

A new rudist bivalve *Curtocaprina clabaughikinsorum* gen. et sp. nov. from the Middle Albian of Texas and its bearing on the origin of the Ichthyosarcolitidae Douvillé

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ABSTRACT. A new rudist bivalve, *Curtocaprina clabaughikinsorum* gen. et sp. nov. is described from the Middle Albian of Texas. This species shows characters that relate it both to the Caprinuloideidae and to the Ichthyosarcolitidae. It shows a small posterior tooth separated from the large anterior tooth by a central socket as well as an additional toothlet (called here the ichthyosarcolitid toothlet) and two plate-like myophores in the left valve. The anterior tooth and ichthyosarcolitid toothlet fit into slots in the body chamber of the right valve, whereas the two wall-like myophores face directly onto the inner surface of the body cavity in the right valve. *Curtocaprina* is a primitive member of the Ichthyosarcolitidae and suggests that the family originated before the mid Albian most likely from an as yet unknown primitive form of Caprinuloideidae.

Key words: Rudist bivalves, Cretaceous, Albian, *Curtocaprina* new genus, *Ichthyosarcolites*, Texas.

1. INTRODUCTION

The Ichthyosarcolitidae Douvillé, 1887, is an enigmatic family of rudist bivalves which does not fit easily into cladistic analyses (e.g., Skelton and Smith, 2000). New light was shed on their origin at the Eighth International Congress on Rudist Bivalves in Izmir, Turkey, in 2008, when Javier Aguilar Pérez (Aguilar et al., 2008) discussed the myocardial arrangement of *Mexicaprina alata* Filkorn, 2002, and suggested that this species belonged to *Ichthyosarcolites* and not *Mexicaprina*, a sentiment with which I agree.

In 2009, I spent a month studying the collections of the Texas Memorial Museum, and during this study I came across a few specimens of a small canal-bearing rudist from the Edwards Limestone of Texas. It is these specimens that are described here and shed new light on the origin of the Ichthyosarcolitidae.

2. AGE AND DERIVATION OF MATERIAL

The specimens in the Texas Memorial Museum were collected by S. E. Clabaugh and W. C. Ikins in Bush-Whack Creek, 10 miles (16 km) SW of Kerrville, Kerr County, Texas, during their study of the Edwards Limestone (Ikins and Clabaugh, 1940). The specimens are indicated to have been derived from a level about 50 ft. (15 m) above the base of the massive limestone of the Edwards Formation, on the crest of a low hill on the fence line between the Allen and Strohacker ranches, about ½ a mile (0.8 km) southwest of the Allen Ranch House (Ikins and Clabaugh, 1940). The fauna is silicified and

weathers out of the Edwards Limestone. Mancini and Scott (2006) correlate the Edwards Limestone with the interval from the mid Middle Albian to the earliest Upper Albian, and since the specimens come from the lower part of the Edwards Limestone a mid to late Middle Albian age seems appropriate.

3. SYSTEMATIC PALEONTOLOGY

The classification adopted here follows Skelton (2011) and Carter et al. (2011), as modified by Skelton (2013 this volume). Specimens are preserved in the collections of the Texas Memorial Museum, University of Texas at Austin, Texas (TMM numbers); comparative material of *Ichthyosarcolites* Desmarest is housed in the Museum of Paleontology, Institute of Geology, Universidad Nacional Autónoma de México, Ciudad Uiversitaria, México (IGM numbers).

ORDER HIPPURITIDA Newell, 1965

SUBORDER RADIOLITIDINA Skelton, 2013

SUPERFAMILY CAPRINOIDEA d'Orbigny, 1847

FAMILY ICHTHYOSARCOLITIDAE Douvillé, 1887

Diagnosis. Caprinoidea lacking an external ligamental groove, bearing an anterior tooth and an ichthyosarcolitid toothlet (see below) in the left valve that fit into slots in the right valve, and a central tooth in the right valve that fits into a socket in the left valve. The posterior tooth is reduced or absent. The myophoral plates in the left valve are rotated to face directly onto the inside wall of the body cavity in the right valve.

Genus *Curtocaprina* gen. nov.

Type species. *Curtocaprina clabaughikinsorum* gen. et sp. nov. from the Middle Albian Edwards Limestone of Kerr County, Texas.

Origin of name. From *curtus* (=short) and *caprina* in reference to its caprinoid relationship.

Diagnosis. A genus of *Ichthyosarcolitidae* bearing a small posterior tooth, central socket, anterior tooth, *ichthyosarcolitid* toothlet (see below), and wall-like myophores in the left valve. The posterior tooth of the left valve fits into a socket in the right valve, the anterior tooth and *ichthyosarcolitid* toothlet of the left valve fit into slots in the body cavity, and the myophoral plates of the left valve are rotated down to face the inner surface of the body cavity of the right valve.

