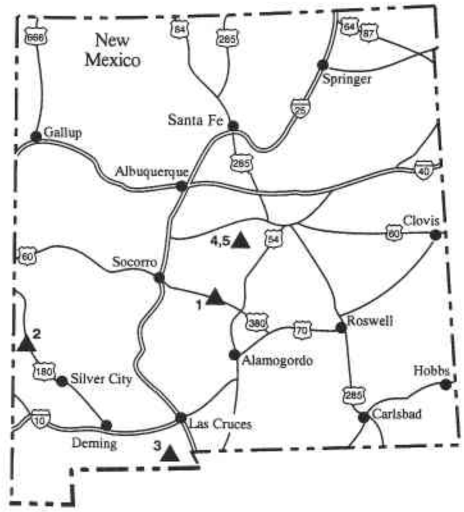
Abstracts

New Mexico Mineral Symposium

The Thirteenth Annual New Mexico Mineral Symposium was held November 14–15, 1992, at New Mexico Institute of Mining and Technology, Socorro. Following are abstracts from talks given at the symposium that concern New Mexico. The numbers in parentheses refer to locations on the map.



NEW MEXICO METEORITES—MINERALOGICAL MESSENGERS FROM THE EARLY SOLAR SYSTEM, by *Adrian J. Brearley*, Institute of Meteoritics, Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM 87131–1126

Meteorites are the oldest known examples of solar system material available for study on Earth, with formation ages of around 4.6 billion years. They represent rocks from a variety of planetary bodies within our solar system including asteroids, comets, the Moon, and Mars. Thus, with the exception of the Moon, they provide us with specimens of bodies that have not been sampled by space missions, manned or robotic. The vast majority of meteorites come from within the asteroid belt, a region of small rocky planetessimals located between the orbits of Mars and Jupiter. Since their formation they have largely escaped the wide-scale geologic processes that have affected Earth, the Moon, and Mars. As such they are extremely important for providing insights into the early geological history of the solar system and subsequent evolution of small planetary bodies. Three broad groups of meteorites can be recognized: stones, characterized by the presence of common terrestrial silicate minerals, such as olivine and pyroxene; stony irons, consisting of a mixture of silicates and iron-nickel metal; and irons, consisting almost entirely of iron-nickel metal. The stones can be further divided into two groups called the chondrites and achondrites. Chondrites are characterized by the presence of abundant, millimeter-sized silicate spherules called chondrules, while the achondrites are igneous rocks with affinities to terrestrial mafic to ultramafic lavas. The mineralogy of these meteorites is of special importance in determining their origins and conditions of formation. The arid climate of New Mexico makes the state particularly suitable for the preservation and recovery of meteorites after they have fallen. Approximately 160 meteorites have been recovered in New Mexico, many from the eastern plains region, particularly in Roosevelt County, in the southeastern part of the state. This area alone has yielded close to 200 meteorite samples corresponding to some 80 separate meteorite falls. Of the meteorites discovered to date in New Mexico, most are stones (~85%), the majority being of a type called the ordinary chondrites, the most common group worldwide. Only one carbonaceous chondrite, similar to the famous Allende meteorite that fell in northern Mexico in 1969, has been recovered in the state. The remainder are irons (~11%) and stony irons (2.5%). Of the stony irons, two pallasitic meteorites, Acomita and Dora, are especially fine examples with centimeter-sized olivine crystals set in an iron-nickel metal matrix. More than 140 minerals occur in meteorites. Many occur on Earth, but a significant number are found uniquely in meteorites. The main constituents of stony meteorites are olivine and pyroxene, but inclusions containing Ca- and Al-bearing minerals such as hibonite, gehlenite, corundum, spinel, fassaite, mellite, and perovskite also occur, especially in the carbonaceous chondrites. Iron-nickel metal is also present attesting to the reducing conditions under which these meteorites formed. Iron meteorites and pallasites contain a number of unusual carbides, phosphates, phosphides, and sulfides, such as cohenite ($(Fe,Ni)_3C$), haxonite ($Fe_{23}C_6$), and schreibersite ($(Fe,Ni)_3P$). The most unusual meteoritic minerals occur in a group of chondrites and achondrites called the enstatite meteorites, which are not represented among New Mexico meteorites. These meteorites are dominated by the pyroxene, enstatite ($MgSiO_3$), but contain numerous exotic sulfides, nitrides, chlorides, silicides, and phosphides. These include oldhamite (CaS), caswellsilverite ($NaCrS_2$), heideite ($(Fe,Cr)_{1+x}(Ti,Fe)_2S_4$), djerfisherite ($K_3CuFe_{12}S_{14}$), osbornite ($TiN$), lawrencite ($(Fe,Ni)Cl_2$), sinoite ($Si_2N_2O$), and perryite ($(Ni,Fe)_5(Si,P)_2$). The minerals and mineral assemblages found in meteorites attest to the wide range of physical conditions (gas pressure, temperature, etc.) that were present during the early stages of the formation of our solar system.

