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INVERTEBRATE PALEONTOLOGY OF THE UPPER TRIASSIC SNYDER QUARRY, CHINLE GROUP, CHAMA BASIN, NEW MEXICO

SPENCER G. LUCAS, KATE E. ZEIGLER and ANDREW B. HECKERT

New Mexico Museum of Natural History, 1801 Mountain Road NW, Albuquerque, NM 87104-1375

Abstract—The Snyder quarry in the Chama basin of north-central New Mexico is stratigraphically high in the Petrified Forest Formation of the Chinle Group and of Revueltian (Norian) age. Besides an extensive fossil vertebrate assemblage, the quarry yields a small assemblage of nonmarine invertebrates from mudstones and conglomerates a few meters above the principal bonebed. A single, incomplete conchostracan carapace from the mudstone has fine growth lines, granular sculpture, no longitudinal striae and a carapace length of ~ 6 mm. It can be tentatively assigned to the polymorphic genus *Lioestheria,* and it indicates the presence of a shallow, ephemeral pond of probable high alkalinity soon after Snyder bonebed accumulation. Mudstone above the main bonebed also yielded a decapod specimen that is wide-bodied and short-tailed, unlike other known Triassic crustaceans. This animal represents the first decapod body fossil from the Triassic of New Mexico and is the oldest eubrachyuran crab.

The most abundant invertebrates from the Snyder quarry are unionid bivalves from a conglomerate above the main bonebed. These unionids are elongate to ovate in outline, thin shelled and have abrupt anterior ends and prominent umbonal ridges. They are tentatively assigned to *Antediplodon terraerubrae* (Meek, 1875) *sensu* Good, 1998, though we conclude that application of the name *Antediplodon* Marshall, 1929 to Chinle Group unionids is problematic. Shell shape of the Snyder quarry unionids suggests they lived in a high velocity stream, and they are preserved articulated as an allochthonous assemblage in fluvial conglomerate. *A. terraerubrae* is a common Revueltian unionid from Chinle Group strata in New Mexico, Arizona and Utah.

Keywords: unionid, Conchostraca, decapod, Upper Triassic, Norian

INTRODUCTION

Near Ghost Ranch in Rio Arriba County, New Mexico, NMMNH locality 3845, also known as the Snyder quarry, is stratigraphically high in the Petrified Forest Formation of the Chinle Group (Fig. 1). This locality is best known as an extensive bonebed of tetrapod fossils (e.g., Heckert et al., 1999a, b, 2000), but the Snyder quarry has also yielded nonmarine invertebrates (a conchostracan, a decapod and unionid bivalves). Here, we document the invertebrate fossil assemblage from the Snyder quarry. NMMNH = New Mexico Museum of Natural History, Albuquerque.

CONCHOSTRACAN

A single incomplete carapace (left valve?) of a conchostracan, NMMNH P-29042 (Fig. 2), was found on a spoil pile during excavation at the Snyder quarry. The gray-green color and the fine-grained nature of the matrix surrounding the specimen suggest it came from one of the finer-grained intervals between the three conglomerate beds at the quarry (Fig. 1). However, further search for conchostracans in these strata failed to locate additional specimens.

NMMNH P-29042 has an ovate carapace approximately 6 mm long. The numerous finely spaced growth lines are separated by narrow intervals with a granulate sculpture, but the carapace lacks nodes or spines. There are also no longitudinal striae (hachures) on the intervals. We tentatively assign the specimen to the polymorphic genus *Lioestheria sensu* Tasch (1969, 1987), but do not attempt a more precise identification of so incomplete a specimen (cf. Lucas and Kirkland, 1998).

Very little has been published about Chinle Group conchostracans, though they are known from many stratigraphic intervals in the Chinle of Texas, New Mexico, Arizona and Utah (Lucas, 1997, p. 216-217). The only Chinle Group conchostracan that has received a formal name is "*Cyzicus (Lioestheria) wingatella*" from the Adamanian Bluewater Creek Formation in west-central New Mexico (Tasch, 1978).

