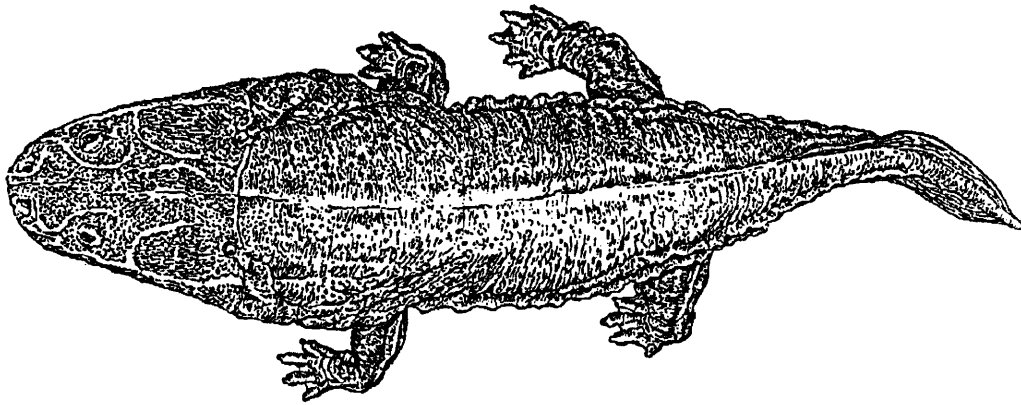


STRATIGRAPHY AND SEDIMENTOLOGY



**REVISED TRIASSIC STRATIGRAPHY IN THE TUCUMCARI BASIN,
EAST-CENTRAL NEW MEXICO**

SPENCER G. LUCAS and ADRIAN P. HUNT

New Mexico Museum of Natural History, P.O. Box 7010, Albuquerque,
New Mexico 87194

Abstract - We revise the Triassic stratigraphic nomenclature in the Tukumcari basin of east-central New Mexico and propose two new formations--Garita Creek and Bull Canyon--for some of the Upper Triassic strata in this area. The oldest Triassic strata in the Tukumcari basin are Anisian rocks of the Anton Chico Member of the Moenkopi Formation. The Upper Triassic Santa Rosa Formation disconformably overlies the Moenkopi and consists of three members (in ascending order): Tecolotito, Los Esteros, and Tres Lagunas. An extensive vertebrate fauna of Late Triassic (Carnian) age is known from the Los Esteros Member of the Santa Rosa Formation near Lamy in Santa Fe County and is the oldest Late Triassic vertebrate fauna in the Tukumcari basin. The Santa Rosa Formation is conformably overlain by the Garita Creek Formation, a new name for the unit long referred to as "lower shale member" of the Chinle Formation. The term Trujillo Formation, long used in the Palo Duro basin of west Texas, replaces Cuervo Member of Chinle Formation in the Tukumcari basin. The Trujillo Formation grades upward to the Bull Canyon Formation, a new name for the unit long termed "upper shale member" of Chinle Formation in east-central New Mexico. The youngest Triassic strata in the Tukumcari basin pertain to the Redonda Formation which conformably overlies the Bull Canyon Formation and is disconformably overlain by the Middle Jurassic Entrada Sandstone.

INTRODUCTION

Jules Marcou (1858) identified "Keuper" strata near Tukumcari in east-central New Mexico and thereby first recognized the presence of Triassic strata in the American Southwest. In the ensuing 140 years, stratigraphic understanding of Upper Triassic strata in east-central New Mexico (upper Paleozoic Tukumcari basin) has evolved considerably (see Lucas et al., 1985b for a review of the literature). Here, we present a revised nomenclature of Triassic strata in the Tukumcari basin, based on studies we have undertaken since Lucas et al. (1985b) and Lucas and Hunt (1987).

