

NEW CAPRINID RUDIST GENERA *GUZZYELLA* AND *MUELLERRIEDIA* (BIVALVIA-HIPPURITACEA) FROM THE ALBIAN (CRETACEOUS) OF CENTRAL MEXICO

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ABSTRACT

Two new rudist genera *Guzzyella* and *Muellerriedia* of the family Caprinidae, are described from the rich fossiliferous locality of El Madroño, in the State of Querétaro, central Mexico. Although both genera share several morphological features, they differ markedly in the left valve posterior myophore, which in *Guzzyella* is tooth-like, equal in size and shape to the posterior tooth, but in *Muellerriedia* consists of a vertical thin plate, not comparable at all to the posterior tooth. Two new species of *Guzzyella* are described, *G. bisulcata* and *G. acuminata*, and a new species of *Muellerriedia*, *M. boesei*.

Also are described and illustrated some forms, which undoubtedly belong to these genera, but are different to the type species. They are not proposed as formal species, because the available specimens are very few. However, as they have to be named in some way, they are included in an informal, open nomenclature. The fossils are contained in the El Abra Limestone, which in this area consists of a short interval deposit of middle to late Albian age.

Key words: *Guzzyella*, *Muellerriedia*, Rudists, Caprinids, Albian, Mexico

RESUMEN

Se describe dos nuevos géneros de rudistas, *Guzzyella* y *Muellerriedia*, de la familia Caprinidae, que fueron encontrados en la rica localidad fosilífera de El Madroño, estado de Querétaro, en la parte central de México. Ambos géneros comparten varios caracteres morfológicos. Sin embargo, difieren marcadamente en el mióforo posterior de la valva izquierda, que en *Guzzyella* es semejante en forma y tamaño al diente posterior, en tanto que en *Muellerriedia* consiste en una lámina vertical delgada, no comparable con el diente posterior. Del nuevo género *Guzzyella* se propone dos nuevas especies (*G. bisulcata* y *G. acuminata*) y de *Muellerriedia* una nueva especie (*M. boesei*).

También se describe unas formas que evidentemente pertenecen a estos géneros, pero difieren de las especies tipo. No se les asigna nombres definitivos, porque se cuenta con muy pocos ejemplares, y se ignora la variación intraespecífica. Sin embargo, para nombrarlos de algún modo, se designan de manera informal en nomenclatura abierta. Los fósiles están contenidos en la unidad estratigráfica Caliza El Abra, que en esta área constituye un depósito de corto intervalo de edad albiana media a tardía.

Palabras clave: *Guzzyella*, *Muellerriedia*, Rudistas, Caprinidos, Albiano, México.

INTRODUCTION

Rudist bivalves are very important fossils in México for several reasons. They are abundantly preserved in many of the limestone sequences in most of the country, and are present in all levels of the Cretaceous System. The rudists have also economic importance, because usually they are found in rocks of considerable thickness which are exploited in quarries for industrial purposes. In the subsurface they constitute reservoirs for oil in the Gulf Coastal Plain.

The maximum development of these organisms was reached during the Albian, when the carbonate platforms had their greatest extension and thickness, and the sea covered almost the entire country. Among these paleogeographic features, one of the largest and better known is the Valles-San Luis Potosí Platform, first described by Carrillo-Bravo (1971). The fossils studied in this paper come from this platform.

This article is one of a series of taxonomic studies on rudists, based on the fossiliferous locality of El Madroño, in the state of Querétaro (Figure 1). This locality contains a rich and diverse fossil association of invertebrates, in which the bivalve rudists, gastropods, and corals predominate.

The objective of the study is to document the taxonomy of the rudists, on the basis of a more detailed knowledge of their morphology, since the fauna under study presents an exceptional type of preservation, in which the specimens were recovered complete, and with the finest structures intact. This permitted more precise taxonomic studies, the discovery of unknown structures, the finding of new taxa, as well as the amendment of other previously known taxa.

Although El Madroño has been the object of a few previous collecting activities since 1930 (Alencáster and Oviedo-García, 1998), the rediscovery of the locality took place recently (Alencáster, 1987) and the taxonomic studies are just beginning (Alencáster and Aguilar-Pérez, 1995; Alencáster and Oviedo-García, 1998).

It is considered appropriate to state in relation to the fossil material treated in this paper, that many of the specimens were

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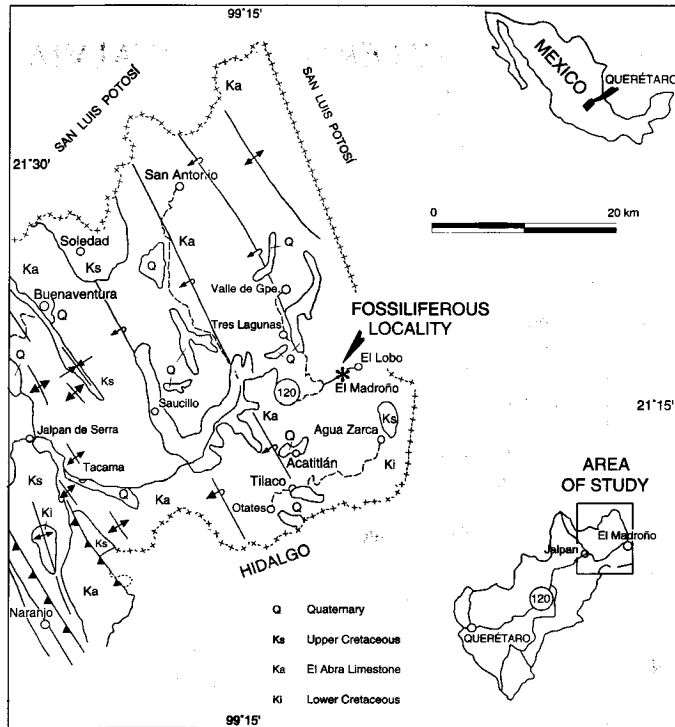


Figure 1. Location of El Madroño in the state of Querétaro, and a simplified part of the geological map of López-Ramos (1985).

already presented during the lecture the author delivered at the First International Conference on Rudists, held in Belgrade in 1988. The paper, together with others, were planned for publication as a proceeding volume by the Serbian Geological Society. In 1991, a few of the manuscripts, including that of the present author (Alencáster, 1991), were printed separately as preprints, expecting that the entire volume could soon be completed. Unfortunately, however, the entire volume so far, has not been published, due to the Yugoslavian crisis. Since the few preprints that appeared are not considered to be formal publications, the author decided to publish the present paper in which, from the original preprinted version, *Guzzyella bisulcata* and *Guzzyella bicarinata* (now *Muellerriedia boesei*) are here described, in addition to material resulting from more recent collecting.

LOCALITY AND STRATIGRAPHIC SETTING

Querétaro is one of the states of the central part of Mexico, and El Madroño is located in its northeastern extreme, in Landa de Matamoros municipality. The locality is at Km 233 of the federal highway 120, which connects the city of Querétaro with the town of Xilitla, (State of San Luis Potosí) (Figure 1). The outcropping rocks are in low hills at both sides of the highway. The region is covered by a thick red soil, which gave the name of "Laguna Colorada" (*Red Lagoon*) to an old mining claim for phosphorite. This informal name for the place is unknown to the natives, but it has been used mainly in geological publications (Aguayo-Camargo, 1978; Enos *et al.*, 1983; Chartrousse, 1998).

According to Mexican laws, in which the fossils are legally considered as part of the national patrimony, important paleontological localities such as El Madroño, are under the custody of the National Institute of Anthropology and History. Therefore, this fossil locality is regarded as a special protected area of study, and any collecting should be closely supervised by the corresponding federal and scientific authorities, represented by the Consejo Nacional de Paleontología, depending of the cited institute.

The fossil-bearing stratigraphic unit is the El Abra Limestone (Kellum, 1930; Muir, 1936; Bonet, 1952, 1963) which is the most widespread and thickest sequence of carbonate deposits in eastern Mexico. On the basis of the lithology and faunal content, the El Abra Formation comprises two markedly different facies. The Taninul facies represents the platform margin (Bonet, 1952; Aguayo-Camargo, 1978), while the El Abra facies is referred to the lagoonal or inner platform environment (Bonet, 1952; Johnson, 1984). The Taninul facies fringes the eastern margin of the Valles-San Luis Potosí Platform, and is the predominant facies at El Madroño, where small massive rudist banks are discontinuous and immersed in voluminous thick beds of bioclastic debris (Bonet, 1952).

