A new aetosaur from the Redonda Formation (Late Triassic: middle Norian) of east-central New Mexico, USA

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With 3 figures in the text

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Abstract: Aetosaur scutes from the Upper Triassic (Norian) Redonda Formation of eastern New Mexico represent a new taxon here named *Redondasuchus*. *Redondasuchus* is distinguished from other aetosaurs by having dorsal paramedian scutes that are strongly flexed (to 45°) two thirds along their length from the medial edge, in having ornamentation that lacks a radial patten or raised bosses and possesses a discontinuous ventral keel.

Redondasuchus can be used to distinguish a *Redondasuchus* biochron of middle-?late Norian age. *Redondasuchus* is the only aetosaur in this biochron and is the youngest aetosaur in North America.

Zusammenfassung: Aetosaurier-Panzerplatten aus dem Norium des östlichen Neumexiko werden als *Redondasuchus reseri* n. g. n. sp. beschrieben. Das Taxon unterscheidet sich von anderen Aetosauriern durch dorsale paramediane Panzerplatten, die in zwei Dritteln des Abstands von der Medianlinie eine Krümmung bis zu 45° aufweisen, durch Ornamentierung der Platten ohne radiales Muster sowie durch einen unterbrochenen ventralen Plattenkiel. Es ist möglich, ein *Redondasuchus*-Biochron mittleren bis späten norischen Alters zu definieren. *Redondasuchus* ist der einzige Aetosaurier in diesem Biochron und der stratigraphisch jüngste aus Nordamerika bekannte Aetosaurier.

Introduction

Aetosaurs are among the most commonly preserved fossil animals in Norian strata of the American Southwest and are second only to phytosaurs in their abundance. The vast majority of aetosaur specimens consist of fragments of the numerous large scutes that covered their bodies. Fortunately, these scutes are generically determinate on the basis of their exterior ornamentation patterns and their gross morphology (LONG & BALLEW 1985, HUNT & LUCAS 1990). Here, we describe a new aetosaur on the basis of scutes from the Redonda Formation of eastern New Mexico.

Prior to 1947, only dinosaur footprints were known from the Redonda Formation, but in that year J.T. GREGORY discoverd localities which yielded

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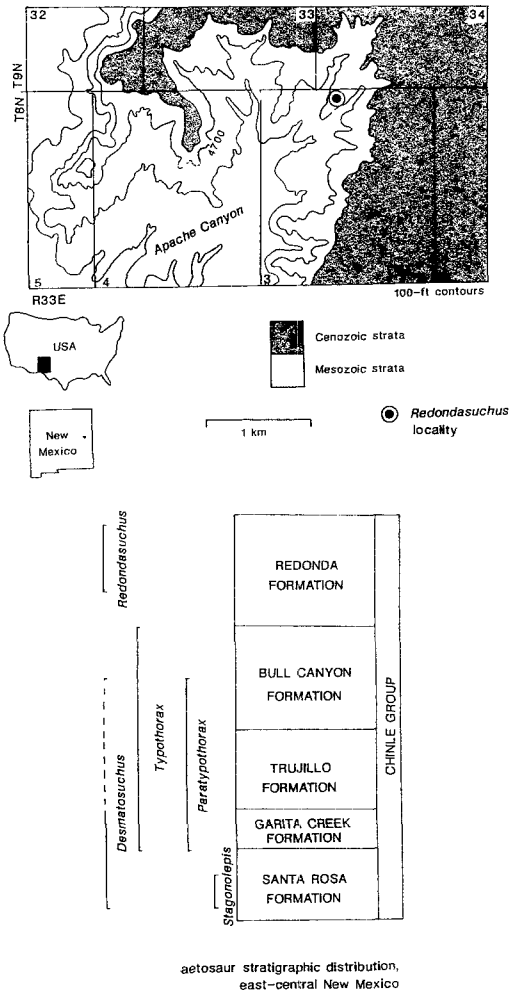

Fig. 1. *Redondasuchus* type locality in Quay County, New Mexico and the stratigraphic distribution of aetosaur genera in the Upper Triassic of east-central New Mexico. Stratigraphic nomenclature follows LUCAS (1991).

