New Mexico Geological Society

*Downloaded from:* https://nmgs.nmt.edu/publications/guidebooks/38




# *Stratigraphic nomenclature and correlation chart for northeastern New Mexico*

Spencer G. Lucas, A. P. Hunt, and Barry S. Kues
1987, pp. 351-354. https://doi.org/10.56577/FFC-38.351

*in:*

*Northeastern New Mexico*, Lucas, S. G.; Hunt, A. P.; [eds.], New Mexico Geological Society 38 th Annual Fall Field Conference Guidebook, 354 p. https://doi.org/10.56577/FFC-38

*This is one of many related papers that were included in the 1987 NMGS Fall Field Conference Guidebook.*

## 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.

### Free Downloads

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.

### Copyright Information

Publications of the New Mexico Geological Society, printed and electronic, are protected by the copyright laws of the United States. No material from the NMGS website, or printed and electronic publications, may be reprinted or redistributed without NMGS permission. Contact us for permission to reprint portions of any of our publications.

One printed copy of any materials from the NMGS website or our print and electronic publications may be made for individual use without our permission. Teachers and students may make unlimited copies for educational use. Any other use of these materials requires explicit permission.

*This page is intentionally left blank to maintain order of facing pages.*

# STRATIGRAPHIC NOMENCLATURE AND CORRELATION CHART FOR NORTHEASTERN NEW MEXICO

SPENCER G. LUCAS, ADRIAN P. HUNT and BARRY S. KUES
Department of Geology, University of New Mexico, Albuquerque, New Mexico 87131

**Abstract**—Stratigraphic nomenclature and age relationships of Phanerozoic rocks in northeastern New Mexico are reviewed briefly and depicted in a chart.

## INTRODUCTION

The stratigraphic nomenclature and ages of Phanerozoic rock-units in northeastern New Mexico are summarized in the accompanying chart (Fig. 1). The chronostratigraphic scale on the left side of the chart is slightly modified from Harland et al. (1982).

## EXPLANATORY NOTES

### Paleozoic units

Rocks of Paleozoic age do not crop out in the field conference area. The nearest New Mexico Paleozoic exposures are Mississippian through Permian strata in the southern Sangre de Cristo Mountains and smaller ranges immediately to the east, some 85 to 100 km west of the western border of Union County. In Union County, Paleozoic strata have been identified in the subsurface above a large area of Precambrian basement, the Sierra Grande uplift (Baldwin and Muehlberger, 1959; Foster, 1972). The oldest Paleozoic strata here are sandy and cherty dolomites of the Early Ordovician Arbuckle Group in northeastern Union County, Cimarron County, Oklahoma and the northwestern Texas Panhandle. Foster (1972) also reported lithologies in the subsurface just to the east of Union County believed to represent the Middle Ordovician Simpson Sandstone and the Late Ordovician Viola Limestone.

Poole et al. (1967) and Baars (1972) indicated that the latest Devonian Williams Canyon Formation of eastern Colorado may extend just into northeastern New Mexico. Unnamed Mississippian carbonates are widespread in the subsurface of eastern Colorado and western Kansas, and at least part of the Mississippian (Osagean and Meramecian) is present in Union and Cimarron Counties (Craig, 1972). Exposed Mississippian strata in the southern Sangre de Cristo Mountains include thin limestones of the Espiritu Santo and Tererro formations of the Arroyo Peñasco Group (Armstrong et al., 1979; Armstrong, 1987).

