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## ***Front Matter***

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

*in:*  
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*This is a section from the 1997 NMGS Fall Field Conference Guidebook.*

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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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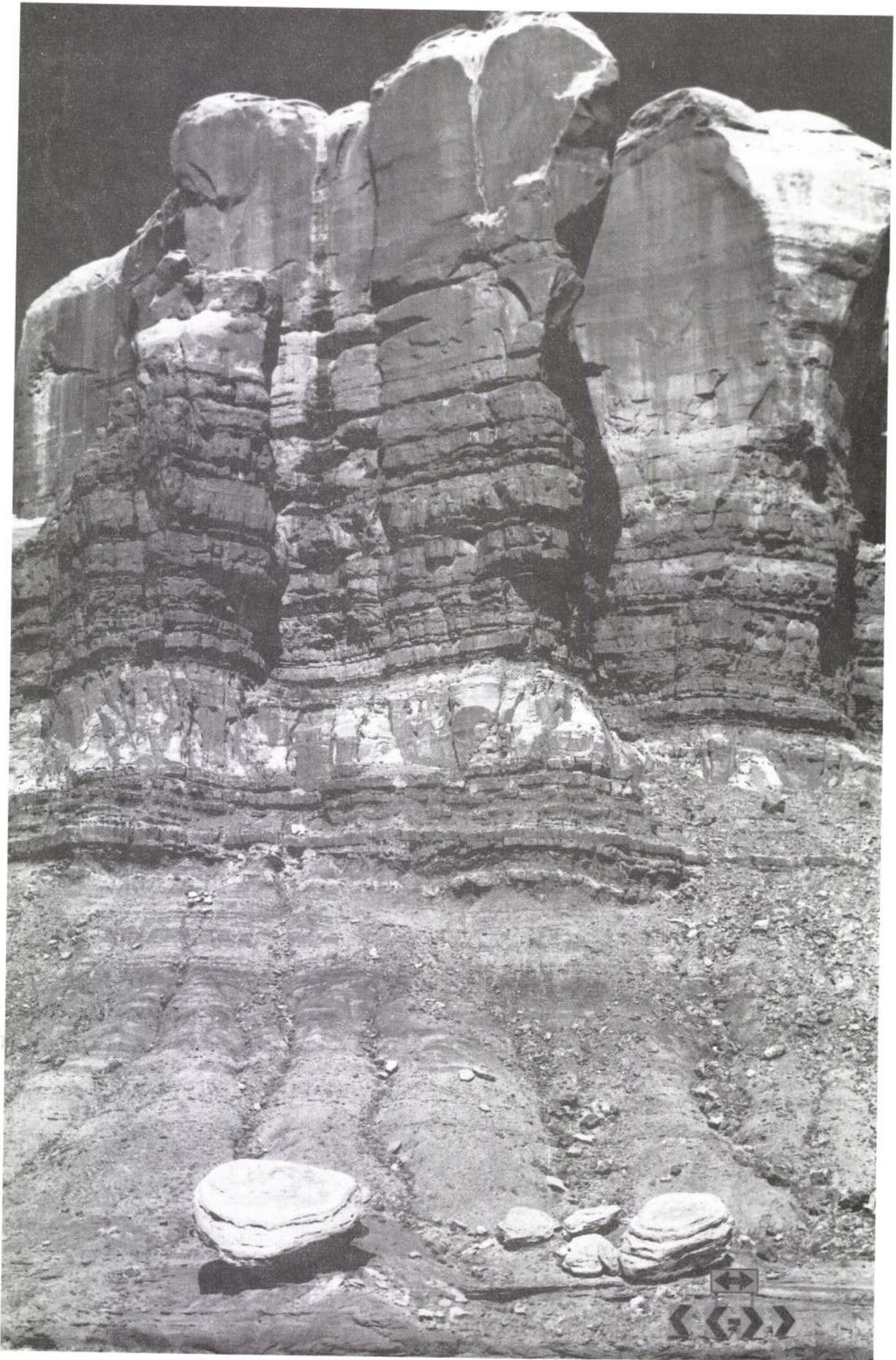
NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our 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.

