREEK, STOLZITE FROM NUGGET GULCH, AND TILASITE FROM WILLOW SPRINGS DRAW, BLACK RANGE TIN DISTRICT, NEW MEXICO, by *Eugene E. Foord*, U.S. Geological Survey, Box 25046, MS 905, Denver Federal Center, Denver, CO 80225, *Paul F. Hlava*, Sandia National Laboratories, Division 1822, Albuquerque, NM 87185, *Joan J. Fitzpatrick*, U.S. Geological Survey, MS 939, Denver, CO 80225, and *Charles H. Maxwell*, U.S. Geological Survey, MS 905, Denver, CO 80225 (7)

Three new mineral species have been identified at a tin prospect on the north side of Squaw Creek, Catron County, New Mexico. The first is squawcreekite $(Fe,Sb,Sn,Ti)O_2$, the iron- and antimony-dominant member of the rutile group. Cassiterite is also a member of the rutile group. Trivalent iron and pentavalent antimony substitute in equal amounts (atomic) to preserve charge balance. This new mineral is associated with a high-temperature assemblage of quartz, cassiterite, hematite, pseudobrookite, tridymite, chernovite–(Y), the cerium-dominant analogue of chernovite (a new species), and the iron-analogue of durangite, $NaFeAsO_4F$ (a new species). Squawcreekite occurs in very sparse amounts and the maximum crystal size observed is about 50 x 120 x 200 micrometers. The mineral usually occurs mantled by epitaxial overgrowths of Fe- and Sb-bearing cassiterite, adjacent to hematite-cassiterite veins, disseminated within and in small miarolitic cavities in hydrothermally altered rhyolite. The squawcreekite is light to medium yellow brown with a very pale yellow-brown streak. Cell data are: *a* 4.6673(7)A, *c* 3.1006(8)A, V 67.542 (2)A^3, Z = 2; space group $P4_2/mnm$. Relative to pure SnO_2 (cassiterite), there is a reduction in squawcreekite of 1.5% for the *a* parameter, 2.7% for the *c*, and 5.6% for the volume. Crystals have a prismatic habit, and all are euhedral. Forms present include {100}, {110}, {111}, and {101}. Twinning, by rotation about [101], is present in some crystals.

The iron-analogue of durangite has not yet been named but is currently before the IMA (International Mineralogical Association) for voting and approval. It is the most abundant of the three new minerals at Squaw Creek. Crystal size is 0.05 to 1 mm, and aggregates may be as much as 3 mm in maximum dimension. The crystals are euhedral to subhedral. Most crystals show some evidence of solutional etching and are somewhat opaque, but others are clear and lustrous. Crystals are medium to dark red with a medium red-orange streak. The typical crystal habit is unlike that of durangite found at the "clearing" near Boiler Peak. Higher-order crystal forms dominate rather than the simpler forms for durangite. The mineral is strongly compositionally zoned and somewhat color zoned and shows solid solution towards durangite ($NaAlAsO_4F$) and tilasite ($CaMgAsO_4F$). The average analysis is: Na_2O 8.0 wt %, CaO 8.0, Fe_2O_3 14.0, MgO 3.5, Al_2O_3 5.0, TiO_2 5.0, Mn_2O_3 0.5, SnO_2 0.6, ZnO 0.1, As_2O_5 51.0, ZrO_2 0.3, Nb_2O_5 0.2, Li_2O 0.1, F 6.0, total 102.3, O for F 2.5, total 99.8. An empirical formula calculated on the basis of 5 (F,O) atoms is:

$$(Na_{0.59}Ca_{0.33}Li_{0.02})\Sigma_{0.94}$$
$$(Fe^{+3}_{0.40}Al_{0.22}Mg_{0.20}Ti_{0.14}Mn_{0.01}Sn_{0.01}Zr_{0.01})\Sigma_{0.99}$$
$$(As_{1.01}O_4)(F_{0.72}O_{0.28})\ \Sigma_{1.00}.$$

Ion microprobe studies (R. W. Hinton, Univ. of Chicago) yielded results in agreement with the electron microprobe results. Optical properties for the mineral are: biaxial (+), α 1.748, β 1.772, γ 1.798, γ − α = 0.05, $2V_{meas}$ 86°, $2V_{calc}$ 89°. Dispersion r > v, strong. Cell data are: *a* 7.161A, *b* 8.780A, *c* 6.687A, β 114.58°, Z = 4, V 382.4A^3. Space group Aa or A2/a.

The third new mineral appears to be the Ce-group dominant analogue of chernovite–(Y), which is $YAsO_4$. The mineral is bright lemon yellow and occurs in very sparse amounts. It is the rarest of the three new minerals. Maximum grain size is about 75 micrometers in length. Habit is short pris-

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Lower Gila Box Wilderness study area (NM–030–023), Grant and Hidalgo Counties, New Mexico, by H. N. Barton and G. W. Day, 1987, 10 pp. $2.00

***87–334**—Aeromagnetic map of the Sabinoso area, northeastern New Mexico, by U.S. Geological Survey staff, 1 over-sized plate (not reproducible).

***87–335**—Aeromagnetic map of the Big Hatchet Mountains and vicinity, southwestern New Mexico, by U.S. Geological Survey staff, 1987, 1 over-sized plate, scale 1:50,000 (not reproducible).

***87–338**—Aeromagnetic map of the Horse Springs area, western New Mexico, by U.S. Geological Survey staff, 1987, 1 over-sized plate (not reproducible).