The thickness of El Abra Formation varies in different places. A maximum thickness of about 2,000 to 3,000 m has been considered for the subsurface of the Golden Lane Platform (Guzmán, 1967; Pedrazzini, 1979). Its age also varies in different localities from the Aptian to the Turonian (Aguayo-Camargo, 1978) and even to the Coniacian (Suter, 1987). However, at El Madroño the sequence reaches only about 90 m (Enos *et al.*, 1983). The content of the fauna is indicative of a restricted interval which, at the moment, is considered as of middle or late Albian age (Alencáster and Oviedo-García, 1998; Rosales-Domínguez, 1998).

SYSTEMATIC PALEONTOLOGY

The specimens studied are deposited in the Museum of Paleontology of the Institute of Geology, of the National Autonomous University of Mexico (IGM), in Ciudad Universitaria, 04510 D.F., Mexico.

Order Hippuritoida Newell, 1965
Superfamily Hippuritacea Gray, 1848
Family Caprinidae d'Orbigny, 1847

Guzzyella new genus

Type species—*Guzzyella bisulcata* new species, herein designated.

Diagnosis—Medium size shell, inequivalve, left valve slightly smaller and capuliform, and right valve conical or cylindroconical, straight or slightly curved. Shell wall with round or polygonal canals in more or less irregular rows, with a margin-

al layer of smaller pyriform or oval canals; the internal shell wall is compact. The left valve anterior tooth is large and the anterior muscle insertion area is a corrugated thick surface, around the tooth. The posterior tooth is much smaller. The posterior myophore and the posterior tooth are close together; they have a narrow basis, and are vertically erect, with acute tips; they are similar in shape and size, looking like a double or bifid tooth. The dental socket for the right valve tooth is narrow and elongate, wider ventrally.

The right valve tooth is a vertical plate, emerging a little above the commissure, of semicircular free margin (this tooth is named falciform or crescentic), narrow and elongate. The posterior myocardial cavity is short and curved, its outline is as a w letter or as the wings of a butterfly, with two almost equal compartments, separated by a septum. In this valve there is no special structure for the anterior muscle insertion, which is on the smooth interior surface of the shell wall. The ligament groove is well marked in both valves, with a small internal cavity.

Derivation of name—The name of the genus is in honor of the late Dr. Pedro Guzzy, his wife Mrs. María Teresa Arredondo de Guzzy, and their sons and daughters, of Mexico, D.F. Due to their interest in paleontology, they visited and sampled many Mexican fossiliferous localities. Their great collection from El Madroño, including the holotype of *Guzzyella* and of other taxa, was donated for study to the Institute of Geology.

Discussion—The new genus *Guzzyella* is comparable to *Texicaprina* Coogan 1973, which is present in Texas, Trinidad, several localities of eastern Mexico, including El Madroño, and other places of the Caribbean region (Coogan, 1973, 1977; Alencáster and Oviedo-García, 1998). These genera are similar in the shape of both valves, in the right valve tooth, and in the posterior myocardial structure of both valves. They differ in the shell wall structure, which in *Texicaprina* is totally perforated, but in *Guzzyella* is compact internally. The genera are also unlike in the anterior myophoric apparatus. In *Texicaprina* it is formed by a series of clearly separated protruding tubercles in the left valve, and the corresponding pits in the right valve. In *Guzzyella* it consists in a thick, wrinkled area in the left valve, facing a smooth area on the inner shell wall of the right valve. With respect to the peculiar anterior myophoric structure of *Texicaprina*, it is interesting to notice that it is of the same type as in *Jalpania* Alencaster and Aguilar-Pérez (1995), which is found also in El Madroño, Querétaro.

Caprinuloidea Palmer (1928) and *Kimbleia* Coogan (1973) are somewhat similar to *Guzzyella* in having canals in the outer shell wall but a compact inner shell wall in both valves. They differ markedly in the morphology and relative size of both valves, and also in the posterior myocardial structure. In these genera the left valve posterior myophore is a vertical slightly curved plate, much larger than the posterior

smaller tooth; the right valve posterior cavity is long, divided in two unequal parts, the dental socket being smaller and the myophoric compartment larger, of typical coalcomaninid shape.

According to the new species of *Guzzyella* described, the variable morphologic features are in the left valve, and therefore they are the diagnostic aspects of specific value. These are the shape of the valve, its convexity, the outline of the commissure and of the cross section, and the size, position and shape of the beak. The shape of the right valve may vary also, but among more restricted limits, and always in correspondence with the left valve morphology. The commissural outline, the posterior myocardial cavity, the anterior muscle insertion area, and the shape of the dental socket, present in the left valve, constitute characters which are correlated necessarily with these structures of the opposite valve. The four species described differ in the cited characters. Nevertheless, due to the few specimens, two species are left in open nomenclature.

Guzzyella bisulcata new species

(Figures 2.1–2.9, 3.1–3.10)

Types—Holotype IGM-4590, paratypes IGM-4591 to IGM-4593, and IGM-4614 to IGM-4621.

Material—One complete and two almost complete specimens, three complete and one incomplete left valves, two complete right valves, 10 fragments of right valves and seven of left valves.

Diagnosis—*Guzzyella* with a longitudinal bulge along the middle of the posterior side of both valves, which is occupied by the posterior myocardial apparatus; it is limited dorsally by the ligament groove and ventrally by a deep sulcus parallel and identical to the first one. Cross section rhomboidal to suboval, with the dorsoventral axis longer than the anteroposterior axis. A large, prominent and angular keel is present along the middle of the ventral side of both valves.

Description—Medium size species (see Table 1) inequivalve, right valve moderately larger than left valve. Left valve convex and capuliform, and right valve conical and straight or slightly curved or with apex coiled. In both valves, the convex longitudinal swelling, located in the center of the posterior side, is limited dorsally by the ligament groove, and ventrally by another similar groove. In the center of the ventral side is a longitudinal prominent, acute flange or keel. The anterior side is flat or slightly convex. In transverse section, the outline is roughly rhomboidal to sub-oval. Surface smooth, with growth lines and transverse wrinkles. The shell external layer is very thin, and it is preserved only in small portions. The shell wall inner layer presents a marginal thin layer of small pyriform canals (from 0.5 to 1 mm), and a few irregular rows of small round or polygonal pallial canals, which increase moderately

