

LATE TRIASSIC VERTEBRATE LOCALITIES IN NEW MEXICO

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Abstract - Significant (and some world-class) Late Triassic vertebrate localities are present across the northern half of New Mexico. Localities reviewed here are Fort Wingate (McKinley County), Canjilon and Whitaker (Ghost Ranch) quarries (Rio Arriba County), Lamy amphibian quarry (Santa Fe County), Peacock and Sloan canyons (Union County), Bull Canyon (Guadalupe County), Mesa Redonda, Apache Canyon, Shark-Tooth Hill, Barranca Creek and Revuelto Creek (the last five in Quay County). Most of these localities are of early Norian age and represent some of the youngest Late Triassic vertebrates known from the Southwest.

INTRODUCTION

Although Upper Triassic strata were originally recognized in New Mexico by Marcou (1858), it was Cope (1875) who first reported Late Triassic vertebrate fossils from the state. Since Cope, many Late Triassic vertebrates have been collected from New Mexico. Indeed, some world-famous Late Triassic vertebrate localities are known in the state of New Mexico. Here, we review these and other scientifically significant Late Triassic vertebrate localities in New Mexico (Figs. 1, 2). The following institutional abbreviations are used: AMNH, American Museum of Natural History, New York; CM, Carnegie Museum of Natural History, Pittsburgh; CMNH, Cleveland Museum of Natural History, Cleveland; NMNH, National Museum of Natural History, Washington; NMMNH, New Mexico Museum of Natural History, Albuquerque; UCMP, University of California Museum of Paleontology, Berkeley; UMMP, University of Michigan Museum of Paleontology, Ann Arbor; UNM, University of New Mexico, Albuquerque; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D. C.; YPM, Yale Peabody Museum, New Haven.

FORT WINGATE

Geographic and Stratigraphic Context

Secs. 9 and 16 (unsurveyed), T14N, R16W, McKinley County, New Mexico; ownership Federal. The fossil vertebrate and plant localities here are in the lower part of the Petrified Forest Member of the Chinle Formation (Fig. 3). We do not endorse Ash's (1978b) use of Monitor Butte Member in this area, nor do we believe his "Ciniza Lake Beds," based on a unit a couple of m thick that crops out over a few tens of acres should be recognized as a formal stratigraphic unit. Furthermore, Ash's

