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1959, pp. 52-56. https://doi.org/10.56577/FFC-10.52

in:

West-Central New Mexico, Weir, J. E., Jr.; Baltz, E. H.; [eds.], New Mexico Geological Society 10 th Annual Fall Field Conference Guidebook, p. https://doi.org/10.56577/FFC-10

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MISSISSIPPIAN STRATA ON THE EAST SIDE OF THE DATIL PLATEAU

By
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PREVIOUS WORK

Herrick (1904, p. 311) named the Mississippian strata of the Magdalena Mountains the "Graphic-Kelly limestone" after the two leading mines of the area. Gordon (1907, p. 62-63) renamed these strata the "Kelly limestone" after the mining town of Kelly on the west side of the Magdalena Mountains. G. H. Girty (in Gordon, 1907, p. 58) identified fossils collected by Lee from the southern Ladron Mountains, which he considered to be of early Mississippian age. Loughlin and Koschmann (1942) in their study of the Magdalena Mountains collected two small lots of Mississippian fossils, which G. H. Girty noted as being unlike, suggesting marked differences of age. Noble (1950, p. 38; also Kelley and Silver, 1952, p. 86-87) proposed the name "Caloso formation" for the entire Mississippian section in the Ladron Mountains and collected a fauna of brachiopods from the base of his section; these were identified by S. A. Northrop (Kelley and Silver, p. 86), who believed that they were Kinderhook in age and suggested that they were related to the fauna of the Escabrosa limestone of southeastern Arizona. Armstrong (1955, p. 30-32) divided the Mississippian strata of the Ladron Mountains into two formations, the Caloso formation, and the overlying Kelly formation. Armstrong (1958) published detailed descriptions of the lithology and paleontology of the Mississippian strata of west-central New Mexico. The present paper is largely taken from that report.

Caloso Formation

The oldest Paleozoic rocks in west-central New Mexico are the Caloso formation of earliest Osage age. The Caloso formation is known only in west-central New Mexico, occurring in the Coyote Hills, in the Lemitar, Ladron, and Magdalena Mountains, and as pre-Pennsylvanian erosional remnants in the southern end of the Manzano Mountains (fig. 1). It rests on peneplained Precambrian igneous and metamorphic rocks. The Precambrian rocks consist of phyllites, schists, quartzites, greenstones, coarse-grained porphyroblastic gneisses, granites, and related pegmatites and aplites. The basal bed of the Caloso formation, which was deposited over this heterogeneous Precambrian terrain, generally is a transgressive detrital-quartz sandstone, graywacke, or arkose. This bed ranges in thickness from a few inches to about 3 feet. Its mineralogical composition varies markedly over short lateral distances; within a few hundred yards it grades from a pure orthoquartzite into arkose and shales. The mineralogical makeup of the basal clastic unit is related to the composition of the underlying Precambrian rocks. Above the basal clastic bed, there is, at most places, a few feet of gray shale and nodular thin-bedded limestone. This is overlain by about 30 to 40 feet of massive gray dolomitic limestone, which contains bands of gray to black locally fossiliferous chert.

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The sparse funa of the Caloso formation, shown in table 1, makes age determination hazardous, but it appears to be of earliest Osage age. The Caloso formation is thought to be correlative with the Andrecito member of the Lake Valley formation of south-central New Mexico (fig. 2). However, the Caloso fauna is not characteristic of the Andrecito but rather of the lowest 150 feet of the Escabrosa formation in the Klondike Hills and Big Hachet Mountains of southwestern New Mexico.

TABLE 1. — FOSSILS FROM THE CALOSO FORMATION, COYOTE HILLS AND MAGDALENA, LEMITAR, AND LADRON MOUNTAINS, NEW MEXICO.