The Pennsylvanian is represented by a thick marine to nonmarine sequence (Sandia Formation and Madera Group of Baltz and Myers, 1984; or La Pasada/Flechado and Alamitos formations of Sutherland, 1976) that grades upward into the red, clastic Sangre de Cristo Formation. During the Pennsylvanian and Permian, the Sierra Grande uplift formed a positive area occupying much of northeastern New Mexico (Baltz, 1965; Armstrong et al., 1979). It thus separated to some extent Early-Middle Pennsylvanian marine environments to the west from extensive areas of marine deposition to the east in Kansas, Oklahoma and northern Texas. Despite this, marine sediments of Pennsylvanian age are continuous in subcrop from Las Vegas through the Tucumcari basin and into the Texas and Oklahoma panhandles (Roberts et al., 1976; Broadhead and King, 1985). Mallory (1972) and Roberts et al. (1976) reported that eastern Union County also received marine sediments during much of the Pennsylvanian. Study of the subsurface Pennsylvanian stratigraphy of northeastern New Mexico has not progressed to the point where lithostratigraphic units have been delineated and correlated with exposed units to the east and west. Instead, the subsurface Pennsylvanian is discussed in terms of regional chronostratigraphic units identified by fusilinids (e.g., Roberts et al., 1976; Broadhead and King, 1985).

Exposed Permian formations to the south and west of the field-conference area include, in ascending order, the Sangre de Cristo, Yeso, Glorieta, San Andres and Bernal formations (Lucas and Kues, 1985). Beginning in the Late Pennsylvanian and continuing through the Wolfcampian, increased tectonic activity in the Uncompahgre and Sierra Grande uplifts shed large volumes of red, arkosic sediments (Sangre de Cristo Formation) into adjacent marine basins. These sediments spread eastward from the Sierra Grande uplift across eastern Union and Cimarron Counties into the Midcontinent sea. Not far east of the field conference area (eastern Cimarron County and along the Kansas-Colorado border), these sediments give way to the cyclic, predominantly marine, Wolfcampian facies of the Admire, Council Grove and Chase Groups, units that are widely exposed across central Kansas, Oklahoma and northern Texas (Rascoe and Baars, 1972).

During Leonardian time, interbedded shale, siltstone and evaporites of the Sumner and Nippewalla Groups were deposited during regional retreat of the Midcontinent sea. Early Leonardian evaporites are conspicuous in southwestern Kansas and the eastern Texas and Oklahoma panhandles, and by the late Leonardian gypsum and anhydrite deposition had advanced westward to northeastern New Mexico and eastern Colorado. The Nippewalla Group is characterized by prominent evaporite beds at its base (Stone Corral Formation) and top (Blaine Gypsum) which can be traced in seismic profiles across Baca County, Colorado (Rascoe and Baars, 1972). To the south and west of Union County, similar lithologies, including carbonates and evaporites, were being deposited as the Permian shoreline moved north and south across central New Mexico, producing the Yeso to Bernal sequence there, and the evaporitic Artesia Group (equivalent to the Bernal) to the southeast (e.g., Kelley, 1972).

Upper Permian units in Union and Cimarron Counties are assigned to the Whitehorse Group, Cloud Chief Formation and "Quartermaster" Formation, all predominantly red to orange, fine-grained clastics with numerous local interbeds of sandstone, dolomite and gypsum/anhydrite. The "Alibates Dolomite" is a conspicuous horizon that marks the boundary between the Cloud Chief and overlying "Quartermaster" in the subsurface of Cimarron and Texas Counties, Oklahoma (Fay, 1965), and occurs at the top of the Permian section in northeastern New Mexico (Dixon, 1967; Roberts et al., 1976). The Whitehorse and Cloud Chief units crop out in the eastern part of the Oklahoma panhandle but are not present on the surface in Cimarron County. No Ochoan rocks equivalent to the Rustler Formation of southeastern New Mexico are present in the field-conference area (Dixon, 1967).

### Mesozoic units

Triassic stratigraphy in Union County employed here follows Lucas et al. (1987[a]), and that along the eastern front of the Sangre de Cristo Mountains follows Lucas et al. (1985[a]). The Johnson Gap Formation of Johnson and Baltz (1960) is present in southeastern Colorado and extends as far south as the eastern front of the Sangre de Cristo Mountains in northern Colfax County, New Mexico. Tentatively, we consider the Johnson Gap to be a sand-dominated facies equivalent to the entire Triassic sequence in northeastern and east-central New Mexico (cf. Oriel and Mudge, 1956). The Upper Triassic Santa Rosa Formation is used here in the restricted sense of Lucas and Hunt (in press). The unit formerly referred to as the lower red sandstone member of the Santa Rosa Formation in east-central New Mexico (Gorman and Robeck,