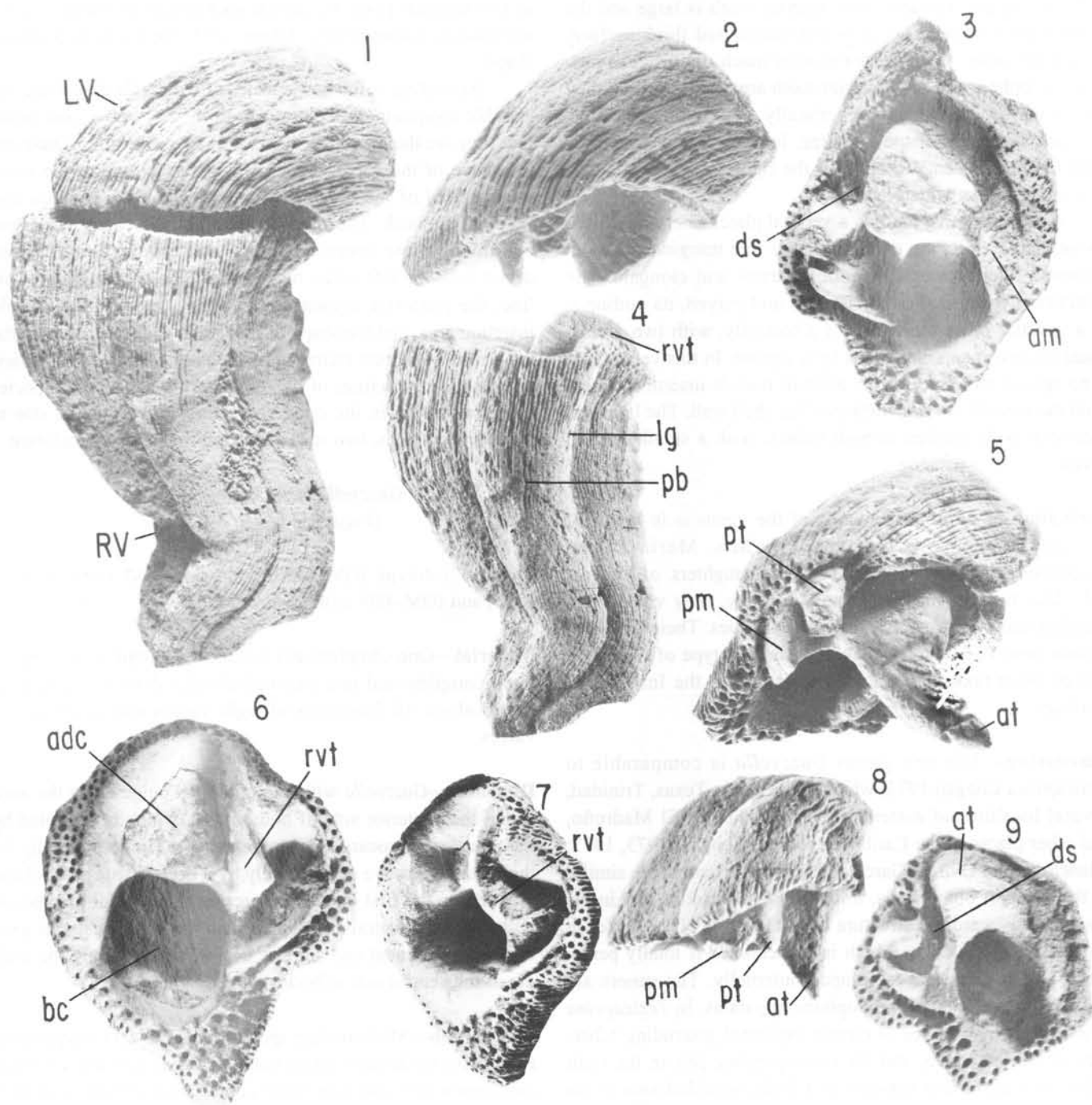


Figure 2. Abbreviations used in figures are the following: IGM—Instituto de Geología, Mexico; adc—anterior dental cavity; pdc—posterior dental cavity; amc—anterior myophoric cavity; pmc—posterior myophoric cavity; bc—body cavity; lc—ligament cavity; lg—ligament groove; at—anterior tooth; pt—posterior tooth; rvt—right valve tooth; ds—dental socket; am—anterior myophore; pm—posterior myophore; pmp—posterior myophoric plate; pb—posterior bulge; LV—left valve; RV—right valve. 1–7, *Guzyella bisulcata* Alencaster, Holotype IGM-4590. 1, Complete specimen a little reduced (x 0.78); 2, posterior view of left valve with anterior tooth broken (x 1); 3, the same, apertural view, showing anterior tooth broken, anterior myophoric area, posterior tooth and posterior myophore, (x 1); 4, right valve showing the crescentic tooth and the posterior bulge (x 0.78); 5, posterodorsal view of left valve, showing the glued anterior tooth, and the posterior tooth and myophore, (x 1); 6, right valve apertural view (x 1), which shows the myocardinal posterior cavity, the tooth, the ventral keel and the posterior bulge; 7, the same view a little reduced (x 0.82), which shows more clearly the tooth; 8, *Guzyella bisulcata* Alencaster, Paratype IGM-4519, (x 2), juvenile left valve, posterior view; 9, the same specimen, apertural view.

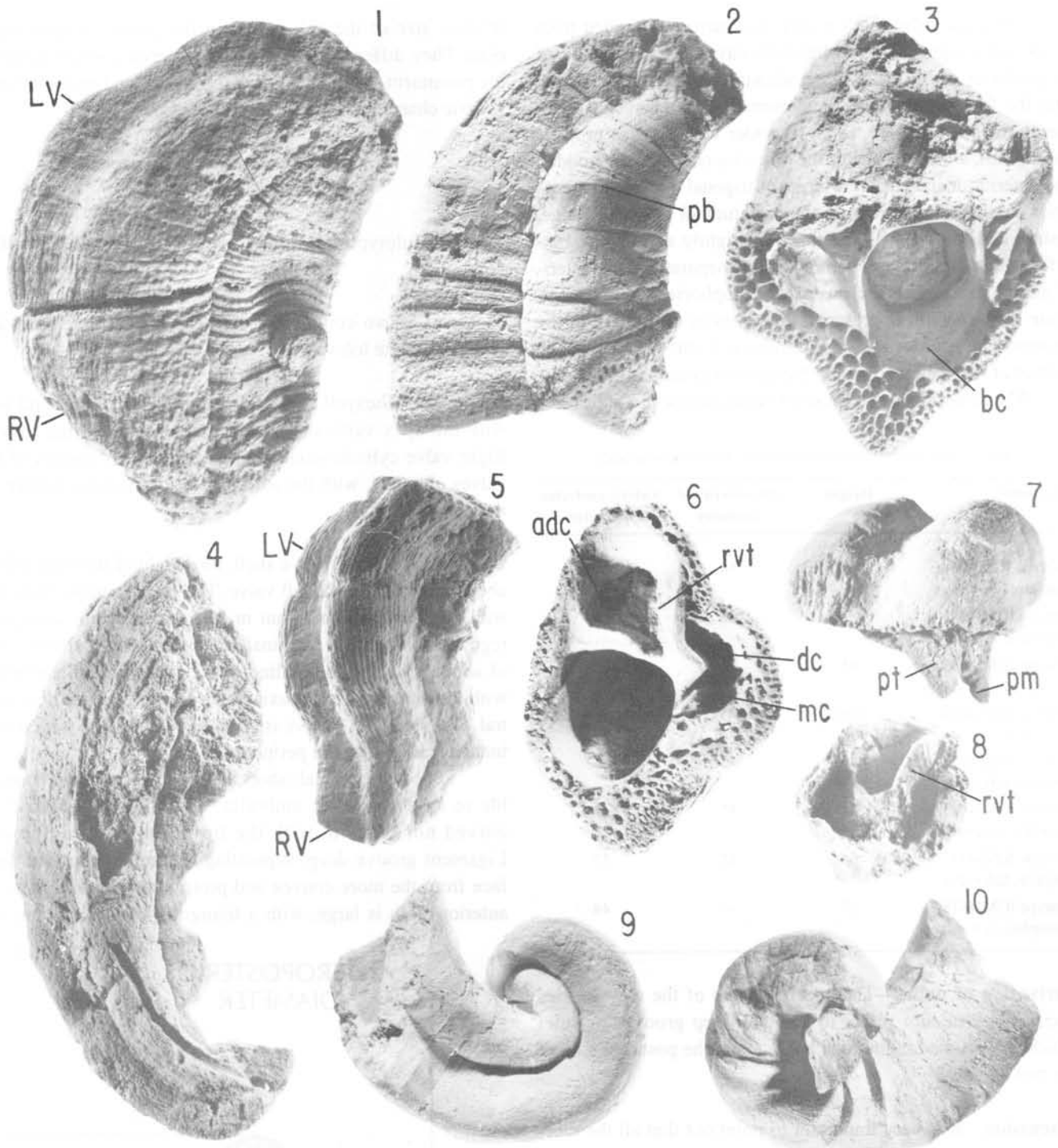


Figure 3. *Guzzyella bisulcata* Alencaster. 1, Paratype IGM-4591, (x 1), posterior view of a specimen with right valve incomplete (x 1); 2, paratype IGM-4617 (x 1), left valve, posterior view; 3, the same specimen, apertural view; 4, paratype IGM-4614, a little reduced (x 0.9), posterior view of an incomplete right valve; 5, paratype IGM-4593 (x 1), two valves specimen, with the left valve broken; 6, paratype IGM-4616 (x 1), apertural view of a right valve fragment, showing clearly the myocardial posterior cavity; 7, paratype IGM-4621 (x 1), a left valve fragment showing the posterior tooth and myophore; 8, paratype IGM-4592 (x 1), right valve fragment with tooth and cavities; 9, paratype IGM-4620 (x 1), right valve coiled apex, upper view; 10, the same specimen, lower view, flat side.

in size toward the interior, from 2 to 4 mm. The ligament groove in both valves presents a small internal cavity. The body cavity is large and circular in transverse section, and it is located in the ventral half of the valve.

Left valve with umbonal beak short, not projected, acute, slightly curved toward the anterior side and somewhat distant from the dorsal margin. The anterior tooth is large and slightly curved, with the basis wide and subtriangular, and the distal end

round or acute. The anterior muscle insertion is on a corrugated thick surface around the tooth. The posterior tooth and myophore are close together, with the acute tips and separated by a short and shallow groove; they are similar in size and shape. The dental socket for the right valve tooth is deep, narrow and elongate, a little wider ventrally. The outer surface of the teeth and muscle insertion areas, is slightly rough with weak wrinkles.

