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Front Matter

(Usually includes Dedication, President's Message, & Conference Organizer's Message.)

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Annual NMGS Fall Field Conference Guidebooks

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual Fall Field Conference that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

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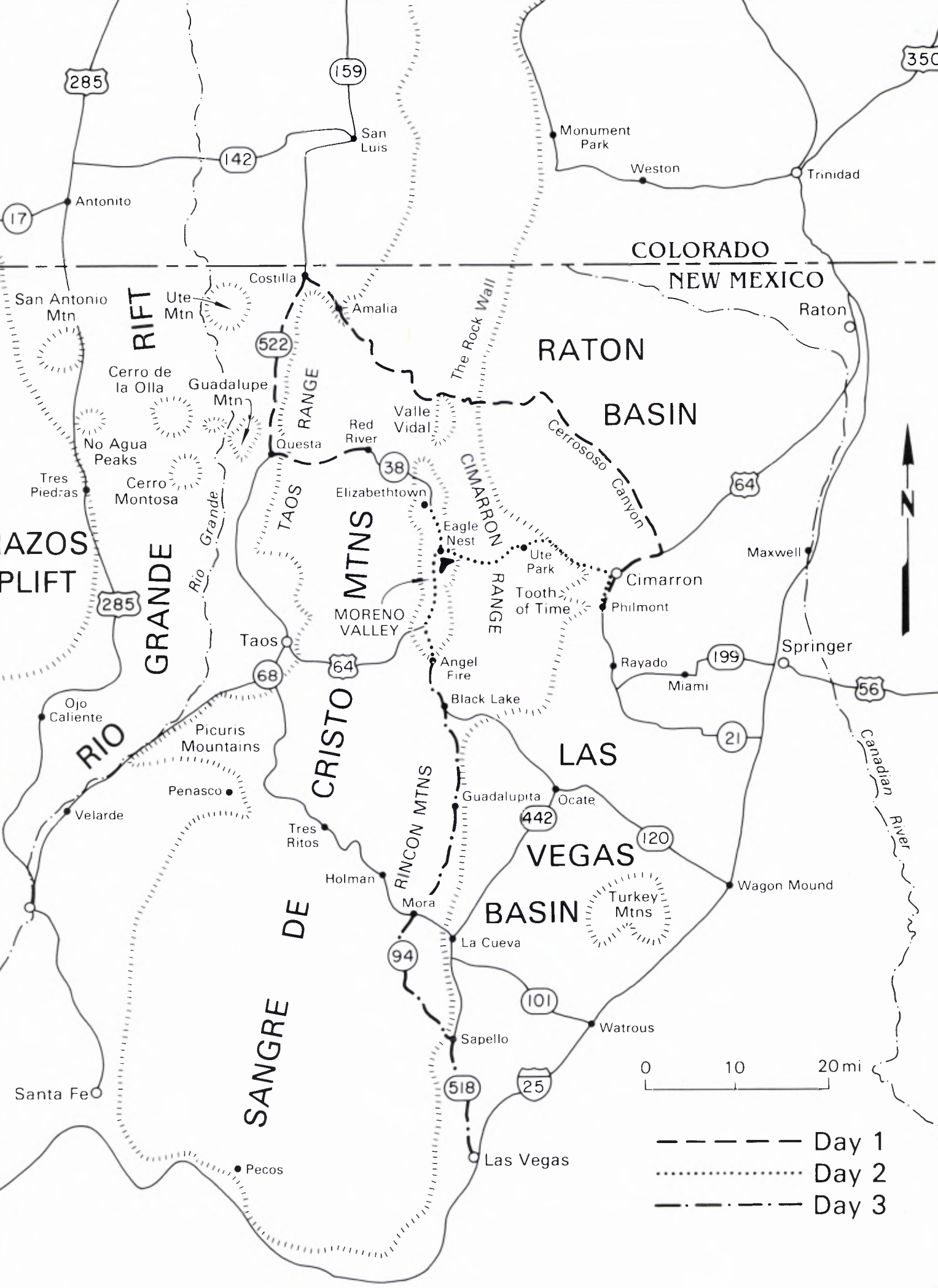
NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our operating budget. Therefore, only *research papers* are available for download. *Road logs*, *mini-papers*, and other selected content are available only in print for recent guidebooks.