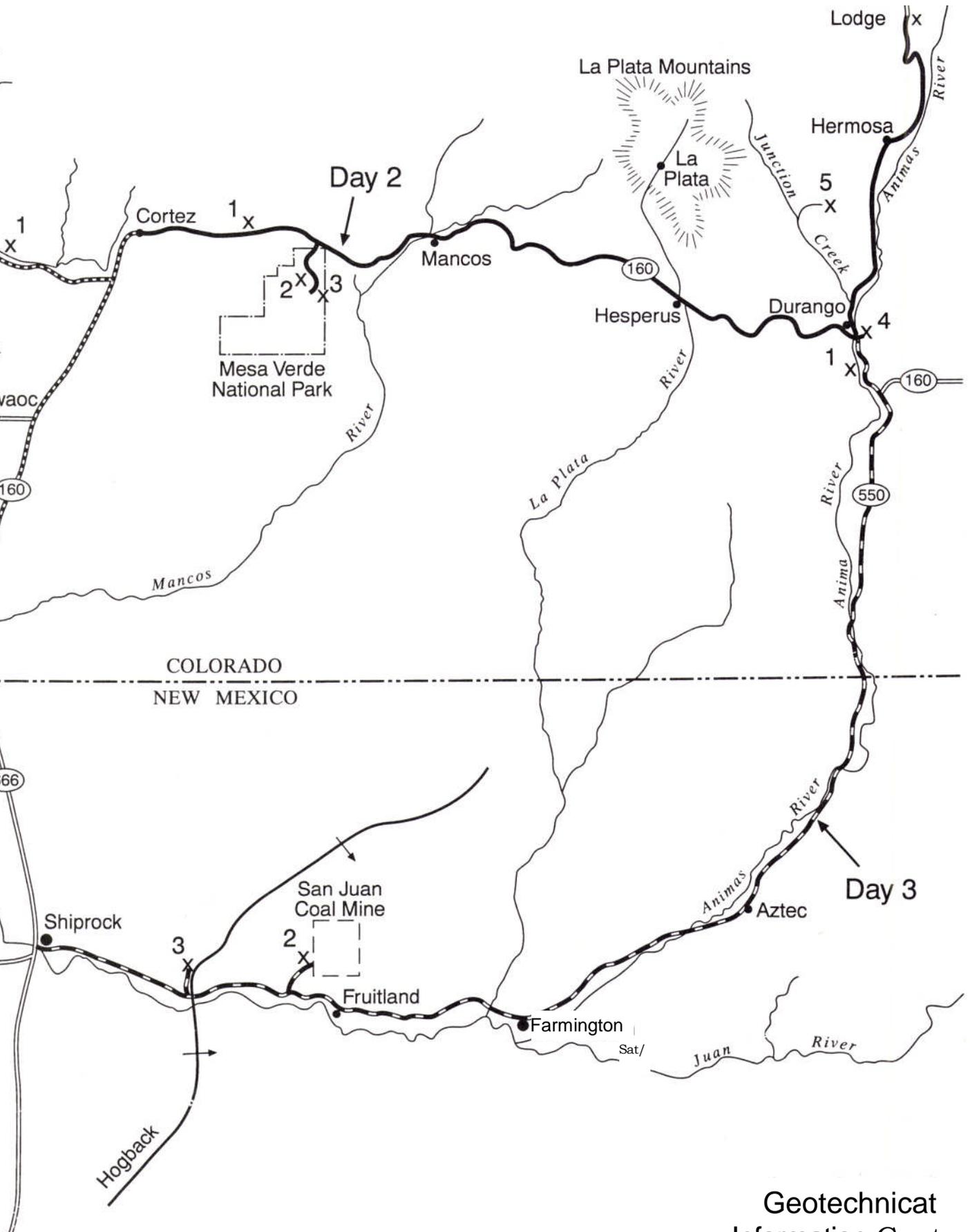
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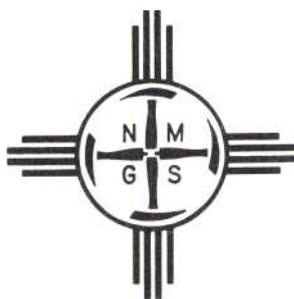
# Mesozoic Geology and Paleontology of the Four Corners Region

## Editors

Orin J. Anderson

Barry S. Kues

Spencer G. Lucas



New Mexico Geological Society  
Forty-Eighth Annual Field Conference  
October 1-4, 1997



The section exposed at Little Round Rock near Kayenta in northeastern Arizona is classic in the stratigraphy of the Triassic-Jurassic transition in the Four Corners region. The light-colored rocks at the base of the section are the Upper Triassic Owl Rock Formation of the Chinle Group. The overlying, dark-colored, rhythmically-bedded sandstones and siltstones are the type section of the Upper Triassic Rock Point Member of the Wingate Sandstone of Harshbarger et al. (1957), subsequently assigned by various workers to the Chinle Formation (Group). The cliff of sandstone capping the butte is the Triassic-Jurassic? Lukachukai Member of the Wingate Sandstone of Harshbarger et al. (1957), now simply termed Wingate Sandstone. Two unconformities have been identified and debated in this section—at the Owl Rock-Rock Point and at the Rock Point-Wingate contacts.