abundant fossil bones of tetrapods at Shark Tooth Hill (LUCAS et al. 1985, HUNT & LUCAS 1989, HUNT et al. 1989). These localities are on the edge of an escarpment where the flat plains of the Llano Estacado are cut by the Canadian River in east-central New Mexico (Fig. 1). Here, a sequence of Upper Triassic formations is exposed, with the Redonda being the youngest (Fig. 1). Subsequently, in 1958 GREGORY found additional localities west of Shark Tooth Hill at Apache Canyon (Fig. 1). GREGORY collected for several years at Apache Canyon for both Yale University (YPM) and the University of California (UCMP), and among his collections are various scutes of a new aetosaur

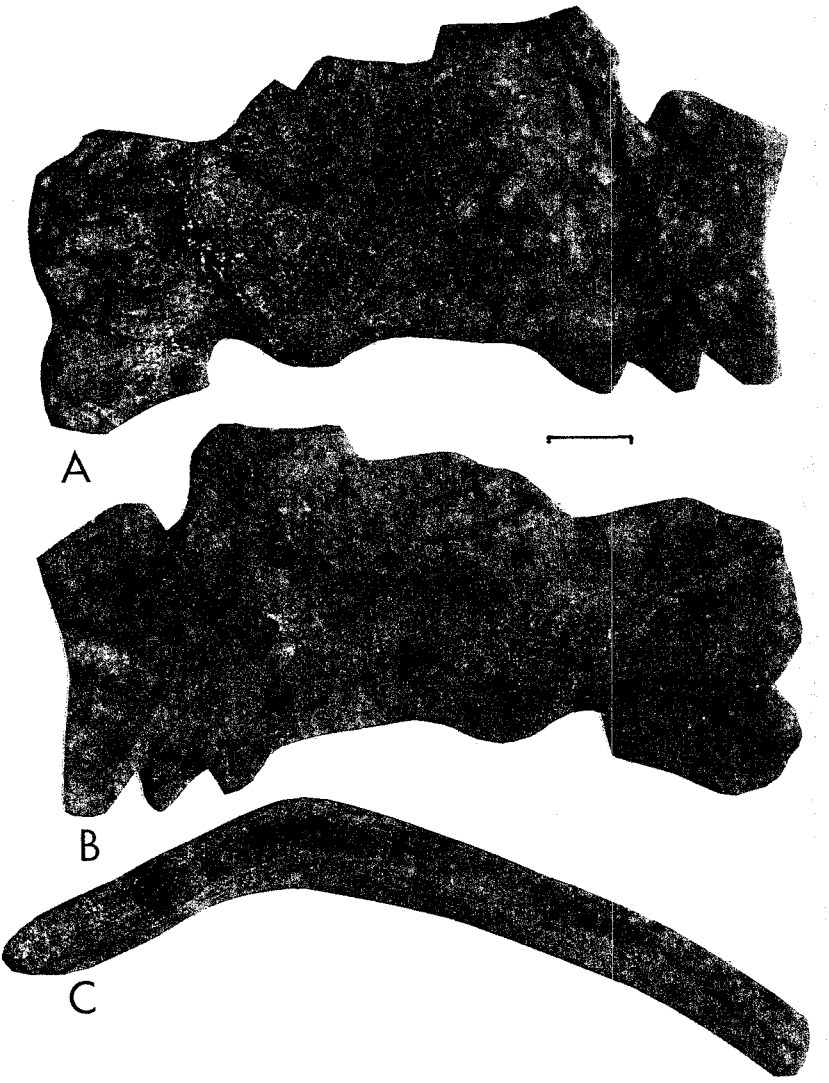

Fig. 2. Holotype left, dorsal, paramedian scute of *Redondasuchus reseri* (UCMP 64515), an aetosaur from the Late Triassic of western North America. A, B, C: holotype in dorsal (A), ventral (B) and posterior (C) views. Bar scale is 1 cm.

described here. One of us (APH) has collected additional specimens of this animal from Shark Tooth Hill in 1986 and Apache Canyon in 1989 for the New Mexico Museum of Natural History (NMMNH).