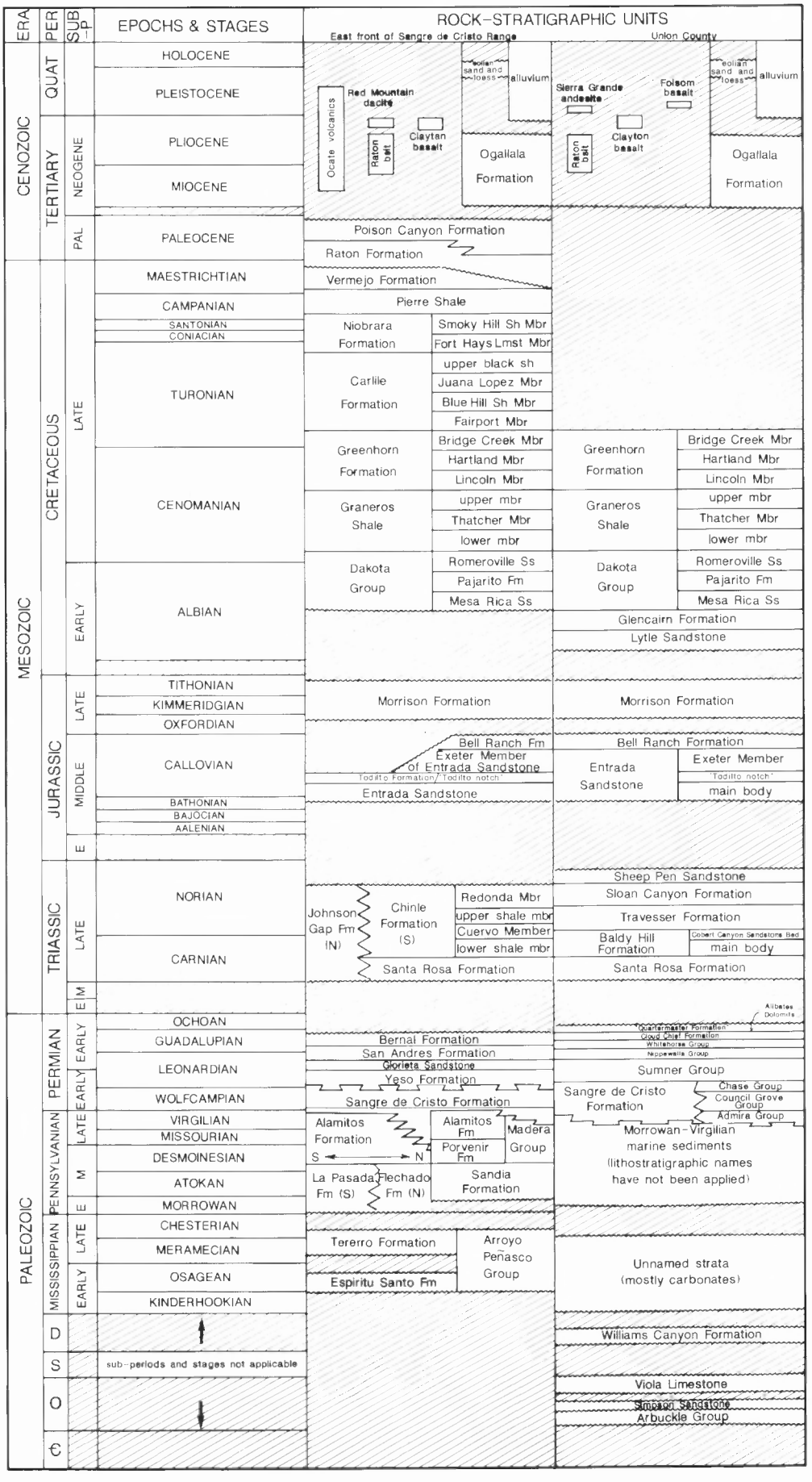



FIGURE 1. Stratigraphic nomenclature and correlation chart for Phanerozoic rocks in northeastern New Mexico.