The right valve tooth is long and narrow, extended from the dorsal margin, near the ligament cavity, to the middle of the posterior cavity. It is of semilunar or semicircular shape, with the free margin acute, ornamented with transverse wrinkles in the outward side. From its wider ventral edge, projects a short keel, which constricts the posterior cavity in the middle. The anterior dental socket is large, of trigonal outline. The posterior cavity, which occupies the longitudinal posterior bulge, is short and curved, with the shape of slightly asymmetric butterfly wings. It presents a central septum separating the posterior dental socket and the posterior myophoric compartment. Some large specimens present a few pores in the bottom of the cavities. The anterior muscle insertion is a smooth area, in the interior of the shell wall, along the anterior commissural edge.

The dimensions of *Guzzyella bisulcata* are in Table 1.

Table 1. Dimension (mm) of *Guzzyella bisulcata*, new species.

Specimens	Height	Dorso-ventral diameter	Antero-posterior diameter
Holotype IGM-4590, complete, two valves	128	58	48
Paratype IGM-4591, incomplete, two valves	88	56	50
Paratype IGM-4593, incomplete, two valves	65	36	30
Paratype IGM-4614, right valve	110	45	36
Paratype IGM-4615, complete, left valve	40	45	36
Paratype IGM-4616, fragment, right valve	34	57	42
Paratype IGM-4617, complete, left valve	65	55	57
Paratype IGM-4618, incomplete, left valve	37	—	44

Derivation of name—The specific name of the new species *Guzzyella bisulcata* refers to the two deep grooves or sulci which delimit the longitudinal bulge along the posterior side of the two valves.

Discussion—It is very important to point out that all the morphologic features of the left valve are very uniform, and do not change with ontogeny. There is not intraspecific variation in the convexity, development and position of the umbonal region and beak, prominence of the posterior bulge, etc. On the other hand, the right valve does vary in elongation and degree of curvature, obviously in relation to the mode of fixation, which could be determined by the nature of the substratum and the crowding conditions. One specimen shows the acute terminal end, coiled in a whole whorl, with the fixed side flat (Figures 3.9, 3.10).

Guzzyella bisulcata new species, in general appearance is similar to *Texicaprina kugleri* (Bouwman), in the shape and

relative size of the valves and in the posterior myocardinal plan. They differ markedly in the posterior convex bulge and the prominent ventral keel of *G. bisulcata*, and of course in the generic characters, as was mentioned above.

Guzzyella acuminata new species

(Figures 4, 5.1–5.8)

Types—Holotype IGM-4620, paratypes IGM-4621 to IGM-4624.

Material—Two complete specimens, a complete left valve, two incomplete left valves.

Diagnosis—*Guzzyella* with left valve conical, short and wide, with the apex vertical, straight and acute, pointing upward. Right valve cylindro-conical or conical. Cross section of both valves elliptical, with the anteroposterior diameter longer than the dorsoventral.

Description—Inequivalve shell, the height of the right valve is about twice that of the left valve. The pallial canals of the shell wall are small, about 1 mm or less, circular, not arranged in regular rows, with a marginal row of smaller pyriform canals of about 0.5 mm. The outline of the cross section is elliptical, with the antero-posterior axis much longer than the dorso-ventral. The ligament groove is deep in both valves, with a small internal cavity near the periphery.

Left valve conical, short and wide at its basis, comparable to an asymmetric umbrella. The apex is eccentric, not curved nor twisted, with the tip acute, pointing upward. Ligament groove deep, separating the amply rounded dorsal face from the more convex and protruding posterior face. The anterior tooth is large, with a triangular basis, the three sides

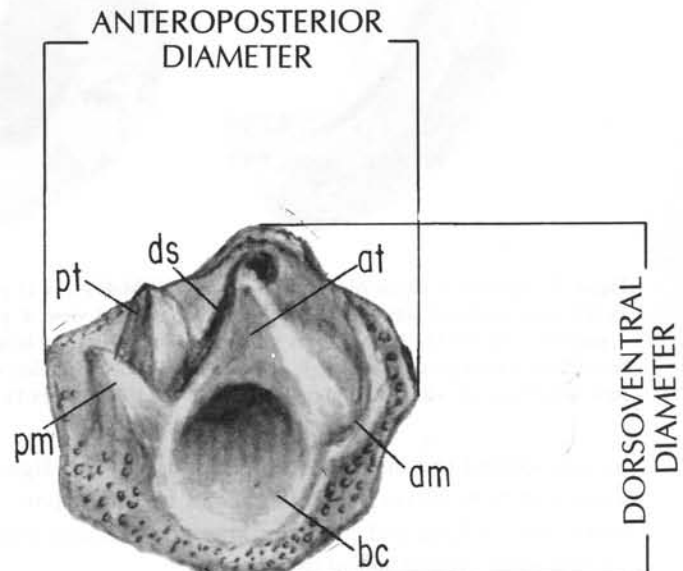


Figure 4. Drawing of *Guzzyella acuminata*, left valve, apertural view.

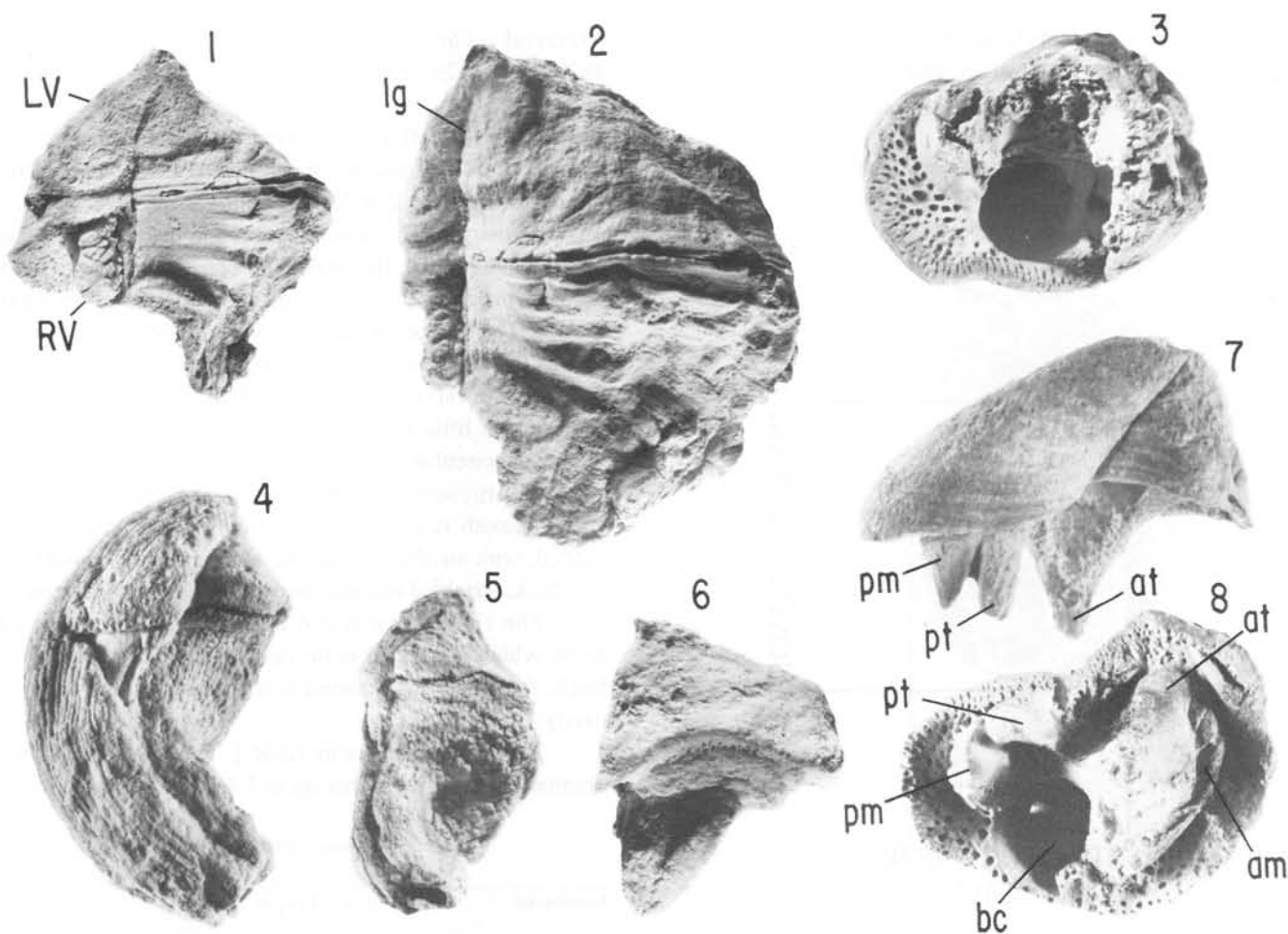


Figure 5. *Guzzyella acuminata* Atencaster. 1, Holotype IGM-4622, (x 1), dorsal view of specimen with two valves; 2, same specimen, anterior view, a little amplified (x 1.5); 3, same specimen, (x 1), apertural view of left valve and part of right valve; 4, paratype IGM-4623, (x 2) juvenile specimen with two valves, posterodorsal view; 5, same specimen, (x 1.4), anterior view; 6, paratype IGM-4626, (x 1), anterior view of an incomplete specimen; 7, paratype IGM-4624 (x 1), posterodorsal view of left valve; 8, the same specimen, (x 1), apertural view.

flat, with angular ridges at the intersection, and with acute tip. The posterior tooth and myophore are long and narrow, with acute apices. They are close together, and about the same size and shape (Figure 4). The dental cavity between the teeth is narrow and elongate. Around the myocardinal structure, the commissural platform is wide, flat, and slightly concave anteriorly and dorsally. The anterior myophoric area is thick and narrow, with soft wrinkles, of appearance similar to a rope.