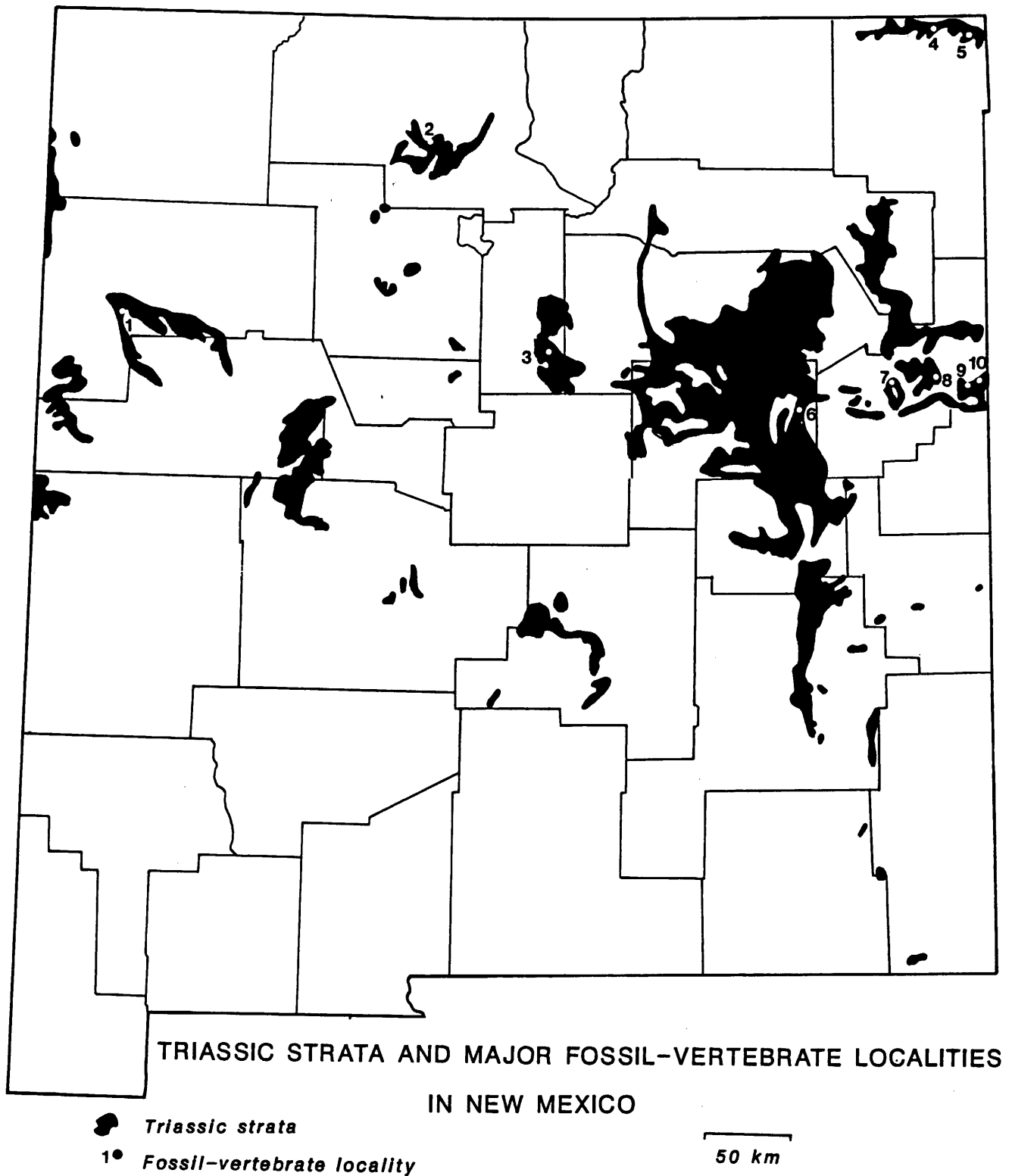


FIGURE 1. Triassic strata and major fossil-vertebrate localities in New Mexico. Localities are: 1. Fort Wingate, 2. Canjilon and Whitaker quarries, 3. Lamy amphibian quarry, 4. Peacock Canyon, 5. Sloan Canyon, 6. Bull Canyon, 7. Mesa Redonda, 8. Apache Canyon, 9. Barranca and Revuelto Creeks, 10. Shark-Tooth Hill.

	WESTERN NEW MEXICO	CENTRAL NEW MEXICO	EASTERN NEW MEXICO
EARLY NORIAN		Whitaker quarry Canjilon quarry	Mesa Redonda Apache Canyon Sloan Canyon Shark-tooth hill Peacock Canyon Bull Canyon Revuelto Creek Barranca Creek
LATE CARNIAN	Fort Wingate	Lamy amphibian quarry	

FIGURE 2. Approximate temporal distribution of major Late Triassic fossil-vertebrate localities in New Mexico.

(1978b) claims for syndepositional slumping in the Chinle here cannot be upheld. The steeply dipping Chinle beds near Fort Wingate are the result of Laramide (Late Cretaceous-early Tertiary) tectonism and/or late Cenozoic slumping. No angular unconformity exists within the Chinle Formation at Fort Wingate.

Fauna and Age

Vertebrate taxa are Chinlea, cf. Metoposaurus, cf. Stagonolepis and unidentified phytosaur. An extensive megafloora as well as palynomorphs, conchostracans and coprolites from near Fort Wingate are described in Ash (1978a) and references cited therein.

The Chinlea material only consists of scales (Ash, 1978a). Amphibian fossils from Fort Wingate in the NMMNH and UCMF indicate an animal the size of Metoposaurus fraasi. Mehl et al. (1916) identified phytosaur specimens from Fort Wingate as Angistorhinus and Paleorhinus. However, we believe these specimens cannot be identified to the genus level.

The best preserved vertebrate specimen from Fort Wingate is the holotype partial skeleton of the aetosaur Acompsosaurus wingatensis Mehl, 1916. This specimen does not pertain to Typothorax as suggested by Gregory (1953) (cf. Long and Ballew, 1985). It is not the oldest Chinle aetosaur (contra Long and Ballew, 1985) simply because it is not in the Monitor Butte Member of the Chinle, and therefore not demonstrably older than other lower Petrified Forest Member aetosaurs. The type specimen