These scutes represent an aetosaur because of their close correspondence in both gross morphology and ornamentation to undoubted aetosaurs (compare Fig. 2 and LONG & BALLEW 1985: figs. 8–9). The only other animals with comparable scutes are some later crocodilians. However, Triassic »crocodilians« are characterized by pronounced anterior prominences on their paramedian scutes (CRUSH 1984: fig. 10C) and are less than a quarter the size of these scutes. A sphenosuchian »crocodile« is known from the Redonda (HUNT 1991b) and its scutes differ from those of aetosaurs not only in the above features, but they also lack ornamentation.

Systematic paleontology

Class Reptilia LAURENTI 1768
Order Crocodylotarsi BENTON & CLARK 1988
Suborder Aetosauria VON HUENE 1908
Family Stagonolepididae LYDEKKER 1887

Genus *Redondasuchus* n. g.

Type species: *Redondasuchus reseri* n. sp.

Derivatio nominis: The name derives from the Redonda Formation which has yielded the holotype and all known specimens of this taxon and from the Greek (Egyptian) for lizard.

Locus typicus: Quarry 2 of J.T. GREGORY (YPM locality 6649; UCMP locality 6148; NMMNH locality 485) in the NE1/4 NE1/4 NW1/4 section 3, T8N, R33E, Quay County, New Mexico, USA (Fig. 1).

Stratum typicum: Upper part of the Redonda Formation (Fig. 1).

Distribution: Redonda Formation of Quay County, New Mexico, USA.

Diagnosis: Dorsal paramedian scutes of *Redondasuchus* differ from other aetosaurs in being strongly flexed (about 45°) two-thirds of their length from the medial edge, in not having any raised boss or radial pattern and in having a length: width ratio of 2:1 or greater.

Redondasuchus reseri n. sp.

Holotype: UCMP 65415, a left, dorsal, paramedian scute (Fig. 2).

Referred specimens: YPM 4256–4257 (Fig. 3, A – B), two partial paramedian scutes (LUCAS et al. 1985: Fig. 3F – G); six uncatalogued scutes from YPM locality 6649; UCMP 65331 and 65416, two partial paramedian scutes; UCMP 65258, a ?cervical scute; NMMNH 17091, a paramedian scute; NMMNH 17084, seven fragments of paramedian scutes.

Derivatio nominis: For P. RESER, Chief preparator at NMMNH, for his indispensable services to vertebrate paleontology in New Mexico over the last 15 years.

Diagnosis: As for genus.

Description: UCMP 65416 is a nearly complete dorsal paramedian scute of an aetosaur (Fig. 2). Its medial and laterial margins are perfectly preserved, but the anterior and posterior margins are damaged. The scute has a length of 90 mm, a maximum width of 45 mm and a maximum thickness of 10 mm. The lateral margin shows no trace of an articulation with a lateral scute. The dorsal surface of the scute is covered by a simple ornamentation pattern of rounded pits averaging 2.5 mm in diameter. The anterior edge of the scute is the only unsculptured area and consists of a raised smooth bar with an estimated maximum width of 12 mm. The contact between the raised bar and the sculptured area is sinuous. In anterior or posterior view the scute is strongly arched downward, at about 45°, two-thirds of the distance from the medial edge. The thickest part of the scute is at this flexure. In ventral view there is a distinct raised keel, with an arcuate cross section, which extends from the medial edge to the flexure point.

All referred specimens are the same size or smaller than the holotype and have similar morphology except for UCMP 65258. UCMP 65258 (Fig. 3, C – E) is a small, nearly square scute with maximum dimensions of 26 by 36 mm. This scute has the same ornamentation pattern as the other scutes but differs in not being arched, in not having a ventral keel and in having an anterior bar that does not extend the whole width of the scute. The anterior bar is excluded from the medial margin by a thin, pointed, anterior extension of the sculptured area.

