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Stratigraphic nomenclature and correlation chart for northeastern New Mexico

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STRATIGRAPHIC NOMENCLATURE AND CORRELATION CHART FOR NORTHEASTERN NEW MEXICO

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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 fusulinids (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-Colo-rado 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,

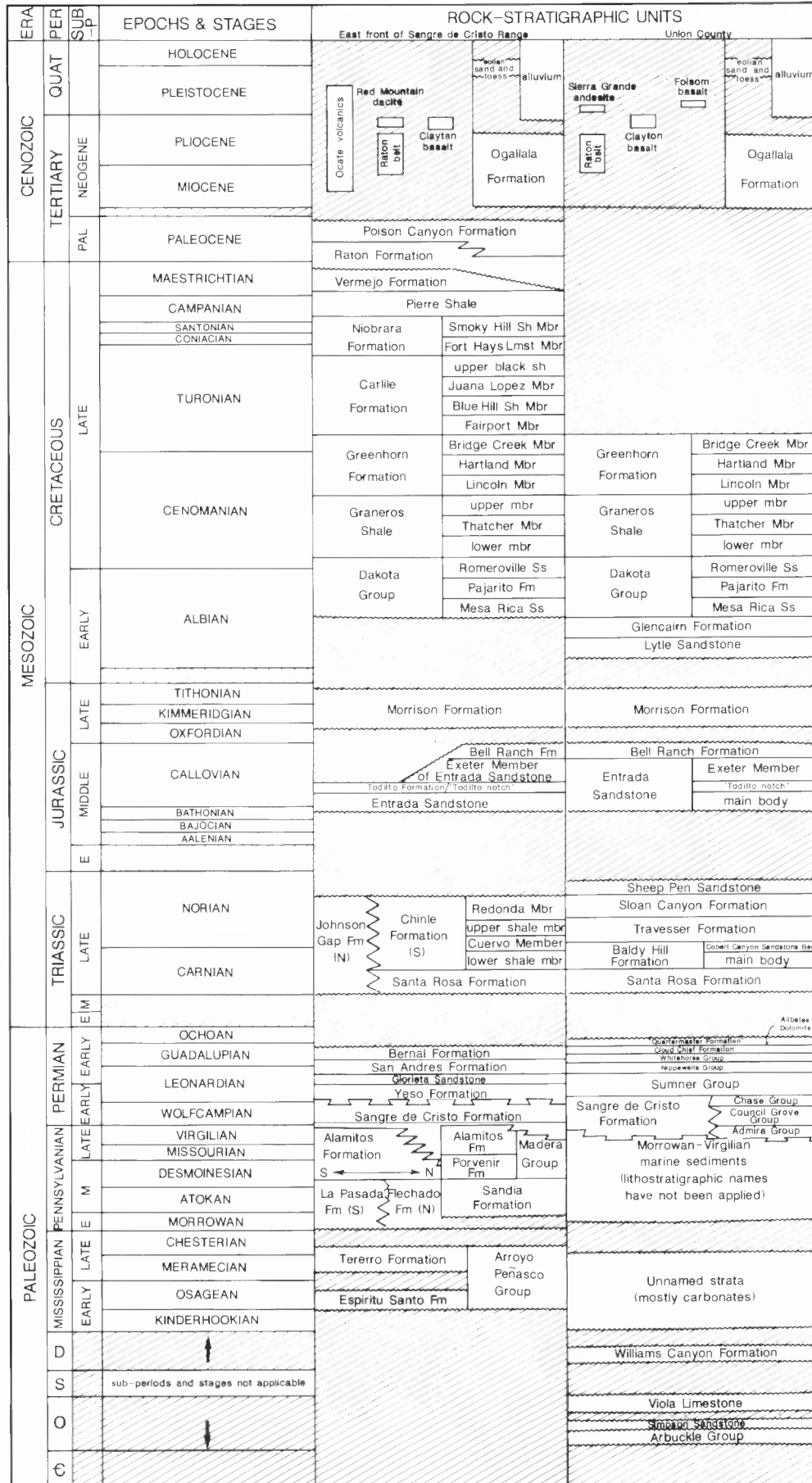


FIGURE 1. Stratigraphic nomenclature and correlation chart for Phanerozoic rocks in northeastern New Mexico.

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 Lyle 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 elastic 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).

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