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## DEDICATION



How many of us can claim to have been publishing scientific papers for more than 50 years? Not many, but William A. Cobban is a member of the select group that can make that claim. His involvement and pioneering work concerning Upper Cretaceous stratigraphy and invertebrate paleontology of the Western Interior (U.S.) is regarded as the standard and is known and recognized worldwide. The ammonite zones used by biostratigraphers throughout the western U.S. are largely the results of his painstaking efforts. The breadth and scope of his work create the impression that the efforts were painstaking; however, with his attitude, insight, devotion and dedication it merely became "natural and obvious" and a labor of love for Bill. So much so that he still looks forward to coming into work every day. Retirement? That was merely administrative paper shuffling!

Bill has authored or coauthored 195 papers (excluding abstracts) pertaining to Upper Cretaceous (and Jurassic) stratigraphy and biostratigraphy. With such well-known practitioners such as Carl Dane, C.M. Molenaar, John Obradovich, S.C. Hook and Ed Landis he is responsible for the current level of refinement of Upper Cretaceous stratigraphy in New Mexico and adjacent areas.

Bill was born December 31, 1916, in Anaconda, Montana. He attended public school there, and was fortunate enough to have had a high school science instructor who encouraged his early fossil collecting and who was able to assist him with some identifications. By the time he entered college he knew what he wanted to do. He subsequently earned a B.A. in Geology in 1940 from Montana State University. He was granted a Ph.D. in Geology from John Hopkins University in 1949, with some years with Carter Oil Company sandwiched in between. In 1949 Bill went to work for the U.S. Geological Survey and remained there in the Paleontology and Stratigraphy branch until "retirement" in 1992.

His professional affiliations include membership in the Geological Society of America (fellow), American Association of Petroleum Geologists, Paleontological Society, Society of Economic Paleontologists and Mineralogists (SEPM), the Rocky Mountain Association of Geologists, and the American Association for the Advancement of Science (fellow).

Awards include honorary membership in both the Montana and Wyoming Geological Societies (1970), as well as the Rocky Mountain Association of Geologists. He earned Department of Interior Meritorious and Distinguished Service Awards, respectively, in 1974 and 1986; he was awarded the Paleontological medal in 1985 by the Paleontological Society. The SEPM presented him with the Distinguished Geological Pioneer Award in 1985 and with the R.C. Moore Paleontological Medal in 1990. Most recently the Paleontological Research Institution bestowed the Gilbert Harris award on Bill in 1996. Aside from all this everyone who has ever met him regards him as a gentleman and all his friends and colleagues think he is not only an excellent geologist but a great scientist. The profession can only be grateful that people like Bill come along now and then.

In recognition of his continuing and outstanding service and contribution to geology and paleontology we are pleased to dedicate this guidebook to Dr. William A. Cobban.

*Orin Anderson*

## PRESIDENT'S MESSAGE

Beautiful scenery and wonderfully exposed geology frequently go hand-in-hand in the West; and the Colorado Plateau probably has a lion's share of North America's scenic "crown jewels." It is no surprise that in 1997, the New Mexico Geological Society (NMGS) Fall Field Conference, now in its 48<sup>th</sup> year, is returning to the Colorado Plateau for at least the eleventh time. For fun, participants in this year's conference may straddle four states all at once as we tour the Four Corners area of New Mexico, Arizona, Colorado, and Utah! On a more relevant note, participants are sure to come away from this year's conference with a greatly expanded understanding of regional stratigraphy and associated research problems and their importance to economic geology and regional geologic evolution.

Co-chairmen Orin Anderson and Spencer Lucas have done a tremendous job in organizing an enlightening view of the Mesozoic geology in this region. We owe our appreciation to all authors of roadlogs and papers for sharing their research and new concepts on this economically important region, especially Dr. Mark Leckie. I encourage conference participants to thank the conference chairmen, editors, authors, registrars, logisticians, and caravan support persons for their hard work and time. Also, thank you, Bruce Black for hosting a last unofficial stop for the conference.

The NMGS continues to be financially healthy. Scholarship donations and strong investment performance, combined with good publication sales, are primary factors. In 1997, nearly \$15,000 will be awarded to undergraduate and graduate geoscience students at New Mexico universities by the NMGS. This year, through the efforts of several Executive Committee members, past and present, the NMGS has been approved for 501 (3) (C) tax status, which allows donors to receive tax benefits.