Discussion: Paramedian scutes of *Redondasuchus* are most similar in dorsal view to cervical scutes of *Typothorax* recognised for the first time in NMMNH 12964. Similarities include the pattern of rounded pits, a raised anterior bar and the relative shortness of the scutes. However, *Redondasuchus* scutes differ in being strongly arched laterally. Ventrally, *Redondasuchus* scutes are superficially similar to *Typothorax* in having a ventral keel, but differ significantly in that the keel terminates at a marked downward flexure. Several specimens of *Redondasuchus* demonstrate this point of flexure in the scute presumably because this is the thickest and hence most robust portion of the scute. LUCAS et al. (1985: 299, figs. 3F – G) incorrectly identified YPM 4256 and 4257 as *Typothorax* because of their superficial resemblance to this taxon.

An obvious question to ask is: Why do these specimens not represent cervical scutes of another aetosaur or juvenile scutes of *Typothorax*? Although the relatively equant proportions of *Redondasuchus* paramedian scutes are suggestive of the cervical or caudal scutes of other taxa of aetosaurs, they differ in their marked flexure, their discontinuous ventral keels, and, from all but *Typothorax*, in their ornamentation pattern. *Redondasuchus* scutes differ from juvenile *Typothorax* scutes in the same features that distinguish them from adult scutes.

UCMP 65258 is a problematic scute (Fig. 3, C – E). The sinous margin of the anterior bar is unlike any other aetosaur scute. The posterior margin of the scute is sinuous, but not enough to suggest that the anterior margin of the next posterior scute was like UCMP 65258. The fact that this scute is more equant than the dorsal scutes suggests that this might be a cervical scute of *Redondasuchus*. Possibly the strange anterior shape of UCMP 65258 was the result of a need to articulate with an anomalously shaped scute immediately behind the skull.

The marked lateral downward flexure of *Redondasuchus* paramedian scutes and the apparent absence of lateral scutes may be related. With this flexure the paramedian scutes may have given some of the lateral protection normally provided by lateral scutes.

The proportions of the dorsal paramedian scutes of *Redondasuchus* indicate that it must have had an anomalously narrow body for an aetosaur. *Redondasuchus* is also appreciably smaller than other described North American aetosaurs, although there may be at least three, small aetosaurs from Upper Triassic strata of the Western United States awaiting description (MURRY & LONG 1989; NMMNH 4202; HUNT personal observation). However, *Redondasuchus* is larger than some other aetosaurs, such as *Aetosaurus* from Germany (FRAAS 1907).

Scutes of *Redondasuchus* differ from other aetosaurs in having an ornamentation pattern that is neither radial nor includes a raised boss. This contrasts with the ornamentation pattern of *Stagonolepis* (WALKER 1964: fig. 20), *Aetosaurus* (FRAAS 1907: pl. 1, fig. 1), *Desmatosuchus* (CASE 1922: pl. 9), *Paratypothorax* (LONG & BALLEW 1985: pl. 6), *Longosuchus* (HUNT & LUCAS 1990: fig. 2) and *Typothorax* (LONG & BALLEW: fig. 9).

Biochronological significance of *Redondasuchus*

VON HUENE (1926) and CAMP (1930) first used aetosaur taxa to construct a vertebrate biochronology of Upper Triassic strata of the American Southwest. Recently, LONG & BALLEW (1985), LUCAS & HUNT (1989) and HUNT & LUCAS (1990) have utilised aetosaurs as part of detailed biochronology schemes. HUNT & LUCAS (1990) defined three successive biochrons on the basis of aetosaurs, which are, in ascending order of age, the *Longosuchus*, *Stagonolepis* and *Typothorax* biochrons. HUNT & LUCAS (1990) did not refer the Redonda Formation or correlative strata (Rock Point and Church Rock Members of the Chinle Formation, Travesser Formation) to any of these biochrons because aetosaurs were not reported from these units which are correlated on the basis of a new phytosaur genus (HUNT 1991a). These strata overlie rock units characterised by the *Typothorax* biochron (Fig. 1) and contain a distinct tetrapod fauna which includes new taxa of phytosaurs, sphenosuchians, meto-