1946; Lucas et al., 1985[a]) was termed the Anton Chico Formation by Lucas and Hunt (in press). It is demonstrably of Middle Triassic (Anisian) age, but it is unclear whether the Anton Chico Formation is present north of San Miguel County.

Jurassic stratigraphy employed here follows Lucas et al. (1985[b], 1987[b]) and Neuhauser et al. (1987). The principal difference between the Jurassic section exposed along the eastern front of the Sangre de Cristo Mountains and in Union County relates to the eastward pinchout of the Todilto Formation (e.g., Lucas and Kietzke, 1986). In Union County, the eastern equivalent of the Todilto Formation is a "notch" (disconformity, bounding-surface or laminar sandstone) that separates the lower, main body of the Entrada Sandstone from the overlying, Exeter Member (Lucas et al., 1987[b]). The Bell Ranch Formation (Griggs and Read, 1959) of eastern Union County is the unit also termed Wanakah Formation (Cooley, 1955) and siltstone member of the Morrison Formation (Baldwin and Muehlberger, 1959). The apparent absence of the Bell Ranch Formation in Cimarron County, Oklahoma and along the eastern flank of the Sangre de Cristo Mountains reflects a profound unconformity at the base of the Morrison Formation (termed J-5 unconformity on the Colorado Plateau by Pipiringos and O'Sullivan, 1978). The tripartite division of the Morrison Formation evident in parts of east-central New Mexico (e.g., Wanek, 1962) does not extend northward into Union County.

The Cretaceous stratigraphy of Union County, New Mexico and Cimarron County, Oklahoma, follows Kues and Lucas (1987). The oldest Cretaceous strata, assigned by them to the Lytle Sandstone, were previously termed Morrison, Purgatoire or Cheyenne (e.g., Stovall, 1943; Baldwin and Muehlberger, 1959). Above the Glencairn, the tripartite Dakota Group (Mesa Rica, Pajarito and Romeroville formations) is present throughout northeastern and east-central New Mexico (Lucas et al., 1986; Kues and Lucas, 1987). The alternative Cretaceous stratigraphic nomenclature advocated by Mateer (1987) runs contrary to all previous usage and thus is not used here (cf. Kues and Lucas, 1987). The remainder of the Upper Cretaceous marine stratigraphy depicted here follows Baltz (1965), Johnson et al. (1966), Cobban (1976), Pillmore and Eicher (1976), Scott et al. (1986), Hattin (1987) and Laferriere (1987). Final retreat of the Cretaceous seaway from this part of New Mexico during the early Maestrichtian is represented by the Trinidad Sandstone, overlain by the clastic wedge that comprises the Vermejo and Raton formations (e.g., Flores, 1987). The Cretaceous-Tertiary boundary lies within the lower Raton Formation, marked by an iridium-abundance anomaly and a palynological change (e.g., Orth et al., 1987).

### Cenozoic units

The Paleocene portion of the Raton Formation and its piedmont facies, the Poison Canyon Formation, are the only lower Cenozoic strata preserved in the New Mexico portion of the Raton Basin. The upper Cenozoic Ogallala Formation, mainly of Miocene age (Hawley, 1984), is the oldest Cenozoic bedrock on the high plains of northeastern New Mexico east of the Raton Basin. Volcanic rocks of the Ocate and Raton-Clayton volcanic fields dominate much of the landscape in Colfax and Union Counties. They range in age from Miocene to Pleistocene (Baldwin and Muehlberger, 1959; Stormer, 1972; Nielsen and Dungan, 1985; Calvin, 1987). The youngest Cenozoic rocks in northeastern New Mexico are alluvium, eolian sand and loess of Pliocene-Holocene age (Hawley et al., 1976).

## REFERENCES


Armstrong, A. K., 1987, Stratigraphy, facies and paleotectonics, Mississippian System, New Mexico: New Mexico Geological Society, Guidebook 38.