REVISED NOMENCLATURE

The revisions in Triassic stratigraphic nomenclature in the Tukumcari basin proposed here (Fig. 1) reflect the following considerations:

1. When we named the Anton Chico Formation two years ago (Lucas and Hunt, 1987), we believed it represented Middle Triassic strata deposited in a basin east of the Rio Grande rift, and therefore well separated from the depositional basin of the

		Lucas, Hunt and Morales (1985)		
		Lucas and Hunt (1987)	This Paper	
UPPER TRIASSIC	CHINLE FORMATION	Redonda Member	REDONDA FORMATION	
		upper shale member	BULL CANYON FORMATION	
		Cuervo Member	TRUJILLO FORMATION	
		lower shale member	GARITA CREEK FORMATION	
	SANTA ROSA FORMATION	Tres Lagunas Member	SANTA ROSA FORMATION	Tres Lagunas Member
		Los Esteros Member		Los Esteros Member
Tecolotito Member		Tecolotito Member		
MIDDLE TRIASSIC	ANTON CHICO FORMATION	MOENKOPI FORMATION	Anton Chico Member	

FIGURE 1. Most recent (left) and revised (right) nomenclature of Triassic strata in the Tukumcari basin, east-central New Mexico.

correlative portion of the Moenkopi Formation on the Colorado Plateau. However, the yeoman efforts of Steven Hayden (1988) in collaboration with us (Hayden and Lucas, 1988a,b; Hunt and Lucas, 1988a) have disproven this idea. Moenkopi strata are present across western and central New Mexico; paleocurrent and lithologic data suggest a north-south depositional slope in a large basin that extends across the entire northern half of the state, from Upper Nutria (T12N, R16W, McKinley County) to the west to Alamogordo Reservoir (T5N, R24E, DeBaca County) to the east. The exact configuration and full extent of this basin are not yet known, but clearly it encompassed the depositional system responsible for the Anton Chico Formation as conceived by Lucas and Hunt (1987). Therefore, we reduce the Anton Chico to member status in the Moenkopi Formation.

2. We abandon the term Chinle Formation in east-central New Mexico. In doing so, we follow the reasoning of McKee (in Reeside et al., 1957) and Chatterjee (1986) when they rejected use of the term Chinle in West Texas. Moreover, we note that: (1) strata equivalent to the Chinle of the Colorado Plateau in east-central New Mexico included not just those strata previously referred to

as Chinle, but the Santa Rosa Formation as well (Lucas et al., 1985b), and (2) much of the Upper Triassic section in east-central New Mexico was deposited in a separate basin (or basins) than Chinle deposition to the west. For these reasons, we no longer advocate use of the Chinle Formation in the Tucumcari basin.

3. However, in abandoning the term Chinle, we do not replace it with Dockum. As we (Lucas et al., 1985b, 1987) have already noted, Dockum is not a particularly precise or useful stratigraphic term. The Triassic section in the Tucumcari basin encompasses strata both younger and older than "Dockum" strata in West Texas, and more precise nomenclature is available for the east-central New Mexico strata.

4. The more precise nomenclature we advocate here (Fig. 1) is a sequence of six formations to encompass Middle and Upper Triassic strata in the Tucumcari basin. Garita Creek and Bull Canyon formations are new names introduced here. Rich (1921) and Darton (1922) first used the name Santa Rosa, and Dobrovolsky and Summerson (in Dobrovolsky et al., 1946) coined the name Redonda Formation, and we extend the Arizona name Moenkopi Formation into the Tucumcari basin. All of these changes are discussed at length in what follows.

ANTON CHICO MEMBER OF MOENKOPI FORMATION

Lucas and Hunt (1987) coined the name Anton Chico Formation for strata earlier included in the Santa Rosa Formation as its "lower red sandstone member" (Gorman and Robeck, 1946) or in the Permian Bernal Formation (Johnson, 1974). However, subsequent studies by Hunt and Lucas (1988a), Hayden and Lucas (1988a,b) and Hayden (1988) demonstrated the essential continuity of the Moenkopi Formation from near Holbrook, Arizona across New Mexico to as far east as Fort Sumner. It thus seems necessary to subsume the Anton Chico Formation as a member of the Moenkopi. As so recognized, the Anton Chico Member of the Moenkopi is the basal Triassic unit in the Tucumcari basin. We now extend it as far west as the Lucero uplift (T5N, R4W, Cibola County), where it grades laterally into strata of the Holbrook and Wupatki (?) members of the Moenkopi Formation. Across the Tucumcari basin, the Anton Chico Member of the Moenkopi Formation is disconformably (Tr-3 unconformity of Pipiringos and O'Sullivan, 1978) overlain by the Upper Triassic Santa Rosa Formation.