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Tectonic Development of the Southern Sangre de Cristo Mountains, New Mexico

Editors

PAUL W. BAUER

SPENCER G. LUCAS

CHRISTOPHER K. MAWER

WILLIAM C. McINTOSH



New Mexico Geological Society Forty-first Annual Field Conference, September 12-15, 1990

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Advertising



Elmer H. Baltz, Jr.

DEDICATION

It is highly appropriate that the New Mexico Geological Society should take this occasion to honor Elmer H. Baltz, Jr. for his geological studies in the southern part of the Sangre de Cristo Mountains, the focus of the 41st Field Conference. I am honored to have been asked to prepare these brief summary remarks regarding Elmer's career. We were closely associated for ten years through our employment with the old Fuels Branch of the U.S. Geological Survey. Though our professional paths have diverged during the past 32 years, our friendship has continued, and my respect for Elmer's abilities and accomplishments has been enhanced.

Son of a civil engineer for the railroad, Elmer lived in several communities along the Santa Fe route, but the major part of his formative years were spent in Las Vegas. He left there to attend the University of New Mexico where he received his B.S. in 1950. While attending UNM, he began his career with the U.S. Geological Survey in 1945 as a part-time student employee. Joining the Survey full-time in 1951, Elmer earned a M.S. in geology in 1953, and after several more years was the first to enroll in the newly inaugurated Ph.D. program in geology at UNM. Working full-time, raising a family (eventually five children), and as the prototype doctoral candidate, being subject to intense faculty scrutiny, this was indeed a strenuous period for Elmer, as some of us well remember. Fortunately, Elmer was blessed with a strong, capable wife, the late Diana Hinman Baltz, who was a draftsman and geologist with the Survey. It was Diana, in collaboration with another Survey draftsman, Marian Jo Cowan, who designed the NMGS logo which remains nearly unchanged since the first guidebook.

Elmer received his Ph.D. in 1962; his dissertation was concerned with the latest Cretaceous and Tertiary rocks in the east-central part of the San Juan Basin. His life-long consuming interest in the southern Sangre de Cristos and adjacent areas began when he was assigned in 1955 to the Fuels Branch's Sangre de Cristo project under the direction of the late Charles B. Read.

Elmer's employment with the Survey, and in particular, his working for Charlie Read, led quite naturally into extensive early involvement with the Third Field Conference in 1952, culminating with his serving as Co-Editor of the 1959 Field Conference. It should be noted that Elmer was rather heavily involved with the Society's first Sangre de Cristo field trip in 1956. He served as a member of the road-log committee, the principal trip leader and co-author of the lead paper in the Guidebook, "Notes on the geology of the southeastern Sangre de Cristo Mountains, New Mexico." Elmer was extensively involved with the 12th Field Conference and to a lesser extent with the 13th Field Conference prior to his leaving Albuquerque in 1962. Elmer is now retired from the Survey and resides in Lakewood, Colorado.

Although Elmer's career has taken him geographically and scientifically far from the mountains of northern New Mexico, he took advantage of every opportunity, no matter how brief, to return to the Sangre de Cristos where he experienced the true delight of being a geologist. His publications, involving many aspects of the detailed and regional stratigraphy and structure of the area, number more than twenty and span a period of 32 years. The intricate detail of his geological maps of the Gallinas Creek, the Mora River and the Sapello River areas are witness to his perseverance and diligence in the field. Much of this work is brought together in a U.S. Geological Survey Professional Paper, presently in editorial review.

It is not surprising that along with Elmer's technical involvement with the NMGS he also became administratively involved. He served as Secretary in 1960, Vice President in 1961 and as President of the Society in 1962. He was recognized for his many contributions to the Society by election to Honorary Membership in 1986.

At present, many of our earth scientists seem hesitant to identify with hands-on geology, and are prone to treat field work as a phase of investigation best left to the semi-professional. In these times, it is refreshing to know that among us is one who believes that what is there is far more significant than what one thinks should be there.