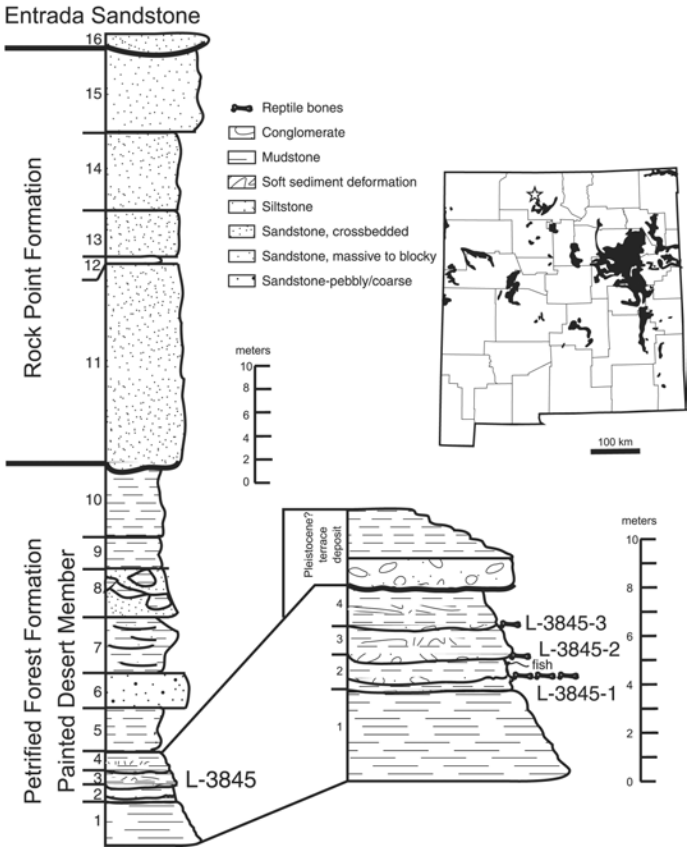

FIGURE 1. Index map showing location of the Snyder quarry site in north-central New Mexico, distribution of Triassic outcrops (after Heckert et al., 2000), and stratigraphic section at the quarry.

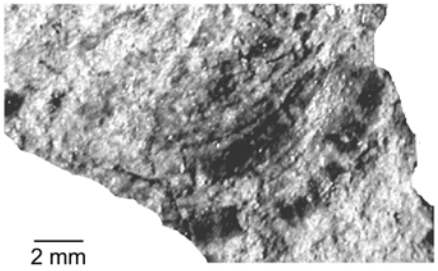

FIGURE 2. NMMNH P-29042, incomplete carapace of the conchostracan *Lioestheria* from the Snyder quarry.

This species has longitudinal striae between the growth lines, so the Snyder quarry conchostracan cannot be assigned to it.

DECAPOD

In this volume, Rinehart et al. (2003) describe a 48 mm long by 19 mm wide decapod specimen (NMMNH P-29041) that originated in one of the fining-upward depositional sequences at the Snyder quarry. The specimen is wide-bodied and short-tailed, unlike any of the known Triassic crustaceans, which are otherwise all of astacid body plan (shrimp- or crayfish-like). This animal represents the first decapod from the Triassic of New Mexico, and Rinehart et al. (2003) name it *Rioarribia schrami* and place it in the Brachyura *incertae sedis*. Previously, the oldest brachyurans were known from the Lower Jurassic, so *R. schrami* significantly extends the temporal range of the true crabs and is a rare freshwater record of a brachyuran.