Armstrong, A. K., Kottlowski, F. E., Stewart, W. J., Mamet, B. L., Baltz, E. H., Siemers, W. T. and Thompson, S. III, 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States—New Mexico: U.S. Geological Survey, Professional Paper 1110-W, pp. 1–27.

Baars, D. L., 1972, Devonian System; *in* Mallory, W. W., ed., Geologic atlas of the Rocky Mountain region: Denver, Rocky Mountain Association of Geologists, pp. 90–99.

Baldwin, B. and Muehlberger, W. R., 1959, Geologic studies of Union County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 63, 171 pp.

Baltz, E. H., Jr., 1965, Stratigraphy and history of Raton Basin and notes on San Luis basin, Colorado-New Mexico: American Association of Petroleum Geologists Bulletin, v. 49, pp. 2041–2075.

Baltz, E. H., Jr. and Myers, D. A., 1984, Porvenir Formation (new name)—and other revisions of nomenclature of Mississippian, Pennsylvanian and Lower Permian rocks, southeastern Sangre de Cristo Mountains, New Mexico: U.S. Geological Survey, Bulletin 1537-B, 39 pp.

Broadhead, R. F. and King, W. E., 1985, Preliminary report on the stratigraphy and structure of Pennsylvanian and Lower Permian strata, Tucumcari basin: New Mexico Geological Society, Guidebook 36, pp. 161–166.

Calvin, E. M., 1987, A review of the volcanic history and stratigraphy of northeastern New Mexico, the Ocate and Raton-Clayton volcanic fields: New Mexico Geological Society, Guidebook 38.

Cobban, W. A., 1976, Ammonite record from the Pierre Shale of northeastern New Mexico: New Mexico Geological Society, Guidebook 27, pp. 165–169.

Cooley, B. B., Jr., 1955, Areal geology of Dry Cimarron Canyon, Union County, New Mexico [M.S. thesis]: Austin, University of Texas, 93 pp.

Craig, L. C., 1972, Mississippian System; *in* Mallory, W. W., ed., Geologic atlas of the Rocky Mountain region: Denver, Rocky Mountain Association of Geologists, pp. 100–110.

Dixon, G. H., 1967, Paleotectonic investigations of the Permian System in the United States, chapter D. Northeastern New Mexico and Texas-Oklahoma panhandles: U.S. Geological Survey, Professional Paper 515-D, pp. 65–80.

Fay, R. O., 1965, Geology and mineral resources of Woods County, Oklahoma: Oklahoma Geological Survey, Bulletin 106, 189 pp.

Flores, R. M., 1987, Sedimentology of Upper Cretaceous and Tertiary siliciclastics and coals in the Raton Basin, New Mexico and Colorado: New Mexico Geological Society, Guidebook 38.

Foster, N. H., 1972, Ordovician System; *in* Mallory, W. W., ed., Geologic atlas of the Rocky Mountain region: Denver, Rocky Mountain Association of Geologists, pp. 76—85.

Gorman, J. M. and Robeck, R. C., 1946, Geology and asphalt deposits of north-central Guadalupe County, New Mexico: U.S. Geological Survey, Oil and Gas Investigations Preliminary Map OM-44.

Griggs, R. L. and Read, C. B., 1959, Revisions in stratigraphic nomenclature in Tucumcari-Sabinoso area, northeastern New Mexico: American Association of Petroleum Geologists Bulletin, v. 43, pp. 2003–2007.

Harland, W. B., Cox, A. V., Llewellyn, P. G., Pickton, C. A. G., Smith, A. G. and Walters, R., 1982, A geologic time scale: Cambridge, Cambridge University Press, 131 pp.

Hattin, D. E., 1987, Pelagic/hemipelagic rhythmites of the Greenhorn Limestone (Upper Cretaceous) of northeastern New Mexico and southeastern Colorado: New Mexico Geological Society, Guidebook 38.