MINERAL SUITE FROM THE SNAKE PIT MINE, MEX–TEX CLAIMS, HANSONBURG DISTRICT, SOCORRO COUNTY, NEW MEXICO, by *Steve K. Bringe*, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801; *Tom Massis*, 9313 Lagrima de Oro, Albuquerque, NM 87111; *Marc L. Wilson*, The Carnegie Museum of Natural History, Pittsburgh, PA 15213; *Mike Spilde*, Institute of Meteoritics, University of New Mexico, Albuquerque, NM 87131; and *Chris McKee*, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801 (1)

In September 1991, during a field reconnaissance of the Hansonburg district in connection with a NMBMMR project, a small tunnel was located on the Mex–Tex claims by two of the authors (SKB and MLW). Referred to as the Snake Pit mine, this tunnel is located 0.25 mi to the northwest and approximately 150 ft lower in elevation than the now-collapsed upper Mex–Tex. A truly interesting mineral suite was observed at this locality. Along with superb specimens of fluorite and galena reminiscent of upper Mex–Tex material, the mineralized zone exposed by a recent collapse revealed a suite of well-crystallized microminerals, including plattnerite, murdochite, rosasite, aurichalcite, calcite, linarite, cerussite, brochantite, hemimorphite, wulfenite, caledonite, and other minerals typical of the district. Perhaps of most significance was the discovery of a mineral that closely resembles scrutinyite. Only a limited amount of this unknown material was recovered, and on a second trip additional specimens were collected for analysis.

MICROMINERALS FROM THE BIG LUE MOUNTAINS, GREENLEE COUNTY, ARIZONA, AND GRANT COUNTY, NEW MEXICO, by *Ron Gibbs*, P.O. Box 448, Tyrone, NM 88065 (2)

The Big Lue Mountains of eastern Arizona and western New Mexico offer several good collecting opportunities for the micromounter. Good micromount specimens have been found in several localities near the state line along NM–AZ–78 west of Mule Creek, New Mexico. The Big Lue Mountains are composed of Tertiary rhyolitic volcanics and younger Tertiary basaltic volcanics as flows and tuffs. The volcanics are often vesicular and host two distinct suites of minerals of interest to collectors. Minerals found in the older volcanics are similar to the Black Range topaz-bearing rhyolites and include: pseudobrookite, titanite, hematite, tridymite, phlogopite, and hollandite. Several unidentified minerals are present but they appear to be pseudomorphs after an undetermined mineral. Pseudobrookite is fairly common, occurring as slender elongated euhedral blades that are rarely over 2 mm long. Titanite is also common, occurring as very small, equant, transparent, reddish-orange crystals. Hematite is common as small blocky to thin lustrous black crystals rarely over 2 mm in size. Tridymite is found in nearly every vesicle in some places and occurs as multiply twinned crystals up to one cm across. Phlogopite occurs as thin, transparent, light-brown crystals up to 4 mm across. Hollandite is locally abundant as black dendritic growths and coatings in vesicles and overgrowths on some of the other minerals. The younger volcanics host a suite of zeolites and associated minerals that include: erionite–offretite, heulandite, mesolite(?), quartz, and calcite. These minerals are more sparsely distributed but locally abundant. Heulandite and erionite– offretite occur as small euhedral crystals in vesicles. A mineral that resembles mesolite is sometimes found with calcite and quartz. The localities examined so far have been in roadcuts or along stream banks. There are many unexplored hills, cliffs, and streams that may yield additional species.