Discussion. Specimens of *Ichthyosarcolites* from the Old World are generally poorly preserved, and have been interpreted from weathered specimens seen in outcrop or random cross-sections of specimens. As such, the details of the dentition have been difficult to observe. Photographs of a specimen of *Ichthyosarcolites* from the Cenomanian of Kefalonia, Greece, illustrated at the Ninth International Congress on Rudist Bivalves in Kingston, Jamaica (2011), by Peter Skelton (from a photograph at outcrop by Thomas Steuber) illustrated a thin dorsal shell layer with the anterior and *ichthyosarcolitid* teeth clearly visible, and no room for the posterior tooth as seen in *Curtocaprina* gen. nov. This specimen seems directly comparable with *I. alatus* from Mexico, which was originally attributed to *Mexicaprina* by Filkorn (2002), but subsequently transferred to *Ichthyosarcolites* by Aguilar et al. (2008), and is also illustrated here (Figure 1F-G). The myocardial arrangement can be easily seen in *I. alatus*, and shows the presence of the anterior tooth and *Ichthyosarcolites* toothlet, but with no room within the narrow shell wall for the posterior tooth as seen in *Curtocaprina*. In consequence, *Curtocaprina* is distinguished from *Ichthyosarcolites* by the presence of a small posterior tooth in the left valve and a prominent central tooth in the right valve.

***Curtocaprina clabaughikinsorum* gen. et sp. nov.**
Figure 1A-E

Type specimens. Holotype (TMM.UT-10937); Paratypes (TMM.UT-10923 and UT10922); all collected by S. E. Clabaugh and W. C. Ikins from

the Edwards Formation of Bush-Whack Creek, Kerr County, Texas (Ikins and Clabaugh, 1940).

Origin of name. From Stephen Edmund Clabaugh and William Clyde Ikins who collected the specimens.

Material. Holotype TMM.UT-10937 consists of a left valve with two attached articulated specimens. Paratype TMM.UT-10923 consists of an articulated specimen. Paratype UT10922 consists of two right valves.

Description. Articulated specimens show a relatively long right valve and a somewhat shorter left valve. The right valve may be straight to strongly coiled and is attached by a moderate to large area and sometimes (juveniles) the complete antero-dorsal flank. In straight right valves the valve has a triangular cross section with flattened sides, whereas in coiled right valves the cross section is triangular to lens-shaped with rounded surfaces. In right valves the anterior-ventral margin may be rounded (Figure 1A), angular or may bear a short flange (Figure 1D). In triangular shells, attached by the whole dorsal surface, acute angles are also found at the margin of the attachment area (Figure 1D). There is no external ligamental groove, and no internal ligamental cavity is visible. The central tooth is large and curved and completely filled with pallial canals. The socket for the posterior tooth is buried within the shell structure. The anterior socket is a slot on the side of the body cavity, and a similar smaller slot is also present situated in the body cavity on the postero-ventral side of the central tooth (IS in Figure 1D). There are no sockets for the myophores of the left valve, which must attach directly to the inner surface of the body cavity in the right valve. The complete shell wall is filled with pallial canals.

The left valve is always strongly coiled and may bear a corresponding flange to that seen in the right valve. There is no external ligamental groove, and no obvious ligamental cavity is visible. The anterior tooth is large and the posterior tooth is small. The two teeth are situated on either side of the central socket. The small posterior tooth is connected by a raised septum around the posterior side of the central socket to connect to the posterior myophore array. The posterior myophore is composed of two structural elements: an additional tooth-like feature (termed here the *ichthyosarcolitid* toothlet), and a wall-like anterior myophoral plate. The posterior myophore is also a wall-like plate. The shell wall is filled with pallial canals, but the teeth, *ichthyosarcolitid* toothlet and myophores are composed of compact shell material. A row of

larger pallial canals extends along the anterior side of the central socket and anterior myophore, and also along the posterior side of the posterior myophore, although in the latter case the larger canals are interrupted by the presence of the ichthyosarcolitid toothlet.

Discussion. There is a lot of variability in the small number of specimens seen (three articulated specimens, one left valve, two right valves), particularly in the cross-sectional shape of the valves, and in the degree of coiling in the right valve. Given the small number of specimens available, it seems unwise to erect more than a single species at the present time.

Distribution. The species has only been collected from the one locality in Texas. Here it is associated with typical specimens of *Caprinuloidea romeri* Mitchell 2013 (this volume); in some cases *Caprinuloidea* forms the attachment area for *Curtocaprina*, and *vice versa*.