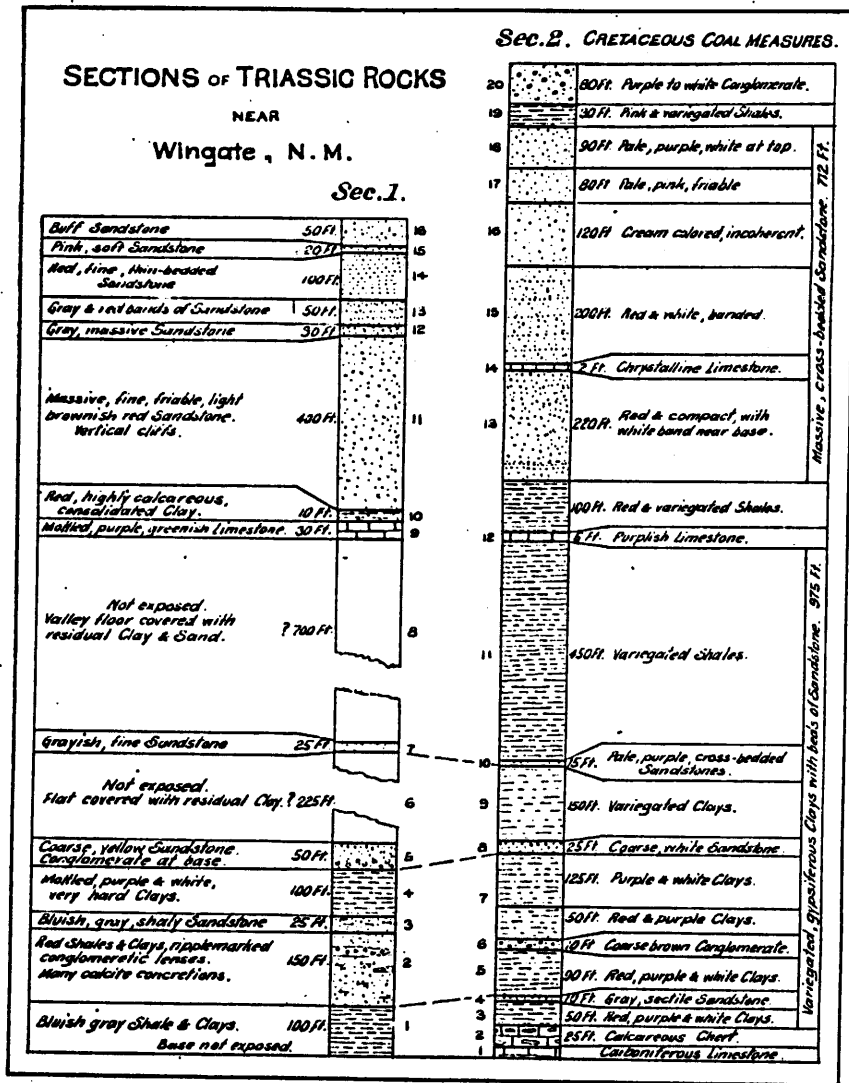


FIGURE 3. Mehl et al. (1916) stratigraphic sections at Fort Wingate. In section 1, units 11-16 are Entrada Sandstone; underlying units are Chinle; unit 5 is the Sonsela Sandstone.

of Acomposaurus is now lost, so it must be evaluated from published illustrations. The pelvis differs from that of Desmatosuchus in having a shorter, broader pubis and an ischium that apparently lacks a vertical supra-acetabular ridge. Instead, the pelvis of Acomposaurus closely resembles that of Stagonolepis robertsoni (Walker, 1961, fig. 16). Therefore, we tentatively believe Acomposaurus wingatensis is a probable species of Stagonolepis.

The probable presence of Metoposaurus and Stagonolepis and stratigraphic position (lower Petrified Forest Member) suggest a Carnian age for the Fort Wingate localities.

Sedimentology and Taphonomy

The Ciniza pond deposit is an unusual (for the Chinle)

sequence of laminated carbonaceous mudstone among typical Chinle red-bed lithologies (Ash, 1978b). These strata have been interpreted as representing a small, tropical, oligomictic lake which was chemically stratified, soft and slightly alkaline with no strong currents (Ash et al., 1978). Bottom waters were stagnant, and the pond floor was composed of organic-rich mud (Ash et al., 1978).

Surrounding beds are of fluvial origin. Mehl et al. (1916) noted that bone fragments are uncommon in mudstones near Fort Wingate. It is not clear what lithology produced the Acompsosaurus type, other than it was in a "red shale" sequence (Mehl et al., 1916). Camp noted bone fragments in fluvial strata and concretions, with the best specimens coming from red-weathering, dark blue strata. The interclavicle at NMMNH came from a massive red mudstone.