GEOLOGY OF MANTLE XENOLITHS AND MAARS OF DOÑA ANA COUNTY, SOUTH-CENTRAL NEW MEXICO, by *Mark A. Ouimette* and *Andrea Reade*, Department of Geological Sciences, University of Texas at El Paso, El Paso, TX 79968 (3)

A variety of mantle and crustal xenoliths are found in the base-surge and air-fall deposits of the five Pleistocene maars of Doña Ana County, south-central New Mexico. The mantle xenoliths are ultramafic in composition and include lherzolite, spinel peridotite, dunite, and pyroxenite. These xenoliths represent a portion of the spinel peridotite mantle found beneath the southern Rio Grande rift and record chemistry and petrology of the mantle at 27 to 65 km depth. The maars are located in the Potrillo volcanic field and are typical of other maars located in the southwestern United States. These maars appear to be confined to mafic alkaline volcanic fields rather than to tholeiitic volcanic fields. A maar is a large volcanic crater that is cut into the country rock and possesses a low rim composed of pyroclastic debris. The pyroclastic material is ejected into the air and forms base-surge and air-fall deposits near the vent. Three types of maar are recognized based on changes in the geometry and amount of pyroclastic material. An explosion crater is formed and the conduit is partially filled in with pyroclastic material and later by slump and often lacustrine material. Tuff-ring maars form with a basal breccia composed of the mobilized surface material and a base-surge deposit. The depression forms within the tuff ring and is usually above the level of the surrounding countryside. Tuff-cone maars form with a basal breccia composed of the mobilized surface material, a base-surge deposit, and a thick air-fall tuff. Kilbourne Hole is the largest and most popular maar in the group. It is approximately 1,600 m long by 2,000 m wide and has the largest array of mantle and crustal xenoliths exposed. Hunt's Hole is smaller, approximately 1,500 m wide, and is 17,000 years old (W. Williams, J. Poths, and E. Anthony, pers. comm. 1992). It is 3 km south of Kilbourne Hole. Hunt's Hole may be synchronous with Kilbourne Hole. Both mantle and crustal varieties of xenoliths have been reported to occur at Hunt's Hole. Potrillo maar is located 17 km to the south and straddles the international border. It is 4,000 m north-south, and 3,000 m east-west, and is 55,000 years old. A vast array of mantle and large crustal xenoliths are present at this maar. All three maars are explosion craters. Malpais maar is a tuff-ring or tuff-cone maar and is 20 km west of Potrillo maar in the southern part of the West Potrillo volcanic field. It is 1,400 m in diameter and stands about 400 m above the surrounding area. It is one of the oldest maars in the area, about 232,000 years old. Anorthoclase megacrysts and olivine xenocrysts have been reported in the pyroclastic deposits. Riley maar is a less-known tuff-cone or tuff-ring maar and is approximately 14 km north of Malpais maar. It measures approximately 1,000 m in diameter. Mantle xenoliths of spinel peridotite have been reported from this locality, as well as pyroxene and anorthoclase megacryst.

METAMUNIRITE, HAYNESITE, AND OTHER MICROMINERALS FROM THE FOUR-CORNERS STATES, by *Patrick E. Haynes*, P.O. Box 1531, Cortez, CO 81321