Edward C. Beaumont

PRESIDENT'S MESSAGE

Bienvenidos. Welcome to the forty-first annual Fall Field Conference of the New Mexico Geological Society. This year's trip is especially significant as it marks four decades of continuous field trips and accompanying guidebooks and sets the course we will take into the 1990's. Quality and dedication are only two of many vital attributes which have contributed to this remarkable achievement. Other accomplishments of importance, which are built upon 40 years of the dedication of many executive committees and "unsung" members, are the many special publications, financial support for students, publication inventory of over $750,000 and a permanent scholarship fund which will soon be self-sustaining as well as financial support for professional meetings.

Providence and counsel received from board members and past board members has been most enlightening and deserving of personal thanks. Participation from these members and the general membership has been exceptional, and I add my admiration for your professional commitment to the Society.

This year we have approved $25,000 for the reprint of the Society's State Highway Geologic Map. We have awarded over $3500 in grants-in-aid to students, $1000 for the Kottlowski Fellowship and $4000 for the Wellnitz Scholarship. Special awards were also granted to undergraduate geology students through generous contributions given by Lucille Pipkin. This year we also provided $175 to regional winners and two finalists in the Science Fair Program.

The Society is indebted to and wishes to acknowledge Spencer Lucas, who is resigning as Guidebook Managing Editor. During the past four years he has left his mark of excellence on each of the guidebooks he has edited. We also extend our "thanks" to Paul Bauer and Chris Mawer for serving as Co-chairmen for our Fall Field Conference and for the exceptional preparation, organization and coordination on this year's trip. In addition, they have spent countless hours of hard work preparing this year's guidebook. We realize it is a difficult task to road log, solicit papers, and write and edit papers for the guidebook, and we greatly appreciate your efforts. We also thank other members of the road-log committee for their assistance in road logging segments of this trip. Again, our appreciation to Spencer Lucas for serving as this year's Managing Editor. The travel logistics handled by Russ Jentgen, Jim Olsen, Ed Heffern and student workers deserve our thanks. We also thank George Austin for serving as Registration Chairman and Maureen Wilks for serving as Advertising Chairman. We greatly appreciate the continued support for student scholarships from the Los Alamos Geological Society and university geoscience departments which allow students to attend the field conference. We are thankful to all authors who contributed papers to this year's guidebook.

This year's annual Spring Meeting held in Socorro was a great success, and we thank Co-chairmen Jim Barker and Bill Chavez for their work, Neil Whitehead for serving as Registration Chairman and the volunteers who provided secretarial support. We also thank the special support received from Orin Anderson and Norma Meeks for organizing the publication-sales booth. We thank the presenters and authors who contributed papers to this year's technical session. The technical session recorded 37 papers, and judges selected one "best student paper." We are thankful for the many standing committee chairmen and volunteers for their outstanding service. Orin Anderson has returned to carry on as Publication Chairman (in the temporary absence of Richard Chamberlain) and is offering innovative marketing systems to increase sales which directly support the Society. We thank Orin Anderson for his successful marketing of our publications at several professional meetings. Jamie Robertson and Jerry Mueller deserve thanks for their advice on investment of our scholarship funds, as well as individuals that have faithfully served on the scholarship, nominating and field trip committees.

This is an organization that is energized by volunteers; please get involved and be a part of a dynamic professional society. I hope you enjoy this year's conference and hope to see you again next year!

Louis Martinez, President

EDITORS' MESSAGE

The 1990 New Mexico Geological Society Fall Field Conference tours the Moreno Valley area of the southern Sangre de Cristo Mountains after a hiatus of 34 years. Remarkably, Elmer Baltz, who wrote much of the road log for the 1956 trip (when this year's editors ranged from –2 to +3 years old) has written a log for this year's guidebook. In 1956, Clay T. Smith was President of the NMGS. This year, Clay has co-authored a paper on the Moreno Valley. Other 1956 NMGS members who have contributed to the 1990 guidebook include Jim Adams, Ed Beaumont, Frank Kottlowski and Sam Thompson III. Furthermore, we predict that a number of other 1956 members will join us on this year's field conference. It is because of this type of long-lived support (and long-lived members!) that the Society can successfully sponsor trips and publish fine guidebooks year after year.