	Coyote Hills	Magdalena Mountains	Lemitar Mountains	Ladron Mountains
Brachipoda				
Schuchertella? sp.	-	X	-	-
Camarotoechia tuta (Miller)	X	X	X	-
Rhynchotreta? sp.	-	X	-	-
Dielasma chouteauensis Weller	-	-	?	X
Spirifer louisianensis Rowley	-	X	-	-
Spirifer centronatus ladronensis, n. subsp.	-	?	-	X
Composita? sp.	-	X	-	-
Syringothyris? sp.	X	X	-	-
Streptorhynchus? sp.	-	X	-	-
Mollusca				
Conocardium sp.	-	-	-	X
Pelecypods, several genera	X	X	-	X
Straparolus luxus (White)	X	?	-	X
Coelenterata				
Michelinia sp.	-	X	-	-
Aulopora sp.	-	X	X	-
Cyathophyllum? sp.	-	X	X	X

Kelly Formation

The Kelly formation is 10 to 60 feet thick and is a medium-bedded crinoidal limestone which contains abundant nodules of white to brown chert. It is separated from the Caloso formation by a disconformity of very minor relief, a hiatus, however, which represents at least all of Burlington time. The base of the Kelly formation is marked by a 1-inch zone of clean, clear quartz sandstone which imperceptibly grades upward into crinoidal limestone. In the Magdalena and Lemitar Mountains, 8 to 10 feet above the base of the Kelly formation, is a distinctive marker zone of dolomitic limestone and shale, 8 to 10 feet thick. This has been named the "silver pipe" by miners in the Magdalena Mountains. Farther north, in the Ladron Mountains, this zone is absent. A large fauna of invertebrates from the Kelly formation, listed in table 2, is of Keokuk, late Osage age.