Metamunirite, $NaVO_3 \cdot H_2O$, is a new mineral from two locations in San Miguel County, Colorado. The type location is the Burro mine at Slick Rock. Only a few square inches of microscopic acicular crystals of metamunirite were found there as efflorescent crusts on the dumps. Some metamunirite was also found in the Deremo–Snyder mine as white acicular crystals to 1 mm. In both cases the metamunirite is associated with rossite, metarossite, and pascoite on vanadium-rich ore. Only about 35 samples have been found so far. Also found at the Deremo–Snyder mine was the world's fourth(?) locality for chalconatronite. It was associated with andersonite. Pascoite was locally common. Mr. Phillip Allen located a potentially new uranium carbonate mineral. At the Long Park #15 mine in Montrose County, Colorado, white efflorescent crusts of a microscopic acicular mineral that resembled metamunirite were collected. It turned out later to be hexahydrite. The Big Indian mine, south of La Sal, San Juan County, Utah, has been producing some interesting secondary copper minerals. Clinoclase, tyrolite, chrysocolla, aurichalcite, olivenite (var:leucochalcite), azurite, malachite, barite, and psilomelane have been found. Haynesite, $(UO_2)_3(OH)_2(SeO_3)_2 \cdot 5H_2O$, was found at the Repete mine in San Juan County, Utah. It occurs as microscopic yellow acicular crystals associated with boltwoodite, andersonite, and ferroselite. Arnold Hampson showed me some interesting things at the Monument #2 mine in Apache County, Arizona. Research and identification is continuing but the species verified so far include tyuyamunite, metatyuyamunite, rauvite, bokite, variscite, metahewettite, fervanite, and a lone sample of schubnelite. Mr. Hampson and I also collected clinoptilolite, mordenite(?), and erionite at a roadcut 3.5 mi west of the New Mexico border in Greenlee County, Arizona on Hwy 78. Marc Wilson and I found some interesting species on Socorro Peak, Socorro County, New Mexico. These included linarite, caledonite, fornacite, rosasite, and anglesite as microspecimens. ACKNOWLEDGMENTS—I wish to thank the following: Marc Wilson for the use of the NMBMMR's microphotography equipment; Debra Wilson for macrophotography; researchers Paul Hlava, Peter Modreski, Howard Evans, Jr., Marc Wilson, Michel Deliens, and Paul Piret; Phillip Allen and the staff at the Deremo–Snyder mine; Marcelino, Marc, and the late Felix Mendisco; and Ron Gibbs and Will Moats for locality information.

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SPANGOLITE AND OTHER SECONDARY MINERALS FROM THE BUCKHORN MINE, LINCOLN COUNTY, NEW MEXICO,* by *Ramon S. DeMark*, 6509 Dodd Place NE, Albuquerque, NM 87110; and *Paul F. Hlava*, 4000 Smith Ave. SE, Albuquerque, NM 87108 (4)

Spangolite, the rare copper sulfate $(Cu_6Al(SO_4)(OH)_{12}Cl \cdot 3H_2O)$, was recently found to occur at the Buckhorn mine in the Red Cloud district of the Gallinas Mountains. Previously known New Mexico localities for this species are restricted to the Hansonburg mining district and a single occurrence at the Kelly mine in Socorro County. The Buckhorn mine lies in the northern portion of the Gallinas Mountains about eight mi southwest of Corona in Lincoln County, New Mexico. Perhac (1970) reported several supergene copper and lead minerals from this mine including pyromorphite, anglesite, chrysocolla, malachite, and azurite. Recent investigations of supergene minerals from the Buckhorn mine have established 12, possibly 13, additional species. These include the sulfates brochantite, cyanotrichite, celestite, linarite, and spangolite. Although arsenates and vanadates have not previously been reported from this mine, duftite, mimetite, olivenite, mottramite, and vanadinite were found to occur. Arsentsumebite has been tentatively identified (by microprobe/SEM) but additional analyses (x-ray diffraction) are required for confirmation. The lead molybdate, wulfenite, was also found in very small amounts. Previous reports of pyromorphite could not be substantiated. Spangolite cyrstals are found in association with free-standing, bright-green sprays of brochantite and mostly flat-lying sprays of light-blue cyanotrichite. Spangolite crystals are generally a lustrous blue green and are transparent to translucent. Although spangolite is hemihedral, being in the ditrigonal pyramidal (also known as the 3m, ditrigonal hemihedral, or tourmaline) crystal class, it usually assumes a morphology that looks holohedral, consisting of striated, equally developed, first- and second-order trigonal prisms terminated by (again) striated, equally developed, first- and second-order, upper and lower trigonal pyramids. A few crystals exhibit small pedial terminations whereas others have large pedial faces, which give them a blocky appearance similar to spangolites from the Hansonburg district. Occasionally a specimen will exhibit the true symmetry of the mineral by having blocky crystals with quite unevenly developed forms. Buckhorn spangolites range in size from 0.5 to 3.0 mm. Extensively fault-brecciated Permian Yeso sandstone/arkose forms the host rock for these minerals (Perhac, 1970). Tertiary intrusives are responsible for the mostly fissure-filling, mineralizing solutions that deposited the primary or hypogene ore minerals of fluorite, galena, and bornite. Bastnaesite, for which the Red Cloud district is famous, was not noted at the Buckhorn mine either by Perhac or by the authors.