The NMGS has reprinted all out of print guidebooks and special publications during the last year. Fred Trauger has championed reprinting with a generous donation. In response, the Executive Committee created the Trauger Reprint Fund to sustain all NMGS publications.

Our 1998 Fall Field Conference will convene in "Las Cruces Country" for the first time in 23 years. Las Cruces is the rallying point for outcrop discussions of stratigraphy, southern Rio Grande rift evolution, and economic geology in south-central New Mexico. Other NMGS projects in the works include a 50<sup>th</sup> "golden" anniversary Fall Field Conference in the Albuquerque area and the publication of an updated New Mexico Highway Geologic Map in 1999. In the year 2000, the Society plans to kick off the new millennium by publishing a special publication on the "Geology of New Mexico."

The success and quality of NMGS conferences, meetings, and publications is due to a large extent to the input of New Mexico Bureau of Mines and Mineral Resources (NMBMMR) personnel and the support and enthusiasm of the Director, Charles Chapin. Special thanks goes to Norma Meeks and Debbie Goering at the NMBMMR for their hard work with publications sales, mailings, and membership renewals. The 1997 Annual Spring Meeting, our 50<sup>th</sup>, in Socorro was an outstanding success. I thank and congratulate the Spring Meeting chairs, Matt Heizler and Bruce Hart of the NMBMMR, for their hard work in organizing and conducting the best Spring Meeting to date!

Barry Kues has been the Managing Editor of NMGS guidebooks for many years now. Barry, we owe you an extreme measure of gratitude for your hard work and for the first class quality of guidebooks that the NMGS has had during your tenure as Editor! After this year, George Austin has agreed to become Managing Editor. Thank you, Barry and George!

I challenge all members to become actively involved in the NMGS and to encourage colleagues, especially students, to join the NMGS and its activities. The life blood of the NMGS is the many volunteers who contribute to field conference and spring meeting efforts. There are probably a hundred volunteers, including many students, that deserve our thanks and appreciation. Enjoy the scenery and people; and learn a lot!

*James C. Witcher*

## EDITORS' MESSAGE

The essence of "The Land of Enchantment" extends throughout the Four Corners region and many of you will feel as though you never left New Mexico. Much of this essence derives from the flat-lying to gently dipping Mesozoic sedimentary rocks, which in turn define much of the topography and scenic quality of the Colorado Plateau physiographic province—we will be touring near the center of this province.

These sedimentary rocks, their fossil record and correlation, and the depositional environments they represent, are the primary focus of this book. Given that most of the pre-Cretaceous Mesozoic stratigraphic record preserved in this region is that of nonmarine sedimentation, age-diagnostic fossils are sparse. We, accordingly, had to sharpen our lithostratigraphic skills in anticipation of this challenge, and we consequently (perhaps predictably) found that the stratigraphic interpretations of some of the earlier workers differed from ours. Field conference participants will have ample opportunity to evaluate these contrasting interpretations on the outcrop (the real value of these events) and perhaps contribute some of their own.

Upper Cretaceous rocks in the conference area are, by contrast, dominantly marine. Foremost amongst this marine epicontinental sequence is the Mancos Shale, the type area of which we will traverse on Day 2. The Mancos spans the first four stages of the Late Cretaceous and encompasses as much as 13 to 15 Ma; it attains thicknesses in excess of 2100 ft, consisting of fine grained elastics and lesser carbonate. An exhaustive treatment of the entire section is presented by Mark Leckie and coauthors, wherein they provide detailed bio- and lithostratigraphic data, and relate the section to the deeper or more basinal facies to the east.

Before the thick peat deposits in the paralic coastal swamps (associated with the regressing Cretaceous seaway) had been transformed into the coals of the present Fruitland Formation, intrusive activity had begun in the Four Corners area. Age data supplied by the Laboratory of Geochronology at the New Mexico Bureau of Mines and Mineral Resources and presented herein by Steven Semken and William McIntosh confirms the pre-(classic) Laramide age of one of these intrusive centers-- the Carrizo Mountains--and at least one other--the La Plata Mountains--is known from previous work to be of similar age.

The doming over the sites of these early magmatic centers resulted in the deposition of distinctive proximal sediments such as those of the Animas Formation, which we will examine (south of Durango) on our last day.

The tectonic history of the area has been summarized by Lee Woodward and others. Bill Chenoweth has provided a historic and technical account of the uranium mining industry in this region. Coal, petroleum, and other matters pertaining to economic geology are for the most part presented in the roadlogs, but petroleum-related topics are presented as contributed papers as well.