History of Collection

In 1914, M. G. Mehl, assisted by G. M. Schwartz, collected vertebrate fossils in Arizona and New Mexico (Mehl et al., 1916). Some of the fossils they collected, including the holotype of Acompsosaurus wingatensis, apparently are lost. All that remains are two specimens in the Field Museum of Natural History, FMNH UC 1252, a phytosaur ilium illustrated by Mehl et al. (1916, plate 2) and FMNH PR 1694, a poorly preserved phytosaur femur.

C. L. Camp collected from near Fort Wingate in 1924. He arrived there on 19 May and was allowed to use a small house by the commander of the fort, Captain Lewis. Camp, in his unpublished field notes for 1924 (UCMP archives) noted that "the best Triassic bad-land exposures east of Gallup surround the Fort....and prospects seem favorable for finding bones." However, he was severely disappointed, noting in his field notes the very next day that the strata here were "almost non-fossiliferous." However, on 21 May he did find several phytosaur vertebrae and part of an ilium near the McGaffey mill. The next day he left Fort Wingate for Thoreau, where he found some phytosaur fossils (Camp, 1930, map A).

From the early 1960's until the present S. Ash has collected fossil plants in the Wingate area (see Ash, 1989 for a bibliography of published work on these plants). He and others also collected and studied conchostracans, coprolites, fish scales and palynomorphs from "Lake Ciniza" (Ash, 1978a). In 1987, Hunt and Kietzke collected a fragmentary metoposaurid interclavicle, plants and microfossils for NMMNH. In 1988, Lucas and others also collected similar material for NMMNH.

CANJILON QUARRY

Geographic and Stratigraphic Context

NE1/4 SW1/4 SW1/4, sec. 3, T24N, R4E, Rio Arriba County, New Mexico (Fig. 1); ownership private. The Chinle Formation in the Ghost Ranch area (Fig. 4) consists of (in ascending order) the