Reference

Perhac, R. M., 1970, Geology and mineral deposits of the Gallinas Mountains, Lincoln and Torrance Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 95, 51 pp.

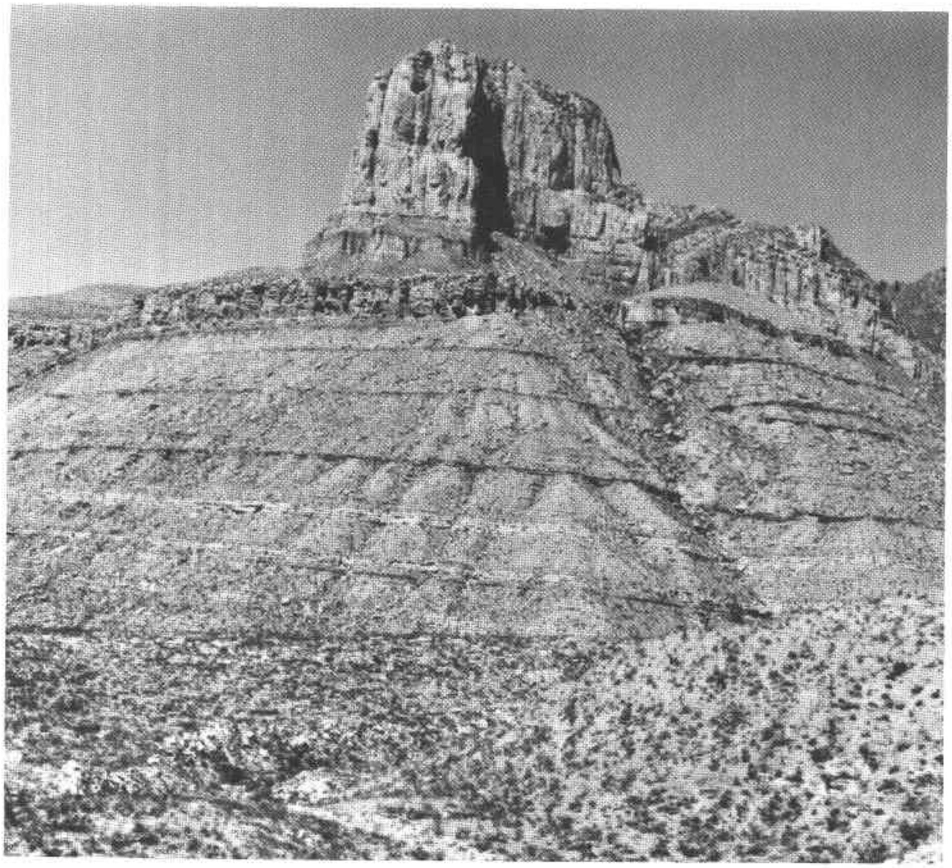
*Part of this work performed at Sandia National Laboratories supported by U.S. Dept. of Energy under Contract #DE-AC04–76DP00789.

Silver and copper mineralization at the Buckhorn mine, Gallinas Mountains, New Mexico, by *Peter J. Modreski*, U.S. Geological Survey, Box 25046, DFC, MS 905, Denver, CO 80225; and *Russell A. Schreiner*, U.S. Bureau of Mines, Box 25086, IFOC-MS 5220, DFC, Denver, CO, 80225 (5)