4. DISCUSSION

Curtocaprina new gen. shows some features which align it with *Caprinuloidea* and other features which align it with *Ichthyosarcolites*. *Caprinuloidea* has a large endomyophoral cavity which is highly reduced in *Curtocaprina* new gen. The presence of the small posterior tooth, central socket and large anterior tooth in the left valve match the features seen in the Caprinuloideidae. However, the posterior myophore of the left valve attaches directly to the inner surface of the body cavity of the right valve; it does not fit into an accessory cavity as seen in the Caprinuloideidae. The most distinctive feature is the presence of the ichthyosarcolitid toothlet which is clearly seen in *Ichthyosarcolites* but is absent in the Caprinuloideidae.

Filkorn (2002) described a flanged, canal-bearing rudist under the name of *Mexicaprina alata* from the Upper Albian of Mexico. Aguilar et al. (2008) suggested that this material does not belong to *Mexicaprina* but instead should be placed in *Ichthyosarcolites*, which is accepted here. Filkorn (2002, fig. 4) interpreted a transverse cross-section (see **Figure 1G** herein) as a right valve bearing accessory cavities and a posterior tooth socket; I interpret this specimen as a left valve with the anterior tooth and ichthyosarcolitid toothlet (which are not easily distinguished in Filkorn's illustration or **Figure 1G**), and the wall-like posterior and anterior myophores separated from the shell by rows of large canals as in *Curtocaprina*. This is much better illustrated in Filkorn's (2002) fig. 6.1

which shows a transverse cross-section (**Figure 1F**) which I interpret as a right valve containing the myocardial elements of the left valve in place. In this transverse section, the details of the anterior tooth and ichthyosarcolitid toothlet, fitting into slots in the body cavity, and the two wall-like myophores, attaching directly to the interior of the body cavity, are clearly visible. *Ichthyosarcolites alatus* is differentiated from *Curtocaprina* by the absence of the posterior tooth and the reduction of the central tooth and clearly has an *Ichthyosarcolites* type dentition.

Jalpania queretana Alencáster and Aguilar, 1995, shows some similarities in regards to the possible presence of an ichthyosarcolitid toothlet; however, in this genus the anterior myophore is divided into numerous tubercles which fit into sockets in the right valve, and the posterior myophore also appears to fit into an accessory cavity in the right valve (although this part of the shell is damaged in most specimens). These features suggest that the myocardial arrangement of *Jalpania* is a highly modified form of Youngicapriniinae Mitchell, 2013 (this volume), that the possible ichthyosarcolitid toothlet is better interpreted as the posterior tooth and moreover that therefore *Jalpania* is not related to *Ichthyosarcolites*.

5. CONCLUSION

The small rudist *Curtocaprina* from the Middle Albian of Texas allows us to consider further the origins of the Ichthyosarcolitidae. *Curtocaprina* combines myocardial features seen in the Caprinuloideidae and the Ichthyosarcolitidae. This strongly suggests that these two families are closely related. However, the attachment of the downward projecting myophores of the left valve directly to the inner surface of the right valve in *Curtocaprina*, as well as in *Ichthyosarcolites*, indicates that even by the Middle Albian, the myocardial arrangements of the families had diverged significantly. As such, *Curtocaprina* is unlikely to have evolved directly from the Caprinuloideinae, and an earlier as yet unknown origin amongst the Caprinuloideidae is likely.

The similarity of the myocardial elements between *Curtocaprina* and *Ichthyosarcolites alatus* suggests that the latter was derived from the former during the mid-to-late Albian by the loss of the posterior tooth and reduction of the central tooth. Subsequently, during the Cenomanian, *Ichthyosarcolites* invaded the carbonate platforms of the Old World, and inhabited them only to become extinct close to the Cenomanian-Turonian boundary (Masse and Philip, 1986).