The wrap-up of this year's conference is provided by Bruce Black. Bruce will give us a tour of his locally-famous cave house in the Ojo Alamo Sandstone, a facility that will eventually become a Bread-and-Breakfast establishment.

With this guidebook, one of us (BSK) is retiring as managing editor. After 7 guidebooks, 32 road logs, 146 minipapers, 228 articles, and nearly 2600 pages, it is time to turn over the rewards and frustrations of producing each year's guidebook to another, in this case to the capable hands of George Austin. Authors who have contributed to these guidebooks have no doubt observed some changes -- most minor, some major -- in their papers between the time they submitted them and their final publication. In editing, the managing editor adjusts a manuscript to NMGS paper format, and looks for ways to tighten prose (every unnecessary word costs the Society additional, wasted money to print!), improve clarity, and correct errors in grammar and word usage, thereby (we hope) improving the final version of each paper. There are numerous, persistent, but unsatisfactory quirks of word and phrase usage that inevitably set an editor's pen in motion whenever they are encountered. A few of my "favorites" are: confusion about the meanings of (for example) that and which, farther and further, while and whereas, and since and because; overuse and misuse of colons; the phrase "a number of" (which has no meaning; numbers range from infinitesimal to infinite); the term "present-day" (is this any different from simply "present"?); wishy-washy, weakly passive phrases like "is thought to be" and "it has been suggested"; and perhaps worst of all, an increasing tendency to distort nouns and adjectives into verbs, e.g., "this conclusion is evidenced by" or "this formation youngs upward". Despite these grumblings (probably a sign that one has been an editor too long), the experience of being managing editor has been a very positive one and I thank the Society for the opportunity. I also thank all of the authors who have provided the substance of our guidebooks, and the folks at UNM Printing Services, who take what I give them over the course of several months each year and make real books out of it all, ready for each Fall's Field Conference. And finally, my thanks to the groups of other editors on each year's guidebook (a total of 20 individuals in all); your dedication and hard work made my job a lot easier.

We wish to thank all who worked so long and diligently to make this guidebook possible. Now we welcome all to the Four Corners Region. Enjoy the conference!

*Orin J. Anderson, Barry S. Kues and Spencer G. Lucas*

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### ROAD LOGS

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# 1997

## FIELD CONFERENCE SCHEDULE

### Wednesday, October 1, 1997—Travel and Registration Day

- |                 |  |
|-----------------|--|
| 3:00-7:00 p.m.  | Caravan travel from New Mexico Museum of Natural History and Science parking lot (1801 Mountain Rd. NW, Albuquerque) to Holiday Inn, Cortez. |
| 7:00- 9:30 p.m. | Registration and icebreaker, Holiday Inn, Cortez   |

### Thursday, October 2, 1997—First Day

- |                 |  |
|-----------------|--|
| 6:45- 7:45 a.m. | Complimentary continental breakfast, Holiday Inn |
| 8:00 a.m.       | Caravan departs from Holiday Inn parking lot     |
| Mid-day         | Lunch provided                                   |
| 6:00 p.m.       | Caravan returns to Holiday Inn, Cortez           |
| 7:00 p.m.       | Dinner provided, Holiday Inn Meeting Rooms       |

### Friday, October 3, 1997—Second Day

- |                |  |
|----------------|--|
| 6:45-7:45 a.m. | Complimentary continental breakfast, Holiday Inn   |
| 8:00 a.m.      | Caravan departs Holiday Inn parking lot, eastbound |
| Mid-day        | Lunch provided                                     |
| 5:30 p.m.      | Caravan arrives Tamarron Lodge north of Durango    |
| 7:00 p.m.      | Annual banquet, Tamarron Lodge                     |

### Saturday, October 4, 1997—Third Day

- |                |   |
|----------------|---|
| 6:30-7:45 a.m. | Breakfast buffet, Tamarron Lodge  |
| 8:00 a.m.      | Caravan departs Tamarron Lodge, southbound to Durango   |
| 1:00 p.m.      | Lunch (provided) at The Hogback, Stop 3 (end of official Field Conference)  |
| 3:00-5:00      | Unofficial Stop 4. Tour and refreshments at the cave home of Dr. Bruce Black, carved into the Ojo Alamo Sandstone in Farmington Glade (west edge of Farmington) |

### CREDITS

**Front Cover:** Photograph of Recapture Member of Bluff Sandstone in Recapture Creek, San Juan Co., Utah, supplied by guidebook editors.

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