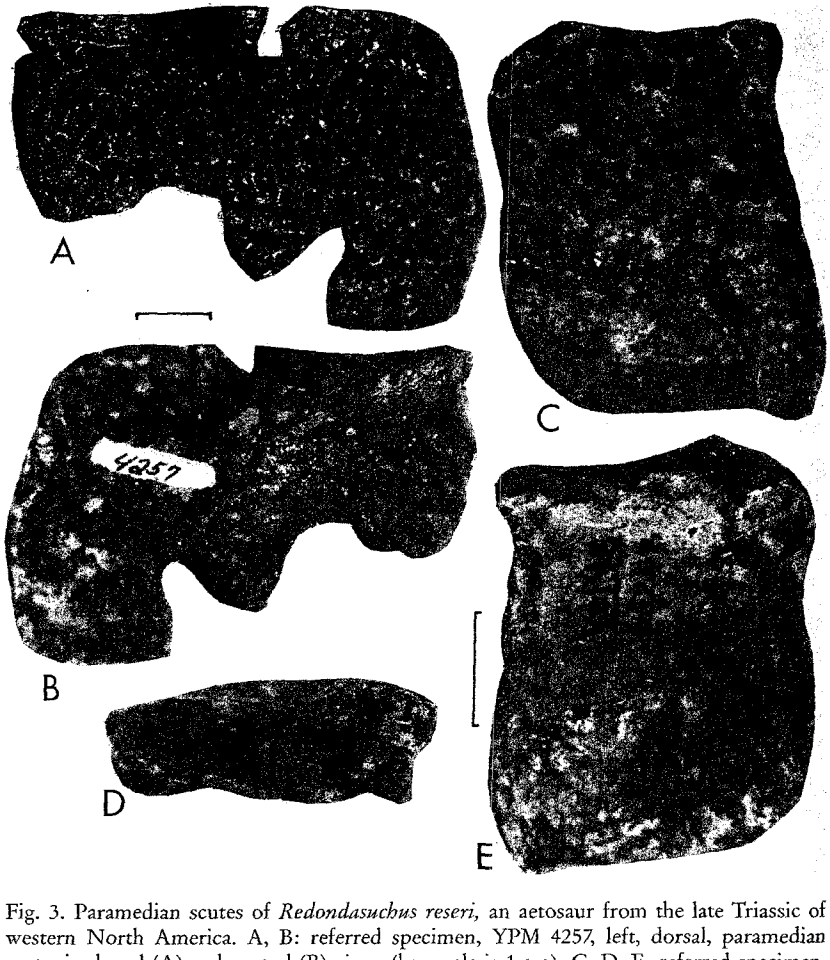

Fig. 3. Paramedian scutes of *Redondasuchus reseri,* an aetosaur from the late Triassic of western North America. A, B: referred specimen, YPM 4257, left, dorsal, paramedian scute, in dorsal (A) and ventral (B) views (bar scale is 1 cm); C, D, E: referred specimen, UCMP 65258, in dorsal (C), lateral (D) and ventral (E) views (bar scale is 1 cm).

posaurs, therapsids (HUNT 1991b) and *Redondasuchus* and we thus assign the Redonda Formation and correlative strata to a newly recognised *Redondasuchus* biochron. Although *Redondasuchus* is only known from the Redonda Formation, we predict that it will be found in the Rock Point and Travesser with further collecting. *Redondasuchus* is the only aetosaur in the Redonda Formation or correlative strata. The *Redondasuchus* biochron is of probable middle-late Norian age but could conceivably be as young as Rhaetian (HUNT 1991a) and thus *Redondasuchus* is the youngest aetosaur known in North

America. Early reports of aetosaurs in the Glen Canyon Group in fact represent crocodilians or the ornithischian dinosaur *Scelidosaurus* (CLARK & FASTOVSKY 1989, PADIAN 1989). Arguably the youngest aetosaur in the world is represented by specimens from the Rhaetian Penarth Group of southwestern England (FRASER 1988) which, however are not *Redondasuchus,* thus leaving the possibility of a fifth aetosaur biochron during the Late Triassic.

Acknowledgments

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