Our knowledge of this geologically complex and diverse region has greatly expanded over the past 34 years, and this is reflected in the quantity and quality of contributions in this book. Many of the 42 papers and 25 minipapers pertain directly to the theme of this year's trip, "Geologic Development of the Southern Sangre de Cristo Mountains." Judging from the number of these studies that are ongoing, we anticipate a wealth of discoveries in the near future.

This year we visit three major physiographic provinces: the Sangre de Cristo Mountains of the Rocky Mountains, the Rio Grande rift and the Raton Basin of the Great Plains. This diversity is well-represented in the broad spectrum of guidebook papers. The Sangre de Cristo Mountains are the most prominent topographic feature in the state, containing the highest point in New Mexico (Wheeler Peak) and several of the next-highest peaks. The Proterozoic rocks of the Sangres are presently the focus of intense study and debate concerning the nature and timing of large-scale Proterozoic tectonic/metamorphic events. The mountains are also rich in metallic mineral deposits, and the responsible extraction of these resources is currently an important and provocative environmental issue. Investigations into the Cenozoic history of the Sangre de Cristo Mountains include such exciting topics as the cooling (uplift) history of the range, the very complex Tertiary volcanic/plutonic geology and the nature of enigmatic intramontane basins such as the Valle Vidal, Moreno Valley, Mora Valley and Rociada Valley.

The basins adjacent to the mountain range are the focus of numerous research projects. Studies along the eastern flank of the Rio Grande rift have revealed detailed information on the neotectonics and seismicity of the range-front faults. The Raton basin, with its well-exposed Mesozoic-Cenozoic stratigraphic section, is the subject of several papers dealing with coal resources, mine reclamation, coal-bed methane resources, basin analysis and the K-T boundary.

Large-scale extensional tectonism is proving to be a fundamental aspect of the geologic history of many regions worldwide. Even in such classical intraplate settings of crustal shortening as the Rocky Mountains, extensional structures are an important part of the tectonic evolution through time. Newly discovered Proterozoic extensional shear zones in north-central New Mexico have apparently had a major effect on the distribution of lithologically distinct, areally extensive rock packages and the metamorphism and plutonism that accompanied their deformation. Low-angle extensional structures have been shown to control Tertiary mineralization (and perhaps volcanism?) in the Questa area. Basin and Range tectonism in the Rio Grande rift is obviously due to lithospheric extension, as is the formation of the various intramontane grabens of the Sangre de Cristo Mountains such as the Valle Vidal and Moreno Valleys. Perhaps even more exciting are the speculations that development of the present-day Rocky Mountains may be due in large part to Basin and Range extension, rather than Laramide compression! We are fortunate to have Brian Wernicke of Harvard University as our keynote speaker this year, as Brian is a pioneer in the development of concepts of extensional tectonism. Discussions about the various extensional tectonic effects seen during the field conference promise to be lively.

In addition to the many people listed in the credits, we wish to express our appreciation to all of those who contributed to the guidebook and field trip. Firstly, special thanks to Frank Kottlowski, State Geologist and Director of the New Mexico Bureau of Mines and Mineral Resources, who generously provided personnel, vehicles, drafting, photographic work, secretarial help and encouragement. This book could not have been published without his blessings. Many of the fine illustrations were carefully drafted by Rebecca Titus and cartography staff at the New Mexico Bureau of Mines and Mineral Resources; and the marvelous turn-of-the-century artist's conception of E'town, reproduced on the cover, was drawn by Mickey Wooldridge of the Bureau. We also thank Robert Young, Bob Leonardson and Leroy Apodaca of Molycorp; Forrest McVicar of Philmont Scout Ranch; Les Davis and family of the CS Cattle Company; Jon Nathan Young of the U.S. Forest Service; Robert Mutz of Elizabethtown; George Lebus of Angel Fire; and Deborah Rhue of the UNM Geology Department. Lynne McNeil of the NM Bureau of Mines cheerfully typed much of the guidebook and Norma Meeks orchestrated each of the mailouts. Dave Speer and crew at the UNM Printing Plant achieved their usual degree of high-quality, efficient work in printing this guidebook. Finally, we thank the authors of manuscripts, minipapers and the many contributors to the road logs for adding to an excellent, informative volume.