UNIONID BIVALVES

The most abundant invertebrate fossils at the Snyder quarry are unionid bivalves from an intraformational conglomerate above the main bonebed. These unionids came from a small area near quarry grid 1S1W at horizon 3 in Figure 1. The NMMNH has 16 catalogued unionid specimens (Table 1), most imbedded in matrix. Shells are generally articulated, abraded and slightly incomplete (Fig. 3). The specimens vary in size but appear to represent a single species, and the best preserved specimens are illustrated here (Fig. 3).

The Snyder quarry unionids are elongate to ovate in outline, thin shelled and have an abrupt anterior end. They appear to most resemble *Antediplodon terraerubrae* (Meek, 1875) *sensu* Good, 1998. Marshall (1929) coined the genus name *Antediplodon* for the species *Unio dumblei* Simpson, originally described from the Chinle Group of West Texas (Simpson, 1896). Marshall (1929, p. 4) diagnosed the new genus as "characterized by elongate form, abrupt anterior end, and especially by the sculpture of the beak, which consists of several fine, clear-cut, direct, radiating riblets."

Nevertheless, there are problems with the application of the name *Antediplodon* to Chinle Group unionids. First, most specimens, including those from the Snyder quarry, are not well enough preserved to include the beak sculpture (radiating riblets) that is the key diagnostic feature of *Antediplodon*. Good (1993a, 1998; also see Kues, 1985) referred Meek's (1875) Chama basin species *Unio cristonensis*, *U. gallinensis* and *U. terraerubrae* to *Antediplodon*, even though the type specimens of these species are so abraded or incomplete that the nature of the beak sculpture cannot be determined. Indeed, in referring to Meek's type specimens, Simpson (1896, p. 382) noted that they "were in such bad condition that even a generic determination could hardly be considered certain." So, it is most reasonable to consider the species of "*Unio*" named by Meek (1875) as *nomina dubia*.

Furthermore, we are currently studying an exceptional sample of excellently preserved unionids from a single, autochthonous assemblage in West Texas (Rinehart et al., 2002). Of the approximately 800

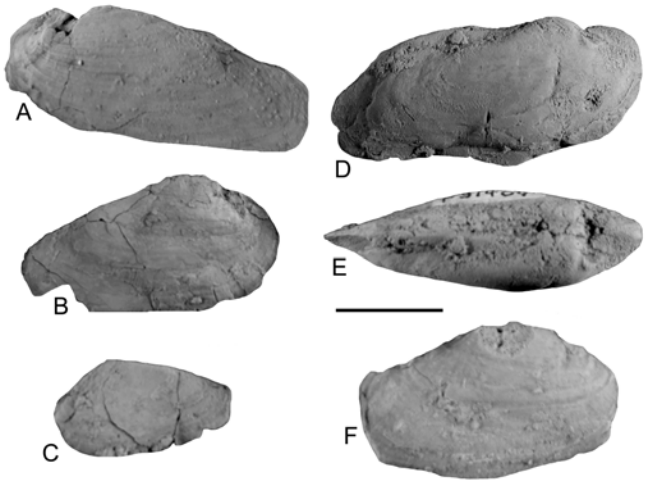

FIGURE 3. Unionid bivalves from the Snyder quarry. **A,** NMMNH P-31401, left valve. **B,** P-31417, right valve. **C,** P-31411, left valve. **D-E,** P-31409, both valves. **F,** P-31415, right valve. Scale bar = 2 cm.

specimens in this sample, all of which fall within a relatively narrow range of shell shape suggestive of a single species, there are some shells with the *Antediplodon* type of beak sculpture and many without. This suggests to us that this type of beak sculpture is variable within a single population sample of Chinle unionids. We thus conclude that the genus name *Antediplodon* is difficult to apply with certainty to Chinle Group unionids.