***87–369**—Catalog of Arizona and New Mexico cores housed at the U.S. Geological Survey Core Research Center, Denver, Colorado, by T. C. Michalski and D. L. Richards, 1987, 14 pp. $2.80

***87–385**—Hydrologic data for the San Juan and Animas River valleys in the Farmington, Aztec, Bloomfield, and Cedar Hill areas, San Juan County, New Mexico, by D. P. McAda and S. G. Shelton, 1987, 23 pp. $4.60

***87–444**—Preliminary assessment of paleoseismicity at White Sands Missile Range, southern New Mexico—evidence for recency of faulting, fault segmentation, and repeat intervals for major earthquakes in the region, by M. N. Machette, 1987, 49 pp. $9.80

***87–450–A**—Plays for oil and gas in the Raton Basin, south-central Colorado and northeastern New Mexico, by E. A. Merewether, 1987, 25 pp. $5.00

***87–450–B**—Petroleum geology and hydrocarbon plays of the San Juan Basin petroleum province, by A. C. Huffman, Jr., 1987, 71 pp. $14.20

USBM

***MLA–61–87**—Mineral investigation of additional parts of the Big Hatchet Mountains Wilderness study area (NM–030–035), Hidalgo County, New Mexico, by D. C. Scott, 1987, 13 pp. $2.60

Upcoming geologic meetings

Conference title	Dates	Location	Contact for more information
American Association of Petroleum Geologists, Southwest Section	Feb. 21–23	El Paso, TX	Robin Hoffer, (915) 747–5501
Fourth annual V. E. McKelvey Forum on Mineral and Energy Resources	March 1–2	Radisson Hotel Denver, CO 80202	Buhler and Abraham, Inc., 8700 1st Ave., Silver Spring, MD 20910, (301) 588–4177
Annual Rockhound Round-up	March 10–13	Southwest New Mexico Fair Grounds, Deming, NM	Deming Gem & Mineral Society, P.O. Box 1459, Deming, NM 88031
New Mexico Hazardous Waste Management Society, annual conference	March 17–18	Holiday Inn, Albuquerque, NM	Betty Humphrey, (505) 828–5430
Gem and Mineral Show	March 19–20	Old airport bldg., Albuquerque, NM	Albuquerque Gem and Mineral Club, P.O. Box 13718, Albuquerque, NM 87192, (505) 884–9457
American Association of Petroleum Geologists, annual meeting	March 20–23	Houston, TX	Richard Bishop, (713) 966–6122
FOCUS Conference on Southwestern Ground-Water Issues	March 23–25	Clarion Four Seasons, Albuquerque, NM	FOCUS Southwest Conference, National Water Well Assn., 6375 Riverside Dr., Dublin, OH 43017, (614) 761–1711
Symposium on the Anadarko Basin	April 5–6	Oklahoma Center for Continuing Education, Norman, OK	Dr. Kenneth Johnson, Oklahoma Geological Survey, University of Oklahoma, Norman, OK 73019, (405) 325–3031
Symposium on Precious and Rare Metals	April 6–8	Clarion Four Seasons, Albuquerque, NM	Dr. Arpad Torma, c/o Mineral Inst., New Mexico Inst. of Mining & Tech., Socorro, NM 87801, (505) 835–5210
New Mexico Geological Society, spring meeting	April 15	Macey Center, New Mexico Tech, Socorro, NM	Gretchen Roybal, NMBMMR, Socorro, NM 87801, (505) 835–5640
Gem & Mineral Fiesta	May 4–7	Community Center, Foch St., Truth or Consequences, NM	Mike or Diana Owens, P.O. Box 392, T or C, NM 87901, (505) 894–3238
Society of Economic Paleontologists and Mineralogists, Permian Basin section	May 12–14	Midland, TX to Las Cruces, NM	Steve Robichaud, (915) 685–0739 or (915) 683–1573

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matic. Crystals are euhedral to subhedral. The mineral is easily confused with yellow cassiterite.

Stolzite, $PbWO_4$, has been identified from hematite-cassiterite veins at the head of Nugget Gulch. Crystals resemble cassiterite in color, lemon yellow, but are slightly more adamantine. Most crystals are euhedral and have a tapered ditetragonal pyramidal habit, much like that of some wulfenite, $PbMoO_4$. The mineral is very rare, and the maximum grain size observed is about 250 micrometers.

A tin prospect in rhyolite adjacent to NM–59 along Willow Springs Draw contains several interesting minerals in the miarolitic cavities. Fresh rhyolite contains cavities with hematite, pseudobrookite, calcite, clinopyroxene, titanite, sanidine, tridymite, and quartz. Some of the titanite is unusual in composition, containing elevated amounts of REE's, Pb, Nb, Fe, and F. Crystals are all clear, lustrous, and sharp. Color ranges from red-brown to orange-brown, and the crystals may be as much as 1 mm or more in maximum dimension. All crystals are euhedral. The clinopyroxene occurs as orange or yellow-orange, thin, slender, euhedral needles as much as several millimeters long but only 100 micrometers wide. Miarolitic cavities in hydrothermally altered rhyolite contain hematite, quartz, sanidine, tridymite, calcite, pseudobrookite, and minor amounts of tilasite and the Fe-analogue of durangite. Crystals of both minerals are extensively corroded and etched. A solid solution exists between these two minerals. Most of the material found is tilasite, and the maximum grain size is about 1 mm. Color ranges from medium red to pale pink. Only small amounts of the arsenate minerals were found, whereas the titanite and clinopyroxene were fairly abundant.

Note added in proof: Sparse amounts of pale tan to creamy-tan vanadinite were identified in the heavy-mineral fraction of material from the quartz–hematite–cassiterite vein from which the first durangite in the Black Range tin district was identified. The vanadinite occurs as clumps of radiating acicular crystals as much as 0.5 mm long. Identification was based on XRD and EDS analyses. □