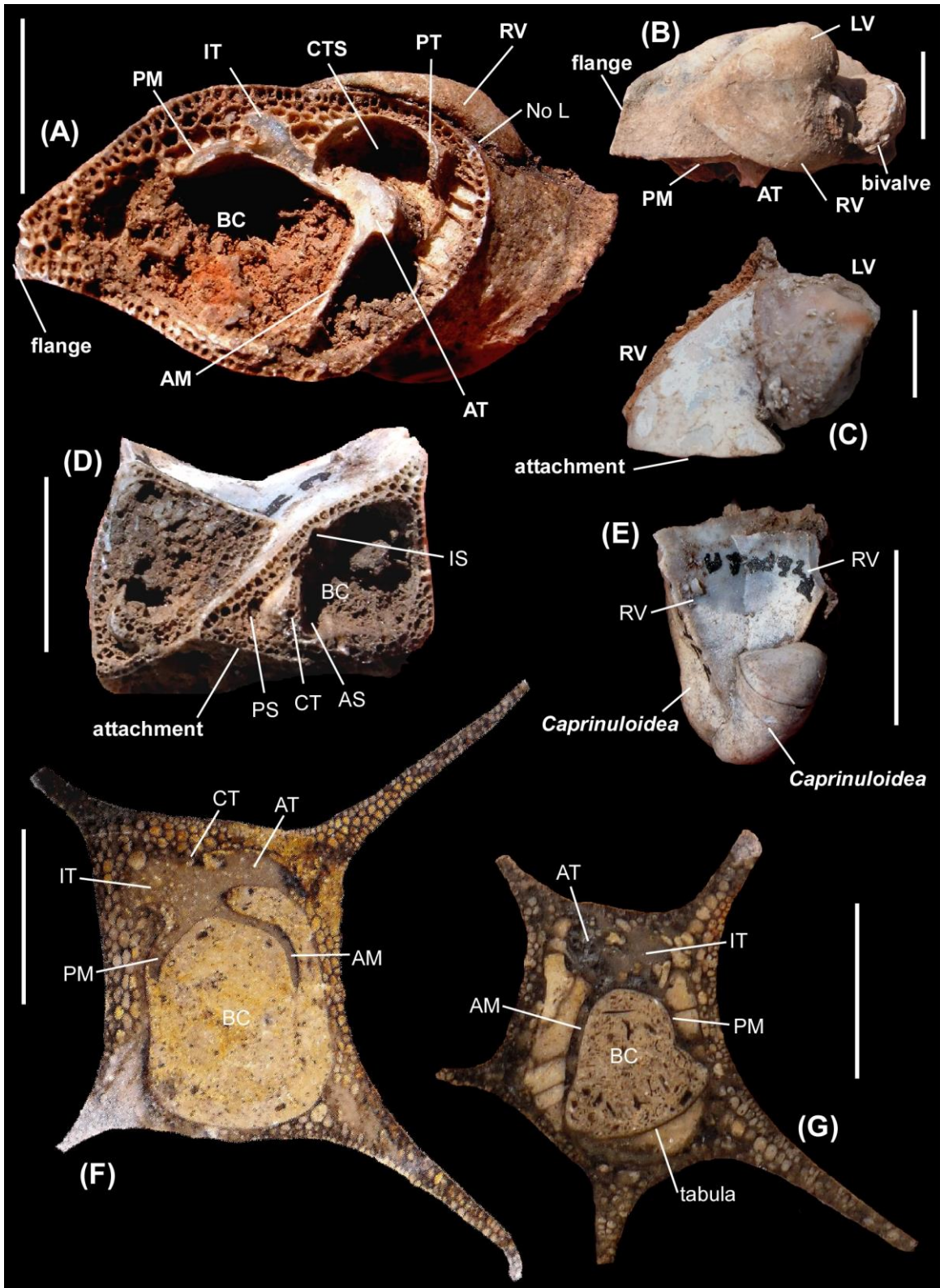


Figure 1. *Curtocaprina claburghikinsorum* gen. et sp. nov. and *Ichthyosarcolites alatus* (Filkorn). A-E, *Curtocaprina claburghikinsorum* gen. et sp. nov. from 50 ft (15 m) above the base of the massive limestone of the Edwards Formation (mid-Albian), on the crest of a low hill on the fence line between the Allen and Strohacker ranches, about ½ a mile (0.8 km) southwest of the Allen ranch house on Bush-whack Creek, 10 miles (16 km) SW of Kerrville, Kerr County, Texas. A-B, holotype (TMM.UT-10937); A, apertural view of left valve showing

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(Figure 1 continued) myocardinal arrangement; B, posterior flank of holotype with small articulate specimen of *Curtocaprina claburghikinsorum* attached. C, Paratype (TMM.UT-10923), articulated specimen. D-E, Paratype (TMM.UT-10922), two right valves; D, apertural view showing myocardinal elements, note that the AT and IT fit into slots on the body cavity, and the PM and AM have no sockets and must attach directly to the inside of the body cavity; E, ventral flanks of paratype (two right valves) attached to a *Caprinuloidea*, and with another articulated *Caprinuloidea* attached to them. F-G, *Ichthyosarcolites alatus* (Filkorn), from the Mal Paso Formation (late Albian), Guerrero Terrane, Mexico: F, Paratype (IGM-6972), right valve, abapical view close to commissure, with in place myocardinal elements of the left valve; G, Holotype (IGM-6970), left valve, abapical view close to commissure, note myophores separated from shell wall by 'gutters' filled with large canals; note the similarity of the AT, IT, PM and AM to the dentition in *Curtocaprina*, although no evidence of the posterior tooth is present. RV, right valve; LV, left valve; AT, anterior tooth; AS, anterior slot; CT, central tooth; CTS, central tooth socket; PT, posterior tooth; PS, posterior socket; IT, ichthyosarcolitid toothlet' IS, ichthyosarcolitid toothlet slot; AM, anterior myophore; PM, posterior myophore; BC, body cavity. Scale bar is 10 mm.