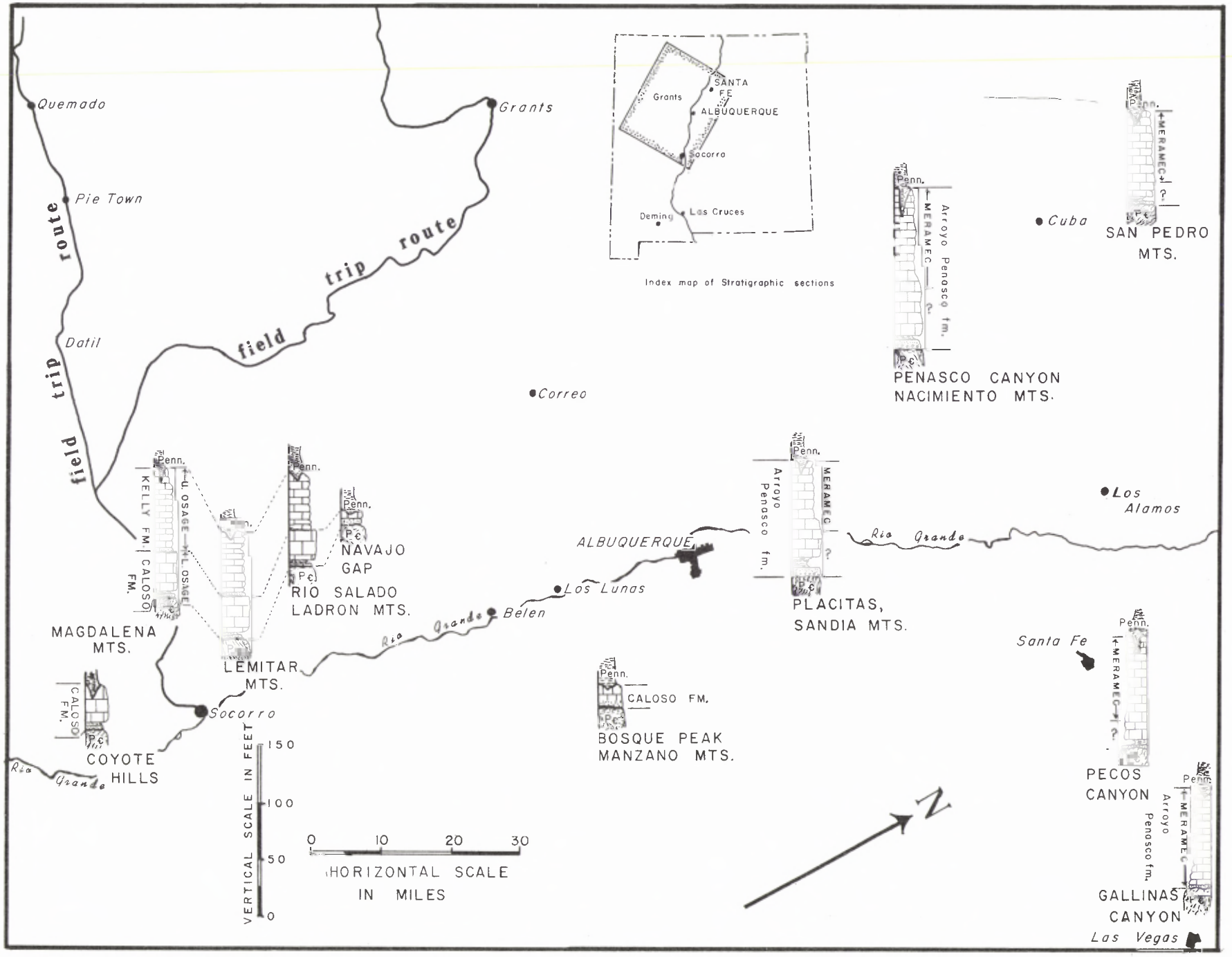

Figure 1. — Diagrammatic columnar sections of Mississippian strata of west-central and north-central New Mexico, illustrating spatial and time relationships.

TABLE 2. — FAUNA OF THE KELLY FORMATION OF THE MAGDALENA, LEMITAR, AND LADRON MOUNTAINS, NEW MEXICO.

	Magdalena Mountains	Lemitar Mountains	Ladron Mountains
Brachiopoda			
"Orthotetes?" sp.	X	X	X
Streptorhynchus? sp.	X	-	-
Rhipidomella sp.	X	X	X
Linoproductus sp.	X	X	X
Productus, sensu lato, several species	X	X	X
Echinoconchus? sp.	X	-	-
Chonetes cf. **illinoisensis**	-	-	X
Tetracamera cf. **subtrigona** (Meek and Worthen)	X	X	X
Tetracamera subcuneata (Hall)	X	X	X
Rhynchopora persinuata (Winchell)	-	-	X
Spirifer tenuicostatus Hall	X	X	X
Spirifer grimesi Hall	X	X	X
Spirifer? sp.	X	X	X
Spirifer? sp.	X	X	X
Brachythyris suborbicularis (Hall)	X	X	X
Athyris aff. **lamellosa** (Leveille)	X	X	X
Cleiothyridina hirsuta (Hall)	X	X	X
Cleiothyridina? parvirostris (Meek and Worthen)	X	-	-
Cleiothyridina obmaxima (McChesney)	X	X	X
Dimegelasma neglectum (Hall)	-	X	X
Blastoidea			
Pentremites conoideus Hall	X	X	X
Orbitremites floweri, n. sp.	X	X	X
Mollusca			
Platyceras sp.	X	X	X
Straparolus spp.	X	X	X
Pelecypods, several genera	X	X	X
Coelenterata			
Zaphriphyllum casteri, n. sp.	X	X	X
Rare fragments of an indeterminable genus	X	X	X
Bryozoa			
Large fauna, unstudied	X	X	X
Arthropoda			
"Phillipsia" sp.	X	X	X
Vertebrata			
Shark's tooth	X	X	X
Protozoa			
Plectogyra sp.	X	X	X

The Kelly formation is separated from the overlying Pennsylvanian Sandia formation by an angular unconformity which reflects deep pre-Sandia stream channeling and truncation. The Mississippian strata of the southernmost exposures in the Ladron Mountains near the Rio Salado are about 90 feet thick, including some 50 feet of the Kelly formation. They were bevelled progressively northward by pre-Sandia erosion (fig. 3). Near Ladron Peak, about 45 feet of Mississippian strata escaped erosion, whereas a mile north of Ladron Peak, the Mississippian occurs only in the synclinal remnant 2 miles south of Navajo Gap.

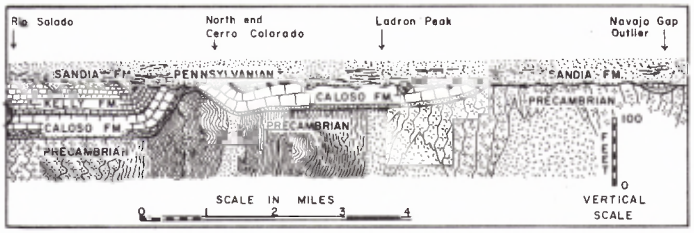

Figure 3. — Erosional pinchout of Mississippian strata in the southern Ladron Mountains, northward from the Rio Salado to Navajo Gap. Armstrong (1958, p. 14).