Right valve conical or cylindro-conical, with the tooth semicircular, thin and with round free margin. Posterior cavity short and curved, with two parts almost of the same size. Anterior muscle insertion area smooth, without a special structure. The measurements of *G. acuminata* are in Table 2.

Derivation of name—The specific name of *Guzzyella acuminata* alludes to the pointing tip of the left valve.

Discussion—This species is considered as *Guzzyella*, because of the anterior myophoric structure in both valves, with no special apparatus, consisting only of a slightly thick surface of the left

valve, and a smooth surface of the right valve. Likewise, by the posterior myocardinal structure, formed by two similar projections in the left valve and a divided cavity similar to a w letter in the right valve.

Table 2. Dimensions (mm) of *Guzzyella acuminata* new species.

Specimens	Height	Dorso-ventral diameter	Antero-posterior diameter
Holotype IGM-4622, complete, two valves	49	31	47
Paratype IGM-4623, juvenile, two valves	32	18	19
Paratype IGM-4624, complete, left valve	45	44	53
Paratype IGM-4625, incomplete, left valve	32	39	51
Paratype IGM-4626, anterior part, left valve	45	35	—

Guzzyella acuminata differs from *G. bisulcata* in the shape of the left and right valves, and also in lacking the posterior bulge and the acute ventral keel.

***Guzzyella* sp. 1**
(Figures 6, 7.1–7.9)



Figure 6. *Guzzyella* sp. 1, left valve, drawing to show the orientation of the measures.

Material—Three left valves, right valve unknown, (IGM-4627, IGM-4628, IGM-4629).

Description—Left valve convex and capuliform, with beak central, short and acute, not projected, a little curved toward the dorsal margin. It is located at the same level as the commissural margin. The dorsal margin and the beak are separated by a triangular area, flat or slightly convex, similar to the inter-area of brachiopods, limited posteriorly by the ligament groove. The section of the valve is oval, with the dorso-ventral axis as the largest measure. Viewed from above (from the ventral face) the valve presents an oval outline, slightly wider ventrally and a little narrower dorsally. The apertural outline is oval to subcircular.

The myocardinal apparatus is as in *Guzzyella*, but the anterior tooth is peculiar, for being a little curved, spatulate shaped, with an obtuse end. The anterior muscle insertion area is a thick, wrinkled and narrow surface, similar to a rope.

The right valve is not known, with exception of the tooth, which is inserted in the dental socket of a left valve. It is thick, falciform, with round free margin, filling entirely the cavity.

The dimensions are in Table 3. The drawings to show the orientation of the measures are in Figure 6.

Table 3. Dimensions (mm) of *Guzzyella* sp. 1.

Specimens	Height	Length	Dorso-ventral diameter	Antero-posterior diameter
Specimen IGM-4627, complete left valve	24	47	31	33
Specimen IGM-4628, complete left valve with tooth	31	43	32	36
Specimen IGM-4629, incomplete left valve with tooth	32	39	31.5	30

Discussion—The diagnostic characters of *Guzzyella* sp. 1, which distinguishes it from the other species, are the oval outline of the cross section, as well as the beak, which is at the same level with the commissural margin. Although only the falciform tooth is known from the right valve, it must be similar to the right valve of the other species of the genus.

***Guzzyella* sp. 2**
(Figures 8.1–8.4)

Material—One complete left valve and an almost complete left valve (IGM-4630, IGM-7608).

Description—Left valve large, with shape of a helmet or a tall cap, regularly convex all around. In profile, the dorsal face is straight and shorter than the ventral flank, which is much larg-

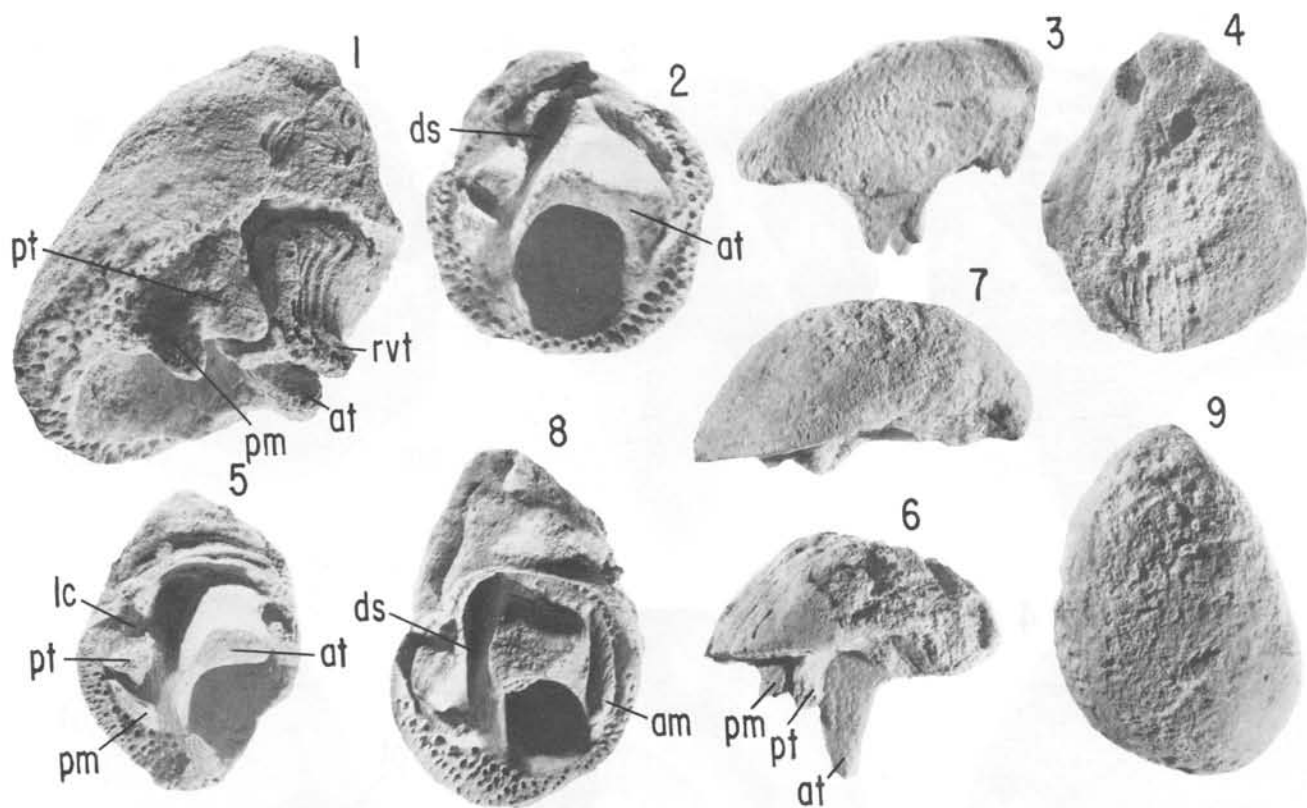


Figure 7. *Guzzella* sp. 1, specimen IGM-4629 (x 1.5) left valve, posterodorsal view, showing posterior tooth and myophore, and right valve tooth inside the dental socket. 2, Same specimen, (x 1), apertural view, with right valve tooth removed; 3, same specimen, (x 1), posterior view, showing the posterior tooth and myophore; 4, same specimen, (x 1), viewed from above (ventral view); 5, specimen IGM-4628, (x 1), left valve a little incomplete, apertural view; 6, same specimen (x 1), posterior view, showing the anterior tooth complete, and the posterior tooth and myophore; 7, specimen IGM-4627 (x 1), posterior view of left valve; 8, same specimen, (x 1), apertural view; 9, same specimen, (x 1), ventral view.

er and convex. The apex is an eccentric, very small flat point, at the dorsal summit of the valve, not projected, nor twisted. The deep ligament groove runs from the apex to the posterodorsal margin, separating the convex borders of the dorsal from the posterior sides, giving rise to a well defined small internal cavity. The commissural outline is subcircular, with the dorsoventral diameter slightly larger than the anteroposterior measure.