Among the Snyder quarry unionids, only NMMNH P-31417 may show a possible radiating beak sculpture (Fig. 3B). Otherwise, the Snyder quarry specimens best match *Antediplodon terraerubrae* as redefined by Good (1998) in being small- to medium-sized with thin shells, having well developed lirae and an abrupt anterior end. Indeed, NMMNH P-31415 (Fig. 3F) closely resembles the Arizona specimen of *A. terraerubrae* illustrated by Good (1998, pl. 4, fig. 2). Thus, with strong reservations about the current taxonomy of Chinle Group unionids, we tentatively assign the Snyder quarry unionids to *A. terraerubrae.*

DISCUSSION

The invertebrate fossils from the Snyder quarry are of some biostratigraphic and paleoecological significance. The decapod is a unique record, the conchostracan is incomplete, and too little is known of Chinle conchostracans to use them in biostratigraphy (Lucas, 1997). Good (1993a,b, 1998) proposed a molluscan zonation of the Chinle Group consisting of two zones: the *Antediplodon graciliratus* zone of early Revueltian age, and the *A. thomasi* zone of late Revueltian age. Good (1998, fig. 2) did not indicate the stratigraphic position of *A. terraerubrae* in his zonation, but his text makes it clear that *A. terraerubrae* is in the *A. thomasi* zone.

A. terraerubrae was originally described by Meek (1875) from the Painted Desert Member of the Petrified Forest Formation near Gallina in the Chama basin (Lucas and Hunt, 1992). Thus, the type material of *A. terraerubrae* is from the same approximate stratigraphic interval as the Snyder quarry unionids. *A. terraerubrae* is common in Revueltian strata of the Chinle Group in New Mexico, Arizona and Utah (Good, 1998), so its occurrence at the Snyder quarry is consistent with the quarry's Revueltian age based on vertebrate biostratigraphy.

Today, conchostracans live in a range of lacustrine environments that include large playa lakes and marshes and less frequently the littoral areas of lakes and small permanent ponds (Webb, 1979). Within this range, conchostracans prefer small (less than a hectare in area), ephemeral bodies of water. They tolerate temperatures of 4-30°C, and

TABLE 1. Measurements (in mm) of unionid bivalves from the Snyder quarry. See Good (1998, fig. 3) for explanation of measurements. B = beak length, C = convexity, H = height and L = length.

NMMNH	L	H	C	BL
P-31401	58	26		15
P-31402	27	10		
P-31403		19		
P-31404	33	18		11
P-31405		24		
P-31406	29	17		12
P-31407	25	14		
P-31408		25		
P-31409	55		8	15
P-31410	46	28		
P-31411	31	18		8
P-31412		15		
P-31414		31		21
P-31415	30	17		12
P-31416	28	14		7
P-31417	53	29		16

thrive in waters with a pH range from neutral (7) to alkaline (9.7). Because they often live in ephemeral water bodies, conchostracans are adapted to fluctuating salinity and alkalinity. Most extinct conchostracans inhabited habitats similar to those still inhabited by conchostracans (Webb, 1979). So, the Snyder quarry conchostracan indicates the presence of a shallow, ephemeral pond of probable high alkalinity soon after Snyder bone-bed accumulation. The paleoecological significance of the Snyder quarry decapod is unclear.

Living unionids are freshwater infaunal filter feeders that prefer shallow, flowing water of rivers and the current-affected portions of lakes (e.g., Tevesz and Carter, 1980). In unionids, there is a broad correlation between shell shape parameters and environment that can be applied to the Snyder quarry unionids. Thus, the Snyder quarry unionids are relatively small, elongate and of low obesity (convexity/length, see Table 1), which suggests they lived in a small river of high flow velocity (Tevesz and Carter, 1980; Good, 1993a, fig. 12). Taphonomically, the Snyder quarry unionids are obviously a transported (allochthonous) assemblage that fit Good's (1993a) taphonomic category "channel-deposit mollusc assemblage." The Snyder quarry unionids thus apparently lived in a high velocity stream and were redeposited as clasts in a channel-lag conglomerate, probably of that same stream.

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View of the Snyder quarry excavations of September 1999 with the NMMNH's Hummer in the foreground (photograph by A.B. Heckert).