SANTA ROSA FORMATION

Lucas and Hunt (1987) revised the Santa Rosa Formation by recognizing three formal members -- Tecolotito, Los Esteros and Tres Lagunas -- and coining the name Anton Chico Formation for Gorman and Robeck's (1946) "lower red sandstone member" of the Santa Rosa (see above). Since Lucas and Hunt (1987), only two aspects of our knowledge the Santa Rosa Formation are worth noting:

1. The Santa Rosa is present as far west as T14N, R10E near

Lamy in Santa Fe County (Allen and Lucas, 1988). Here, Johnson (1973) recognized and mapped informal and lower members of the Santa Rosa. His upper member is our Los Esteros and Tres Lagunas members; his lower member is our Tecolotito Member. Further west, in the Hagan basin of Sandoval County (T12N, R6E to T13N, R5E), the basal Upper Triassic strata are as much as 80 m of sandstone that have been termed Santa Rosa (Kelley and Northrop, 1975). However, we refer these strata to the Agua Zarca Member of the Chinle Formation because of their lithologic similarity to Agua Zarca outcrops on the edge of the Colorado Plateau about 45 km to the northwest. The Agua Zarca Member in the Hagan basin lacks a medial mudstone interval (= Los Esteros Member of the Santa Rosa Formation) and displays northerly directed paleocurrents. This could indicate it pertains to the "sandstone member" of the Chinle Formation as used in the Nacimiento uplift by Stewart et al. (1972). However, like Woodward (1987), we do not believe paleocurrent differences merit separation of the Agua Zarca Member from a "sandstone member" in the Nacimiento uplift. Therefore, we assign basal Upper Triassic sandstones in the Nacimiento uplift and Hagan basin to the Agua Zarca Member and recognize their homotaxis with the Santa Rosa Formation of the Tucumcari basin.

2. Hunt and Lucas (1988b,c) described a vertebrate fauna of Carnian age from the Los Esteros Member of the Santa Rosa Formation near Lamy (NMMNH locality 149 in the NW1/4 SW1/4 NW1/4 SE1/4, sec. 12, T14N, R10E). This fauna, discovered by Phil Birchhoff, includes Unio sp., Metoposaurus sp., Desmatosuchus sp., cf. Calyptosuchus sp., Stagonolepidae Postsuchus kirkpatricki, a "Chatterjeea" and a new sphenosuchian. It represents the oldest Late Triassic assemblage of fossil vertebrates known from the Tucumcari basin. Ash (1988) described a megafossil flora from the Los Esteros Member of the Santa Rosa Formation at Santa Rosa. It is of Late Triassic (Carnian-Norian) age, but does not permit a more precise age assignment.

GARITA CREEK FORMATION

We coin the name Garita Creek Formation for the unit long referred to as the "lower shale member" of the Chinle Formation in the Tucumcari basin. Garita Creek is an intermittent tributary of Conchas Lake in southern San Miguel County, New Mexico. The type section of the Garita Creek Formation is along and just south of the creek, about 0.25 km southwest of NM-Highway 105 in sec. 4, T12N, R24E (Fig. 2; Appendix 1). The Garita Creek Formation is extensively exposed in the drainage of the Conchas River and its tributaries south and west of Conchas Lake in southern San Miguel County. Here, it forms the slopes along escarpments capped by the Trujillo Formation.

At its type section, the Garita Creek Formation is 71 m thick (Fig. 2) and is dominated by mudstone (73% of the section). About 25% of the section is sandstone, and only 2% is conglomerate. The mudstone is dominantly grayish red (5 R 4/2) and moderate reddish brown (10 R 4/6) with sparse, light greenish gray (5 G 8/1) mottles. The sandstones are mostly massive and