The Buckhorn mine is in the Red Cloud mining district, Gallinas Mountains, Lincoln County, New Mexico. The district contains alkaline igneous rocks with associated base-metal and rare-earth mineralization. The Gallinas Mountains are one of a series of alkalic igneous intrusive centers that form stocks, laccoliths, dikes, and sills of middle to late Tertiary age along and near the margin between the Great Plains and the Rocky Mountains or Basin and Range physiographic provinces in New Mexico. Intrusive igneous rocks of Oligocene age in the Gallinas Mountains include rhyolite, trachyte, latite, intrusive breccia pipes, and a few dikes of andesite and basalt. Host rocks include Precambrian granite and gneiss and the sedimentary Abo, Yeso, and Glorieta Formations of Permian age. Mineral deposits in the Gallinas Mountains include limestone-replacement iron deposits, intrusive breccia deposits, and fault breccia deposits that contain concentrations of copper, lead, fluorine, barium, and rare-earth elements, with some anomalous amounts of gold and silver. The intrusive breccias and adjacent country rocks in the district show evidence for several types of alteration, primarily fenitization (introduction of K- and Na-feldspar, sodic pyroxenes, and sodic amphiboles) and carbonatization (replacement by calcite). Apatite, zircon, pyrochlore, monazite, thorite, pyrite, and rutile occur in the fenite veinlets (Schreiner, 1993). The Buckhorn mine, about 2,000 ft east of Rough Mountain in the southeastern Gallinas Mountains, consists of one adit, three shafts, and several prospect pits along a northwest-trending fault breccia zone. Primary ore minerals include cavity-filling galena, tennantite, argentian tennantite/freibergite, and proustite, plus K-feldspar, xenotime, zircon, fluorite, barite, quartz, calcite, and pyrite. Secondary alteration of the tennantite and sulfide minerals has produced other sulfides (covellite, digenite); silicates (chrysocolla, shattuckite); carbonates (malachite, azurite, cerussite); sulfates (brochantite, cyanotrichite); a sulfate-halide (spangolite); arsenates (adamite, cuprian austinite, cornubite, duftite, arsentsumebite); a chloroarsenate (mimetite); and a late-stage copper-bearing clay mineral. An unusual feature is the presence of secondary silver halide minerals including iodargyrite (AgI) and a silver-mercury-sulfide-iodide mineral, possibly related to perroudite, $Hg_{5-x}Ag_{4+x}S_{5-x}(Cl,I,Br)_{4+x}$, or capgaronnite, $HgAgS(Cl,Br,I)$. The iodargyrite occurs as thin prismatic crystals (<30 microns long) within rims of shattuckite and chrysocolla that surround proustite. The Ag-Hg-S-I phase occurs as <5-micron crystals around altered tennantite.

Reference

Schreiner, R. A., 1993, Mineral investigation of the rare-earth-element-bearing deposits, Red Cloud mining district, Gallinas Mountains, Lincoln County, New Mexico: U.S. Bureau of Mines, Open-file report, in press.



Carlsbad region, Permian Basin, New Mexico and west Texas

New Mexico Geological Society
West Texas Geological Society
1993 Fall Field Conference

The New Mexico Geological Society will hold its Annual Fall Field Conference in the Carlsbad region on October 6 to 9, 1993. The conference, jointly sponsored by the West Texas Geological Society, will focus on the geologic evolution of the Pecos Valley–Guadalupe Mountains–Salt Basin area of southeastern New Mexico and western Texas. Tour arrangements are being made in cooperation with the Carlsbad Chamber of Commerce, and the new Carlsbad Area Convention Center (near the airport) has already been reserved for the field conference. Park Inn International on the National Parks Highway (US 62–180) near the Convention Center will be the conference headquarters.

The first day's field trip (Oct. 7) will be in the Delaware Basin, with major emphasis on the area's economic and environmental geology. The tour through the Pecos Valley lowlands between the Guadalupe Mountains and the Southern High Plains will include stops at outcrops of the Castile–Salado–Rustler–Dewey Lake sequence, examination of overlying Mesozoic and Cenozoic continental deposits, and discussion of associated evaporite-karst features. Stops are also planned at sulfur and potash production facilities, and for an overview of the Waste Isolation Pilot Project area.

The following days' tours of the Guadalupe Mountains–Northwestern shelf area will emphasize the classic Permian geologic framework of the region, including advances in sequence stratigraphy. The second day will cover the basin side of the Guadalupe Mountains, northern Salt Basin, and parts of Carlsbad Caverns and Guadalupe Mountains National Parks. The Northwestern shelf area between Carlsbad and Queen will be visited on the final day of the conference, including Dark and Last Chance Canyons, Sitting Bull Falls, and the Seven Rivers Hills. Supplemental road logs will expand these tours into the Algerita Escarpment–Cornudas Mountain area west of the Guadalupe Mountains. Optional, limited, pre- and post-conference tours (October 6 and 10) include visits to potash mines, WIPP site, and Carlsbad Caverns National Park.

The field conference guidebook will be published by the New Mexico Geological Society with Barry Kues as Managing Editor. Technical editors include Jim W. Adams (general geology, oil and gas resources), George Austin and Jim Barker (industrial minerals), and John Hawley and Dave Love (environmental geology).