The shell wall is very thick, with the internal structures compact and the outer wall composed of small, circular canals, of the same size (about 1 mm), arranged in about three irregular rows. The anterior shell wall is a little thicker, having a few more rows of much smaller canals (about 0.3 mm). The anterior tooth is large and massive, of about the same height as the dorsal length of the valve, and its diameter is larger than the body cavity. The tip is acute with trigonal basis and flat sides. At its anterior side is the muscle insertion area, which is a thick and weakly rough surface. The posterior tooth, much smaller and acute, is close to the myophore, of similar shape. The dimensions of *Guzzella* sp. 2 are in Table 4.

Discussion—These specimens are characterized by the thick and large left valve, regularly round all around, like a convex helmet, with a flat beak at the top, and by the notably big and

massive anterior tooth. It is not comparable at all with the other species of the genus.

Table 4. Dimensions (mm) of *Guzzella* sp. 2.

Specimens	Height	Length	Diameter		Anterior tooth	
			D-V	A-P	Height	D-V dia.
Specimen IGM-4630 complete left valve (with tooth)	66	58	58	49	36	29
Specimen IGM-7608, incomplete left valve	62	53	53	—	33	23

Muellerriedia new genus

Type species—*Muellerriedia boesei* new species, herein designated.

Diagnosis—Shell with two subequal conical valves, the right valve slightly larger. Cross section quadrangular or rhomboidal, with the anteroposterior diameter larger than the dorsoventral. Shell wall with small pallial canals, disposed in a few irregular rows, with a marginal row of smaller pyriform canals. Ligament groove deep, with small internal cavity. Internal structure compact.

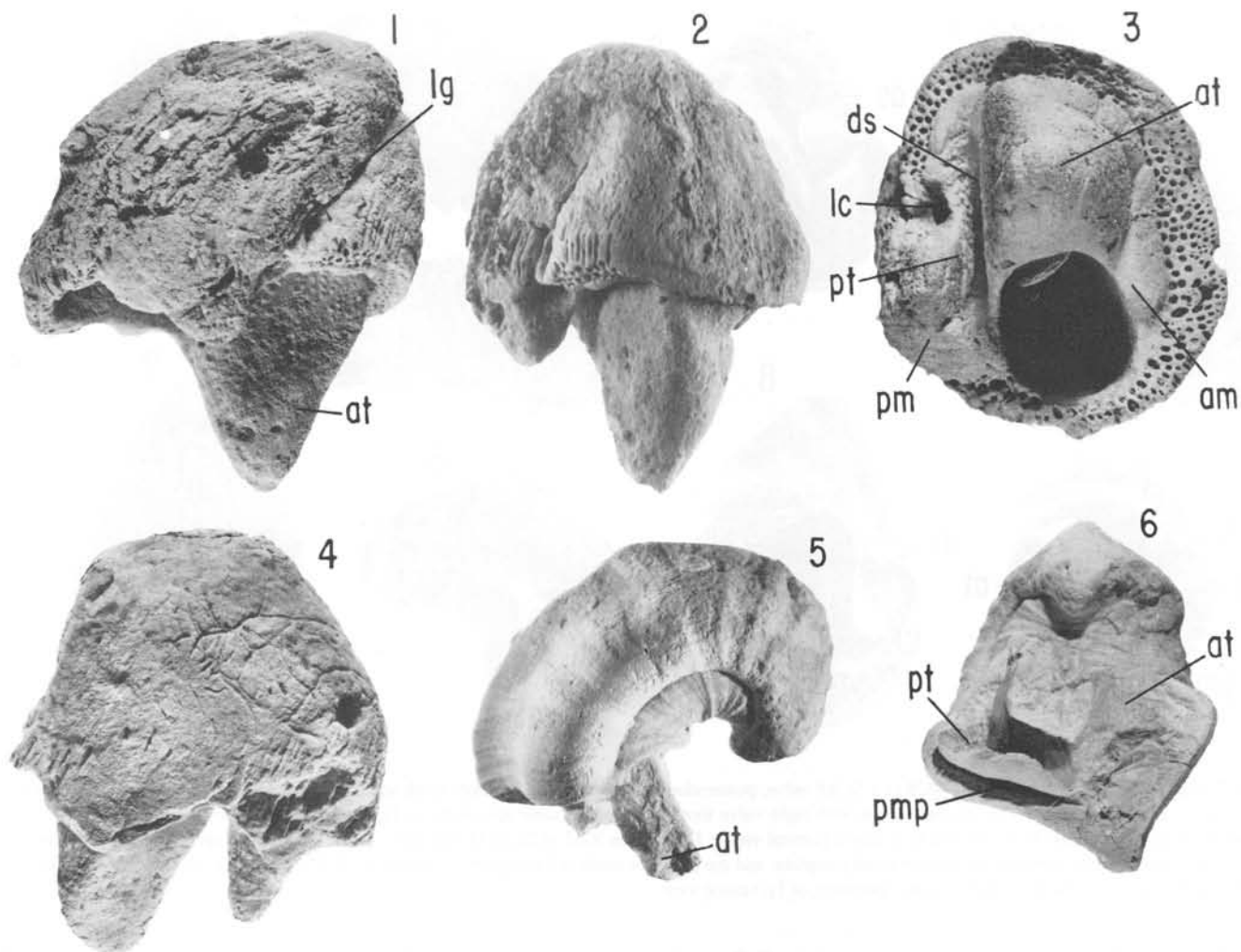


Figure 8. 1, *Guzzyella* sp. 2. Specimen IGM-4630 (x 1), left valve, posterior view; 2, same specimen, dorsal view, showing the large anterior tooth; 3, same specimen, apertural view, showing the canals; 4, specimen IGM-7608, (x 1), incomplete left valve, anterior view; 5, *Muellerriedia* sp., specimen IGM-4595 (x 1), left valve, posterior view; 6, same specimen, apertural view, showing anterior tooth, posterior tooth, and posterior myophoric plate.

Left valve capuliform, with variable level of convexity, with beak acute and orthogyrous. Left valve anterior tooth large. The anterior myophoral area is a small thick surface with some rugae. The posterior tooth is smaller, with the posterior myophore projecting from it, as a thin, vertical tabular plate, extended from the tooth to the wall of the body cavity. The dental cavity between the teeth is narrow and deep. The myocardinal posterior cavity of the right valve is curved and short, divided in the middle by a septum separating two compartments of slightly different size. The anterior muscle insertion area is a smooth surface. The tooth is thin, of semilunar shape (falciform).

Derivation of name—The name of the genus *Muellerriedia* is dedicated to Professor Friedrich Karl Gustav Müllerried, geologist and paleontologist born in Germany, who lived in Mexico for about 25 years. He worked at the institutes of Biology and Geology of the National University of Mexico, until his death, in 1952. He studied Mexican rudists from many

places of the Mexican territory, and published fundamental contributions for the understanding of these fossils.

Discussion—The new genus *Muellerriedia* is very similar to *Guzzyella* in many features. They are similar in the shape and the relative size of the valves, in the canaliculate shell wall and the internal compact shell, as well as in the anterior myocardinal structure of both valves, and in the shape of the right valve tooth and myocardinal posterior cavity. They differ in the structure of the left valve posterior myophore. In *Muellerriedia* it is a thin and vertical plate, projected from the posterior tooth, to which is joined along the ventral side of the latter. In *Guzzyella* the left valve posterior myophore is a long and acute projection, similar to the tooth, joined only at the basis, and separated by a groove. *Muellerriedia* is similar to *Texicaprina* in the shape and relative size of the valves, in the shape of the left valve dental socket and in the right valve tooth. They are also comparable in the posterior myocardinal cavity of the right valve. The remarkable differences are the completely per-

forated shell wall of *Texicaprina*, the anterior complex myophoric structure, formed by a series of tubercles in the left valve, with the corresponding pits in the right valve, and the left valve posterior myophore, which is tooth-like, of the same type of *Guzzyella*.