Hawley, J. W., 1984, The Ogallala Formation in eastern New Mexico; *in* Whetstone, G. A., ed., Proceedings of the Ogallala aquifer symposium II: Lubbock, Texas Tech University Water Resources Center, pp. 157–176.

Hawley, J. W., Bachman, G. O. and Manley, K., 1976, Quaternary stratigraphy in the Basin and Range and Great Plains provinces, New Mexico and western Texas; *in* Mahaney, W. C., ed., Quaternary stratigraphy of North America: Stroudsberg, Dowden, Hutchinson and Ross, Inc., pp. 235–274.

Johnson, R. B. and Baltz, E. H, Jr., 1960, Probable Triassic rocks along eastern front of Sangre de Cristo Mountains, south-central Colorado: American Association of Petroleum Geologists Bulletin, v. 44, pp. 1895–1902.

Johnson, R. B., Dixon, G. H. and Wanek, A. A., 1966, Late Cretaceous and Tertiary stratigraphy of the Raton Basin in New Mexico and Colorado: New Mexico Geological Society, Guidebook 7, pp. 88–98.

Kauffman, E. G., Powell, J. D. and Hattin, D. F., 1969, Cenomanian-Turonian facies across the Raton Basin: Mountain Geologist, v. 6, pp. 93–118.

Kelley, V. C., 1972, Outcropping Permian shelf formations of eastern New Mexico: New Mexico Geological Society, Guidebook 23, pp. 72–78.

Kues, B. S. and Lucas, S. G., 1987, Cretaceous stratigraphy and paleontology in the Dry Cimarron valley, New Mexico, Oklahoma and Colorado: New Mexico Geological Society, Guidebook 38.

Laferriere, A. P., 1987, Cyclic sedimentation in the Fort Hays Limestone Member, Niobrara Formation (Upper Cretaceous) in northeastern New Mexico and southeastern Colorado: New Mexico Geological Society, Guidebook 38.

Lucas, S. G. and Kietzke, K. K., 1986, Stratigraphy and petroleum potential of the Jurassic Todilto Formation in northeastern New Mexico; *in* Ahlen, J. L. and Hanson, M. E., eds., Southwest section of AAPG transactions and guidebook of 1986 convention Ruidoso, New Mexico: Socorro, New Mexico Bureau of Mines and Mineral Resources, pp. 121–127.

Lucas, S. G. and Kues, B. S., 1985, Stratigraphic nomenclature and correlation chart for east-central New Mexico: New Mexico Geological Society, Guidebook 36, pp. 341–344.

Lucas, S. G., Hunt, A. P. and Hayden, S. N., 1987[a], The Triassic System in the Dry Cimarron Valley, New Mexico, Colorado and Oklahoma: New Mexico Geological Society, Guidebook 38.

Lucas, S. G., Hunt, A. P. and Hayden, S. N., 1987[b], Type section of Exeter Member of Entrada Sandstone, Jurassic of northeastern New Mexico: New Mexico Geological Society, Guidebook 38.

Lucas, S. G., Hunt, A. P. and Morales, M., 1985[a], Stratigraphic nomenclature and correlation of Triassic rocks in east-central New Mexico: a preliminary report: New Mexico Geological Society, Guidebook 36, pp. 171–184.

Lucas, S. G., Kietzke, K. K. and Hunt, A. P., 1985[b], The Jurassic System in east-central New Mexico: New Mexico Geological Society, Guidebook 36, pp. 213–242.

Lucas, S. G., Hunt, A. P., Kietzke, K. K. and Wolberg, D. L., 1986, Cretaceous stratigraphy and biostratigraphy, Clayton Lake State Park, Union County, New Mexico: New Mexico Geology, v. 8, pp. 60–65.

Lucas, S. G. and Hunt, A. P., in press, Stratigraphy of the Anton Chico and Santa Rosa formations, Triassic of east-central New Mexico: Journal of the Arizona-Nevada Academy of Science.

Mallory, W. W., 1972, Regional synthesis of the Pennsylvanian System; *in* Mallory, W. W., ed., Geologic atlas of the Rocky Mountain region: Denver, Rocky Mountain Association of Geologists, pp. 111–127.