In south-central New Mexico, in the Mimbres and Cooks Ranges and the Silver City area, above the Tierra Blanca member (lower Osage) of the Lake Valley formation, Laudon and Bowsher (1949) reported crinoidal limestone, which they called the Kelly formation. They (idem, 1949, p. 9, 15) placed the entire Mississippian section of the Magdalena Mountains in one continuous unit, the Kelly formation, which they were certain was pre-Meramec in age, though undecided as to its exact position. Their so-called Kelly formation equivalent in south-central New Mexico contains few fossils. The writer is studying a small collection of corals and brachiopods from these rocks. The "Kelly formation" in the Mimbres Range has yielded upper Osagian brachiopods, such as **Syringothyris subcuspidatus** (Hall), **Spirifer grimesi** Hall, and **Spirifer logani** Hall. In the upper half of a massive crinoidal unit in the Escabrosa formation in the Klondike Hills, Big Hatchet and Animas Mountains of New Mexico, and the Chiricahua Mountains of Arizona, the limestone carries a fauna, characterized by **Syringothyris subcuspidatus**, which is of Keokuk (late Osage) age and apparently a time and stratigraphic equivalent of the Kelly formation of west-central New Mexico.

Mississippian Geologic History

The sea in which the Ouray, Percha, and Portal formations were deposited withdrew completely from the region near the end of the Devonian period. At the beginning of the Mississippian period, New Mexico was a completely emergent peneplain at or near sea level. In late Kinderhook (Chouteau) time, a broad, shallow basin developed in south-central New Mexico, in which the Caballero formation was deposited. This Kinderhook basin of deposition may have extended into southwestern New Mexico and the lowest 50 to 75 feet of carbonates of the Escabrosa formation may be of Kinderhook age.

By Fern Glen (latest Osage) time, the Escabrosa basin in southwestern New Mexico deepened, and marine waters spread north and east, depositing in south-central New Mexico the Andrecito and Alamogordo members of the Lake Valley formation, and in the west-central part of the State the Caloso formation. The Nunn member (low Osage) of the Lake Valley formation in the south-central part of the State apparently represents a retreat of the marine waters from the shelf area in west-central New Mexico.

The events of Burlington time (middle Osage) are recorded in the Tierra Blanca, Arcente, and Dona Ana members of the Lake Valley formation. Faunas from these members are poorly known, but it is evident that during this time the Mississippian sea was again restricted to the