***Muellerriedia boesei* new species**

(Figures 9, 10.1–10.10)

Types—Holotype IGM-4596, paratype IGM-4594.

Material—A complete specimen and a complete left valve.

Diagnosis—*Muellerriedia* with two longitudinal acute carinae in both valves, anterior and posterior to the ventral face, and a posterior longitudinal convex bulge, limited dorsally by the ligament groove.

Description—Small size species (see dimensions in Table 5), of conical valves, and quadrangular cross section, the left valve a little smaller. Surface smooth. Ligament groove deep, with a small internal cavity. In both valves, two prominent angular carinae or keels are at both sides of the wide ventral region, which is slightly concave. Also in both valves, there is a convex bulge all along the posterior region, limited in front by the ligament furrow, and behind by a concave, depressed area. The anterior region is flat and corrugated.

The outer surface is smooth. The shell wall is formed by very small circular pallial canals of 0.5 mm, disposed in about three irregular rows, and a thin marginal row of smaller oval or pyriform canals. The internal shell wall is compact.

The left valve beak is short and acute, not projected, located near the dorsal margin. The myocardial structure is composed of a large anterior tooth, of trigonal basis, with the adjacent anterior myophoric area as a thickening of the shell wall with rugae. The posterior tooth is much smaller. The posterior myophore is a thin plate, with acute edge, joined to the tooth along the latter's ventral side, and extended to the body cavity (Figure 9). The dental cavity between the teeth is very

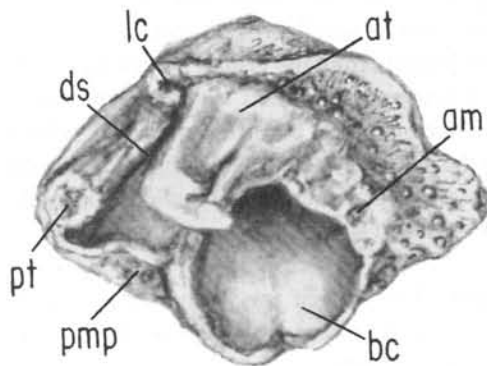


Figure 9. *Muellerriedia boesei*, left valve, drawing to show the main features.

Table 5. Dimensions (mm) of *Muellerriedia boesei* new species.

Specimens	Height	Length	Dorso-ventral diameter	Antero-posterior diameter
Holotype IGM-4596, complete, two valves	85	42 (left valve)	39	42
Paratype IGM-4594, complete, left valve	36	35	32	45

deep and narrow in the dorsal part, and a little wider in the ventral part.

The right valve tooth is a thin vertical plate, with the free margin acute and semicircular, extended a little beyond the ligament groove, to the middle of the posterior myocardial cavity. This cavity is curved, short, divided at the center by a septum in two subequal parts. The anterior dental cavity is large. The smooth anterior muscle insertion area is in the inner shell wall, facing the left valve anterior wrinkled area.

Derivation of name—*Muellerriedia boesei* is dedicated to Emil Böse as an acknowledge to his valuable contribution to the paleontology of Mexico.

Discussion—Because the specimens are nicely preserved, it is possible to know the fine details of the structure. The holotype was fixed to the substratum by the anterior region, which is flat, rough with irregular wrinkles, which suggest an irregular sea bottom. This species is similar at first sight to *Guzzyella bisulcata* in the general shape; however, they are unlike fundamentally in the different type of the left valve posterior myophore. Besides, *Muellerriedia boesei* lacks the second sulcus of the posterior bulge and the ventral ridge of *Guzzyella bisulcata*. Moreover, its largest diameter is anteroposterior instead of dorsoventral and, therefore, the cross section is notably different.

***Muellerriedia* sp.**

(Figures 8.5, 8.6)

Material—One complete left valve (IGM-4595).

Description—Left valve of medium size (see dimensions in Table 6), with prominently developed umbonal region, convex, with acute, orthogyrous beak, projected toward the dorsal margin, hanging over the dorsal wall. The valve presents three well-developed longitudinal ridges. The most prominent is angular and elevated, running along the middle of the ventral region, bounded to each side by soft, longitudinal depressions. The other keels or ridges are convex, located in the middle of the anterior and posterior sides, and of similar prominence. The outline of the aperture is rhomboidal, with the anteroposterior dimension larger than the dorsoventral. The ligament groove is narrow and deep, and limits dorsally the posterior ridge.

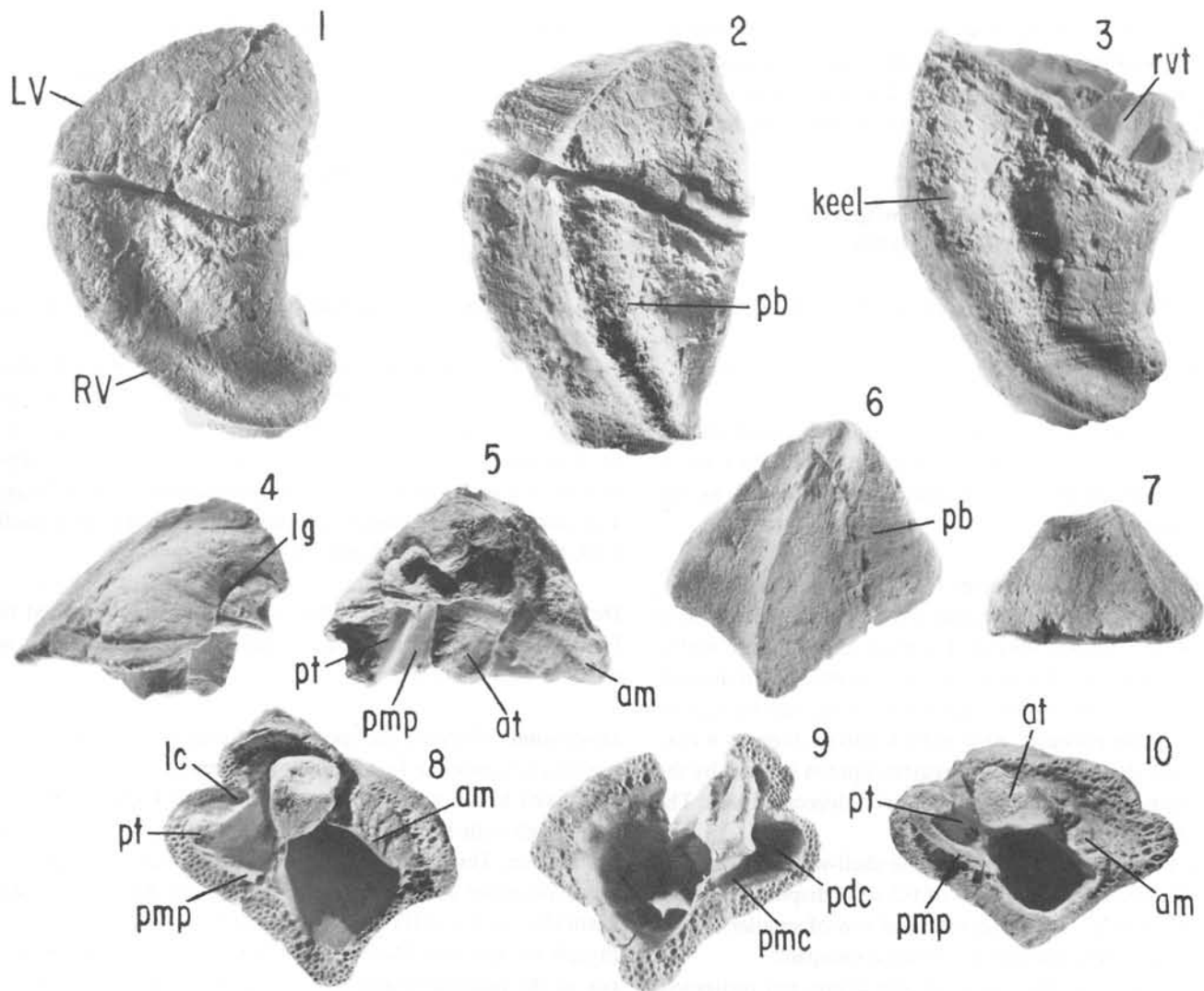


Figure 10. *Muellerriedia boesei* Alencaster. 1, Holotype IGM-4596 (x 1), a complete specimen with two valves, posterior view; 2, the same specimen, posteroventral view, showing the posterior bulge and posteroventral keel; 3, same specimen, right valve, showing the tooth; 4, same specimen, left valve, posterior view; 5, same specimen, left valve dorsal view; 6, same specimen, left valve posteroventral view; 7, same specimen, ventral view of left valve; 8, same specimen, left valve, apertural view, showing the anterior muscle insertion area, anterior and posterior teeth, and posterior myophoric plate; 9, same specimen, right valve apertural view, showing the posterior myocardinal cavity and the tooth; 10, paratype IGM-4594 (x 1), left valve, apertural view.