Mateer, N. J., 1987, The Dakota Group of northeastern New Mexico and southern Colorado: New Mexico Geological Society, Guidebook 38.

Neuhauser, K. R., Lucas, S. G., de Albuquerque, J. S., Louden, R. J., Hayden, S. N., Kietzke, K. K., Oakes, W. and Des Marais, D., 1987, Stromatolites of the Morrison Formation (Upper Jurassic), Union County, New Mexico: a preliminary report: New Mexico Geological Society, Guidebook 38.

Nielsen, R. L. and Dungan, M. A., 1985, The petrology and geochemistry of the Ocate volcanic field, north-central New Mexico: Geological Society of America Bulletin, v. 96, pp. 296–312.

Oriel, S. S. and Mudge, M. R., 1956, Problems of lower Mesozoic stratigraphy in southeastern Colorado: Rocky Mountain Association of Geologists, Guidebook, Raton Basin, Colorado, pp. 19–24.

Orth, C. J., Gilmore, J. S. and Knight, J. D., 1987, Iridium anomaly at the Cretaceous-Tertiary boundary in the Raton Basin: New Mexico Geological Society, Guidebook 38.

Pillmore, C. L. and Eicher, D. L., 1976, Lower part of the marine Cretaceous at Gold Creek, Vermejo Park, New Mexico: New Mexico Geological Society, Guidebook 27, pp. 171–176.

Pipiringos, G. N. and O'Sullivan, R. B., 1978, Principal unconformities in Triassic and Jurassic rocks, Western Interior United States—a preliminary survey: U.S. Geological Survey, Professional Paper 1035-A, 29 pp.

Poole, F. G., Baars, D. L., Drewes, H., Hayes, P. T., Ketner, K. B., McKee, E. D., Teichert, C. and Williams, J. S., 1967, Devonian of the southwestern United States; *in* Oswald, D. H., ed., International symposium on the Devonian System: Calgary, Alberta Society of Petroleum Geologists, v. 1, pp. 879–912.

Rascoe, B., Jr. and Baars, D. L., 1972, Permian System; *in* Mallory, W. W., ed., Geologic atlas of the Rocky Mountain region: Denver, Rocky Mountain Association of Geologists, pp. 143–165.

Roberts, J. W., Barnes, J. J. and Wachen, H. J., 1976, Subsurface Paleozoic stratigraphy of the northeastern New Mexico basin and arch complex: New Mexico Geological Society, Guidebook 27, pp. 141–152.

Scott, G. R., Cobban, W. A. and Merewether, E. A., 1986, Stratigraphy of the Upper Cretaceous Niobrara Formation in the Raton Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 115, 34 pp.

Stormer, J. C., Jr., 1972, Ages and nature of volcanic activity on the southern High Plains, New Mexico and Colorado: Geological Society of America Bulletin, v. 83, pp. 2443–2448.

Stovall, J. W., 1943, Stratigraphy of the Cimarron Valley (Mesozoic rocks): Oklahoma Geological Survey, Bulletin 64, pp. 43–132.

Sutherland, P. K., 1963, Paleozoic rocks: New Mexico Bureau of Mines and Mineral Resources, Memoir 11, pp. 22–46.

Wanek, A. A., 1962, Reconnaissance geologic map of parts of Harding, San Miguel, and Mora Counties: U.S. Geological Survey, Oil and Gas Investigations Map OM-208.

THE PROFESSIONAL GEOLOGIST...




**The American Institute of Professional Geologists (AIPG) seal is used only by outstanding geologists who have met highest standards of education, experience, and ethical practice. The coveted AIPG designation "Certified Professional Geologist" (CPG) or "Certified Professional Geological Scientist" (CPGS) following a name identifies an exceptional geologist--one you can count on for technical competency and proven integrity.**

*For your free Directory of AIPG-Certified geologists by location and specialty write:*

AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS

7828 Vance Drive-Suite 103, Arvada, CO 80003 • (303) 431-0831