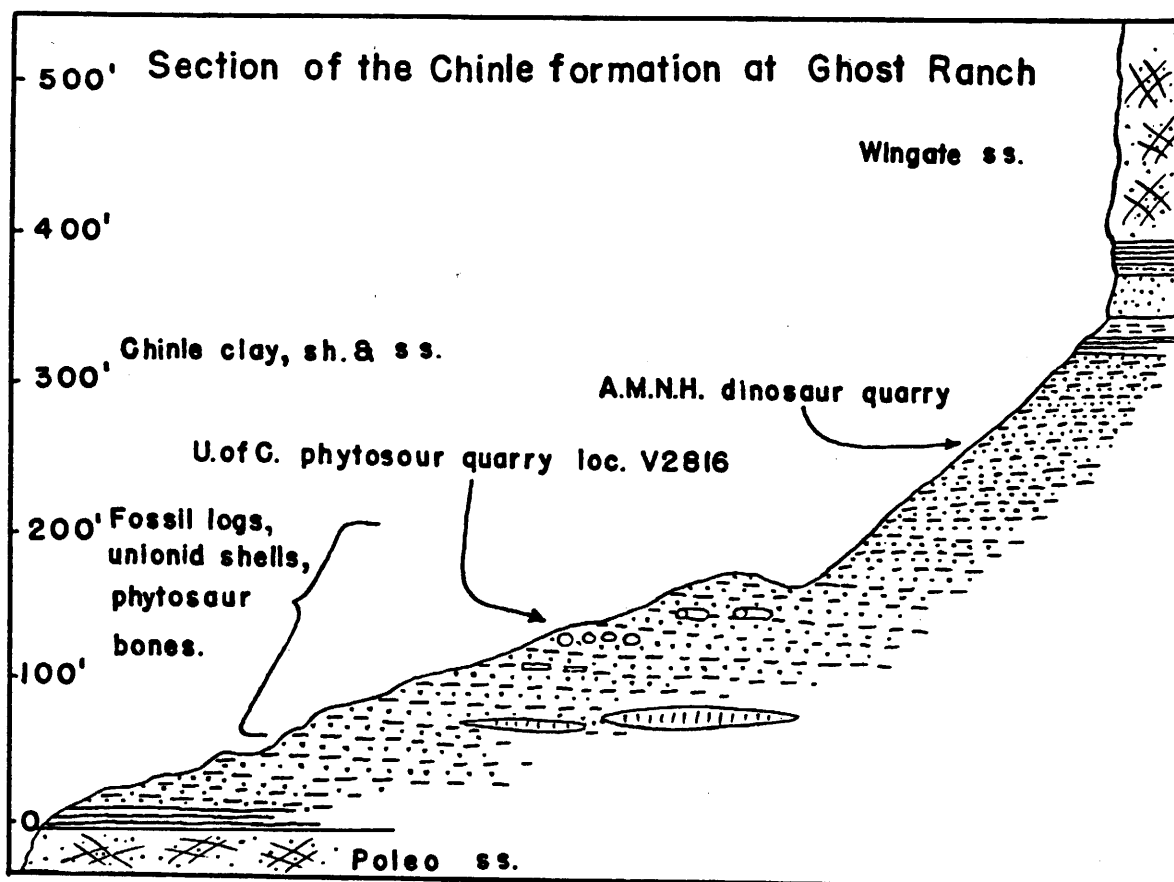


FIGURE 4. Stratigraphic section at Ghost Ranch (from Colbert, 1950) showing the Canjilon quarry ("U. of C. phytosaur quarry loc. V2816") and the Whitaker quarry ("AMNH dinosaur quarry"). Note that the unit identified as Wingate Sandstone actually is Entrada Sandstone.

Agua Zarca Sandstone Member, Salitral Shale Tongue, Poleo Sandstone Lentic, Petrified Forest Member and the siltstone member (Dubiel, in press). The Canjilon quarry is in the Petrified Forest Member (contra Litwin, 1986), 65.5 m below the Entrada Sandstone (Litwin, 1986).

Fauna and Age

The Canjilon quarry has produced abundant phytosaur material and the aetosaur Typothorax coccinarum. NMMNH has a collection from the Petrified Forest Member in the Ghost Ranch area that includes additional phytosaur specimens, Typothorax scutes, fragments of a new, small metoposaurid (see Apache Canyon below) and a partial skeleton of Coelophysis bauri. The nearby Whitaker (Coelophysis) quarry is in the siltstone member. Colbert (1974) lists Ceratodus (=Arganodus), Metoposaurus, Typothorax, "Rutiodon" and Coelophysis from the Chinle Petrified Forest Member in northern New Mexico. The phytosaur skulls from the Canjilon quarry were attributed to Rutiodon tenuis by Lawler (1976).

The phytosaur specimens from the Canjilon quarry are

important in that they represent the only reasonably size quarry sample of phytosaurs known anywhere in the world. Ballew (1986, 1989) assigned these phytosaurs to two species, Pseudopalatus (= Nicrosaurus of Murry and Long, 1989) pristinus and P. buceros. She argued that these taxa inhabited different ecological niches as indicated by their dental morphology.

Litwin (1986) collected pollen from just above the Canjilon quarry which he considered of early Norian age. The presence of a Pseudopalatus/Nicrosaurus-grade phytosaur and Typothorax suggests correlation with the upper part of the Petrified Forest Member in Petrified Forest National Park and the Bull Canyon Formation in east-central New Mexico, both of which are considered to be of Norian age.

Sedimentology and Taphonomy

The Petrified Forest Member of the Chinle Formation in the eastern San Juan Basin represents the deposits of high-sinuosity river channels (Dubiel, in press). Associated floodplain areas apparently developed thick paleosols which suggests seasonal precipitation (Dubiel, in press).

The Canjilon quarry produced a nearly complete phytosaur skeleton, three incomplete skeletons and a total of 10 skulls and numerous postcrania (Lawler, 1976). Typothorax is represented by three articulated, incomplete skeletons (Long and Ballew, 1985). However, the articulated skeletons are scattered over a broad area and mixed with diarticulated specimens (Long et al., 1989, fig. 1). Unpublished field notes of C. L. Camp and S. P. Welles indicate that the quarry matrix was reddish mudstone with calcareous nodules scattered through it, particularly at the base of the bone-producing interval (Lawler, 1976).

Although no explicit taphonomic analysis has been undertaken of the Canjilon quarry, it appears to represent a hydrodynamically sorted and/or scavenged assemblage. Lawler (1976) indicates that the field notes of the quarry workers suggest the depositional environment could have been a stream channel or pond. The former seems unlikely, given the fine-grained quarry matrix and the broad area encompassed by the quarry (Long et al., 1989, fig. 1).

History of Collection

The Canjilon quarry was excavated during 1928, 1930 and 1933 by Charles L. Camp with the assistance of R. Arriss, H. Anderson, G. Barrington and S. P. Welles (Lawler, 1976). All of the fossils excavated are in the UCMP. The collection was prepared and partially curated by WPA personnel during the 1930's, and Lawler further curated the material during the early 1970's. In the late 1930's, Harvard University collected two incomplete skeletons of Typothorax from the Canjilon quarry (Long and Ballew, 1985). This material has not been fully prepared.