Paul W. Bauer
Christopher K. Mower
Spencer G. Lucas
William C. McIntosh

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FIELD CONFERENCE SCHEDULE

Wednesday, September 12 Registration Day

1:00-4:00 p.m. Optional pre-meeting tour of Molycorp open-pit mine and mill. Limited to 50 people.
4:30-9:00 p.m. Registration in lobby of Lifts West, Red River.
6:00–? Cocktail party in lobby of Lifts West, Red River.

Thursday, September 13 First Day

7:30 a.m. Caravan gathers at Lifts West parking lot in Red River. Late registration at Stop 1.
8:00 a.m. Caravan departs for first day's tour.
1:00 p.m. Lunch provided in the Valle Vidal.
5:00 p.m. Arrive at Lambert Park, Cimarron for tour of Grist Mill Museum and St. James Hotel.
6:00 p.m. Arrive at Philmont Scout Ranch Training Center and check in to rooms.
7:00 p.m. Barbecue dinner and concert at Philmont.

Friday, September 14 Second Day

7:00-7:45 a.m. Breakfast at Philmont dining hall provided.
8:30 a.m. Buses depart from Training Center parking lot for second day's tour.
12:00 p.m. Lunch provided at old Mutz Hotel in Elizabethtown.
5:00 p.m. Arrive at Legends Resort in Angel Fire.
7:00 p.m. 8:30 p.m. NMGS annual banquet at Angel Fire Legends Hotel banquet room. Keynote speaker: Dr. Brian Wernicke of Harvard University.

Saturday, September 15 Third Day

7:00-7:45 a.m. Breakfast available at Angel Fire restaurant.
8:30 a.m. Buses depart from parking lot of Angel Fire Hotel for third day's tour.
12:00 p.m. Lunch provided.
3:00 p.m. Field conference ends. Buses return to Philmont. Rides provided back to Red River.

CREDITS

Front Cover: Elizabethtown, New Mexico enjoyed many "firsts"; it was the first incorporated town in the territory, the first county seat of Colfax County, the location of the first modern hydraulic mining operation and is ranked first in New Mexico for the production of placer gold (estimated at $2.5 million by 1904). In this "bird's-eye" view of the northeast portion of town, much of the reason for E'town's success is apparent: the pipeline bringing in water from the Red River via the Big Ditch to power hydraulic monitors; the dredge "Eleanor" working the placers in Moreno Creek; and, on the horizon, Baldy Mountain, whose eroded flanks provided the source for all the placer gold. In the foreground is the road between Cimarron and Red River which tenuously linked the thriving community with the outside world. All save the physical features have long since vanished into the mists of time. Artist's rendition by Michael W. Wooldridge, NMBMMR.

Front End Sheet: LANDSAT false-color composite image of north-central New Mexico and corresponding map of topographic features, highways and road-log routes. Drafted by Rebecca Jean Titus, NMBMMR.

Title Page: Oblique, color aerial photograph of the Molycorp open-pit mine near Questa. 10 September 1975. View west with Rio Grande valley in background. Photo by Bovay Engineering, Albuquerque. Courtesy R. Young.

Back End Sheet: Stratigraphic column for field conference area. Drafted by Rebecca Jean Titus, NMBMMR.

Typing: Lynne McNeil, NMBMMR.

Drafting: Rebecca Jean Titus, John W. Robinson, Michael Wooldridge and Jonathan D. Cheney, NMBMMR.

Photographs: Christopher K. Mawer, Paul W. Bauer, Charles L. Pillmore, Robert Colpitts, Jr., Mrs. Winifred Hamilton, Spencer G. Lucas, Museum of New Mexico, Philmont Scout Ranch, Kit Carson Foundation, Colorado Historical Society, Las Quince Letras, New Mexico State Records and Archives.

Darkroom Work: Monte M. Brown, NMBMMR.

Captions for Historical Photographs: Robert W. Eveleth and Paul W. Bauer, NMBMMR.

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