Table 6. Dimensions (mm) of *Muellerriedia* sp.

Specimens	Height	Length	Dorso-ventral diameter	Antero-posterior diameter
Specimen IGM4595, complete left valve with tooth	48	52	31	41

The very thin outer shell layer is smooth with well marked growth lines and wrinkles. The middle layer shell wall is about 5 mm thick, and a little thicker in the ventral keel (8 mm). It presents a marginal row of very regular tiny pyriform canals and about two or three not well defined rows of oval or circular canals of uniform size (0.3 to 0.4 mm). Internal structure compact.

Anterior tooth in the center of the dorsal margin, large and long, with a trigonal basis, and the three sides flat. The posterior tooth is smaller, with oval basis. The posterior myophore projects from the ventral side of the tooth as an erect plate with acute edge, parallel to the commissure. The dental socket between the teeth is narrow and small, with the size and shape of the presumptive semilunar right valve tooth. Anterior muscle insertion area adjacent to the anterior tooth, is a short and thick wrinkled surface.

Discussion—The studied specimen is a very well preserved left valve, as to deserve to be described, in spite of the lack of the right valve. *Muellerriedia* sp. differs from *M. boesei* by the greater convexity of the umbonal region, and the larger and protruding beak, hanging over the dorsal face. The two species

are similar in having three longitudinal ridges. However, they differ because in *Muellerriedia* sp. these are rounded and symmetrical, because the ventral keel is at the center of the region, and the lateral ridges are equally salient. On the contrary, in *M. boesei*, the ridges or keels are acute and asymmetrical, because the ventral region is wide and slightly concave, with the unequal keels at both sides, being more prominent the posterior.

TAXONOMIC CONSIDERATIONS ABOUT *GUZZYELLA*, *MUELLERRIEDIA*, *TEXICAPRINA* AND *JALPANIA*

The new genera *Guzzyella* and *Muellerriedia* differ only in the LV posterior myophore. (In this section are used the abbreviations LV= left valve, and RV= right valve). In *Guzzyella* it is tooth-like, similar in shape and size to the posterior tooth; they are joined at the basis and have the acute tips separated. In *Muellerriedia* it consists of a vertical, thin plate, joined to the posterior tooth all along the ventral side of the latter.

Conversely, both genera share many common characters, such as the shell wall structure, the RV falciform tooth, the LV dental cavity, the RV posterior cavity, and the simple anterior myophoric structure, consisting in the LV of a shell wall thickened area and in the RV of an inner smooth surface. The cited features, including the dissimilar as well as the common ones, are not exclusive to these taxa, but are shared by other genera. The shell wall structure, with canaliculate outer part and compact inner part, is the more common type in most genera of Caprinidae. The falciform tooth, the LV dental socket and the RV posterior myocardial cavity, are of the same type as in *Texicaprina* and *Jalpania*.

It is interesting to call attention about the RV posterior cavity, which was discovered by Bouwman (1937) in *Sabinia kugleri*, from Trinidad. His figures 2 and 10 suggest the shape of a butterfly with symmetric wings (or like a low w letter) and the figures 5a, b, c, indicate its variations in shape. Bouwman did not know the RV tooth, neither the LV posterior myophore and tooth, which were described as broken thick plates. Erroneously, he assumed that the LV dental socket could not be entirely filled by the RV tooth.

About *Sabinia kugleri* Bouwman, Mac Gillavry (1937) remarked that the RV posterior cavity is shorter and different from that of other species of *Sabinia*, and considered that the generic assignment was wrong. In fact, later on Coogan (1973) proposed the new genus *Texicaprina*, to which belongs *Texicaprina kugleri* (Bouwman), which is the best-known species of the genus (Alencáster and Oviedo-García, 1998). Coogan (1973) considered as the main generic feature of *Texicaprina*, "in the lower valve the accessory plus tooth socket in cross section is shaped like a broad low letter w". Coogan did not describe the LV posterior tooth and myophore that enter into this cavity, because he did not have left valves. Until then, these structures were not well known. They were

described in detail for the first time in *Texicaprina kugleri* (Bouwman) from specimens of El Madroño, Querétaro (Alencáster and Oviedo-García, 1998).

Texicaprina Coogan is the genus more closely related to *Guzzyella*, as was mentioned in the discussion of the new genus. The most notable likeness is the type of LV posterior tooth and myophore. However, *Guzzyella* and *Texicaprina* differ profoundly in the shell wall structure, and in the anterior myophoral structure, as was also pointed out.

Comparing *Muellerriedia* with *Texicaprina*, they resemble and differ in the same characters noted for *Guzzyella*, besides the LV posterior myocardial apparatus, as the most notable dissimilarity, as was reported above.

The recently described genus *Jalpania*, from El Madroño (Alencáster and Aguilar-Pérez, 1995) is a very peculiar taxon, unlike in many aspects to any other genus. However, it presents a similarity to *Guzzyella* and *Texicaprina* in the LV posterior tooth and myophore, which are together and of the same size and shape. Likewise, it is provided with the same type of complex anterior myophoral structure as *Texicaprina*, consisting of a row of tubercles in the LV, opposed to a row of pits in the RV.

By the preceding revision of the characteristics shared by the two new genera, not only a generic, but even a suprageneric taxonomic hierarchy is evident, since the characters are present in two or more genera. Consequently, the LV posterior myocardial structures of *Guzzyella* and *Muellerriedia* have the same taxonomic value. Therefore, notwithstanding the several similarities, they have to be considered as different generic groups.

According to this analysis, the diagnostic aspects to separate the genera *Guzzyella*, *Muellerriedia*, *Texicaprina* and *Jalpania*, result from the different combinations of the described features. It is convenient to give emphasis that each one of these genera is a separate entity, clearly defined and distinguishable.

The discrimination of species is based mainly in the morphology of the left valve. The specimens considered as a species, are recognizable and distinctive from the others. The intraspecific variability is not well known, mainly in the species treated in open nomenclature, due to the insufficiency of specimens. However, the traits of a species seems to be well defined, and, with the material available, it is not possible to mix up a species with another, because there are not gradual forms between them.

As to the suprageneric position of the genera, they would correspond to the subfamily Coalcomaninae of Coogan (1973) as recently emended by Chartrousse (1998). The LV posterior myophore is projected downward, beyond the commissural margin, fitting in the RV myophoral cavity; the muscle insertion is on the external face of the myophore and on the internal face of the shell wall.

However, it is important to accentuate the dissimilarity of the posterior myocardial apparatus of the new genera,

together with *Texicaprina* and *Jalpania*, with that of well-known genera, as *Coalcomana*, *Caprinuloidea*, *Kimbleia*, *Amphitriscoelus*, *Huetamia*, etc. In these last genera, the LV posterior myophore and tooth are clearly different from each other in shape and size. The LV myophore is a vertical, tabular plate, thin or thick, slightly curved, separated or projected from the posterior tooth. The corresponding RV myocardial cavity is large, with two unequal parts, of different size and shape, being always smaller the dental socket and larger the myophoral cavity. In the case of *Muellerriedia*, although the LV myocardial structure differs from that of *Guzzyella*, the RV posterior cavity is very similar, and different from the typical Coalcomaninae.

For that reason, at the moment, the genera are not included emphatically in the subfamily Coalcomaninae, expecting the finding of more material, to evaluate the suprageneric characters and to consider the eventual inclusion of all these genera in a new subfamily.

In this same context, it is pertinent to call attention to the genus *Mexicaprina* (Coogan, 1973), which is frequent in the Albian beds of Texas and in the El Abra Formation of northwestern Mexico, inclusive in El Madroño (Alencáster and Oviedo-García, 1998). It is a peculiar genus with the RV long and slender, tubular, of subcircular or quadrangular cross section, with or without projections at the corners, and about ten times larger than the small, conical left valve. The myocardial organization is unlike that of any other caprinid. The LV posterior tooth and myophore are much reduced, not projected, facing a shallow RV posterior cavity of the same shape and size. In contrast, the LV anterior tooth is large and the LV anterior myophore is a vertical plate, surpassing the commissural margin, hanging downward, opposite to a shallow depression on the anterior side of the RV.

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