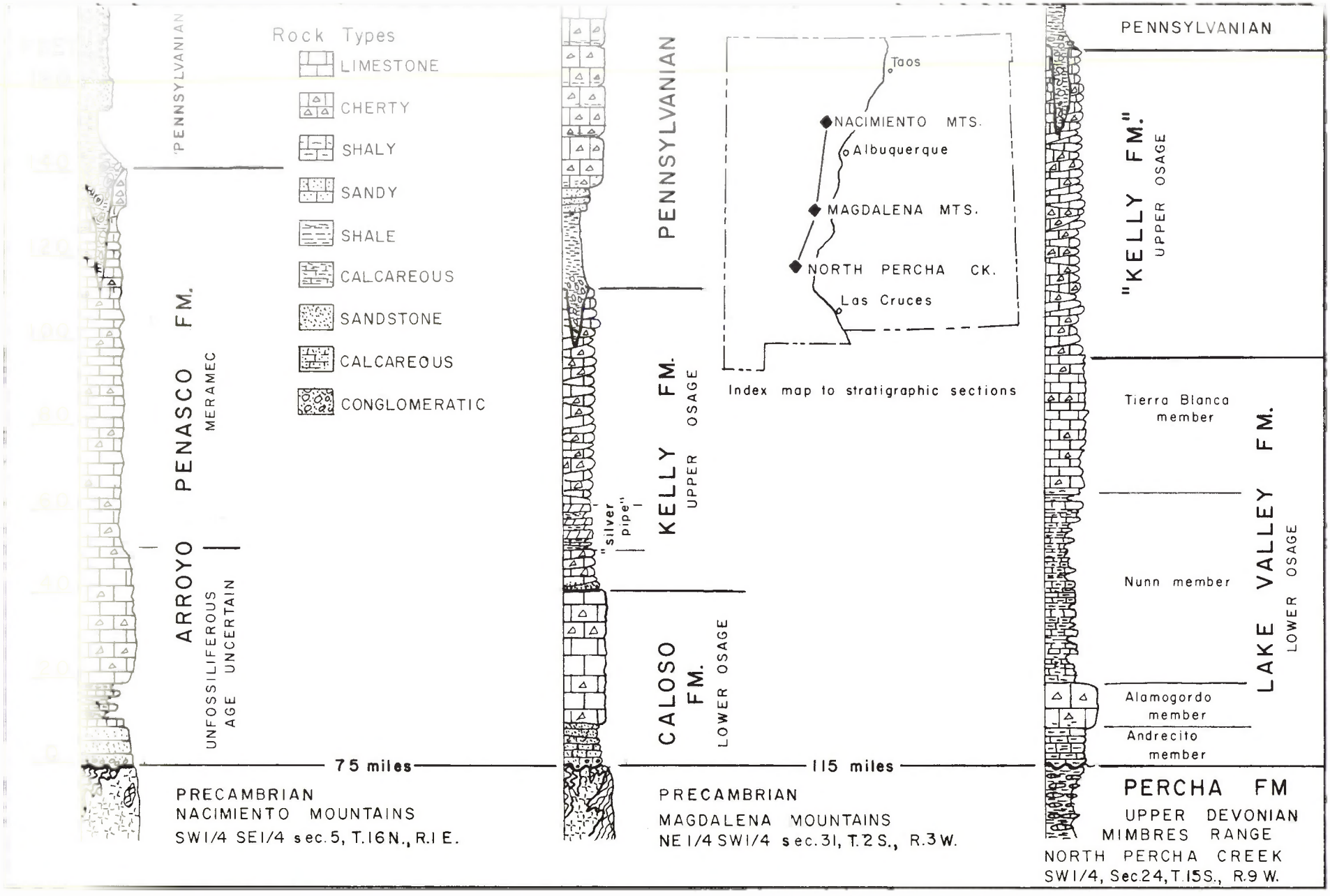

Figure 2. — Stratigraphic columns of the Mississippian strata from north-central to south-central New Mexico, illustrating the age relationships and lithologies.

southern and southwestern parts of the State. By late Osage (Keokuk) time, another widespread submergence occurred. Beds of this age are well represented in the thick, upper crinoidal part of the Escabrosa formation in southwestern New Mexico. Strata of equivalent age are also apparently present in the "Kelly formation" of the Black Range, Mimbres Range, and Silver City area. The Kelly formation of Keokuk age, at its northernmost exposure in the Ladron Mountains, is a clean crinoidal limestone, which indicates that it must have extended somewhat farther north at one time.

In southwestern New Mexico, in the Escabrosa basin, there is no physical evidence of a hiatus between beds of Osage and Meramec age. In the southern end of the Sacramento and San Andres Mountains in south-central New Mexico, Laudon and Bowsher (1941, 1949) reported Meramec beds resting with angular unconformity on beds of Osage (Lake Valley) age.

In Meramec time the peneplain cut on Precambrian rocks, in northern New Mexico, was flooded extensively and the Arroyo Penasco formation was deposited (Armstrong, 1955). Strata equivalent in age to the Arroyo Penasco are represented by about a hundred feet of carbonates at the top of the Escabrosa formation in southwestern New Mexico. It is possible that a thin veneer of Meramec limestone once extended over the entire State but was removed by erosion during late Chester and early Pennsylvanian time.

The beginning of Chester time was marked by a retreat of marine waters to extreme southern and southwestern New Mexico. Sedimentation continued in this restricted area until middle Chester time at least. Elsewhere the veneer of earlier Mississippian limestone was subjected to subaerial erosion and karsting. By late Chester and early Pennsylvanian time, strong orogenic forces caused folding and faulting over broad areas of New Mexico, accompanied by rapid and uneven erosion of much of the Mississippian, and resulted in the present erratic and disjunct nature of the Mississippian strata.

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