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# Upper Berriasian ammonites from the Taraises Formation of Cuencamé de Ceniceros section, Durango State, Northern Mexico

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## ABSTRACT

We present evidence of late Berriasian sedimentation which records the presence of *Spiticeras correardi*, whose stratigraphic range is not well established. Located at Cuencamé de Ceniceros, Durango State, northern Mexico, a section belonging to the Taraises Formation is here presented to show our results. Furthermore, the sampled ammonite assemblage—herein constituted by *Fauriella* cf. *boissieri*, *Berriasella* cf. *calisto*, *Spiticeras correardi*, and *Kilianiceras praegratianopolitense*—is attributed to the upper Berriasian standard Mediterranean ammonite Zone *Fauriella boissieri*. It is worth noting that *B. cf. calisto* has strong biostratigraphic significance, due to the fact that it is restricted to the upper part of the aforementioned *Fauriella boissieri* Zone (*Tirnovella alpillensis* and *Thurmanniceras otopeta* subzones).

**Keywords:** Ammonoids, upper Berriasian, Taraises Formation, Mexico, *Fauriella boissieri* Zone, marine transgression.

## RESUMEN

Presentamos evidencia de sedimentación del Berriasiano tardío que registra contenido de *Spiticeras correardi*, cuyo rango estratigráfico hasta ahora no se encuentra bien establecido. Nuestros resultados se señalan en una sección estratigráfica correspondiente a la Formación Taraises, ubicada en Cuencamé de Ceniceros, en el Estado de Durango, norte de México. La asociación de ammonoideos en la sección—formada por *Fauriella* cf. *boissieri*, *Berriasella* cf. *calisto*, *Spiticeras correardi*, y *Kilianiceras praegratianopolitense*—se atribuye aquí a la Zona *Fauriella boissieri*, del Berriasiano superior del estándar Mediterráneo. Vale la pena señalar que la especie *B. cf. calisto* tiene un fuerte significado bioestratigráfico, pues se encuentra restringida a la parte superior de la mencionada Zona *Fauriella boissieri* (Subzonas *Tirnovella alpillensis* y *Thurmanniceras otopeta*).

**Palabras clave:** Ammonoides, Berriasiano superior, Formación Taraises, México, Zona *Fauriella boissieri*, transgresión marina.

## 1. Introduction

The Berriasian, considered the formal lowest Cretaceous stage since the “Symposium on the Lower Cretaceous” held in Lyon in 1963 (Barbier and Thieuloy, 1965), has called the attention of different researches for its peculiar stratigraphy and ammonites record.

In Mexico, the studies on the Berriasian initiated with the contribution of Felix (1891), who reported the presence of the genus *Subthurmannia* from Cerro de la Virgen, nearby Tlaxiaco in Oaxaca State, southern Mexico. Afterwards, among the few works that reported Berriasian ammonoids in Mexico, are the pioneering contributions of Burckhardt (1906, 1910, 1912, 1919 and 1930). This author collected Berriasian ammonoids in the locality “Cerro del Aguajito”, San Pedro del Gallo, Durango State (1910) that he afterwards described in detail in 1912. He compared those ammonoids with coeval forms from south Europe and the Andean region. Those materials are deposited in the Colección Paleontológica Nacional (National Paleontological Collection), held by the Instituto de Geología of the Universidad Nacional Autónoma de México, and have served as a comparative reference to constrain the late Berriasian from the base of the Taraises Formation in the work presented herein. The same author (Burckhardt, 1930), integrated all information available at that time, regarding ammonites from the Berriasian and other Mesozoic stages. Posteriorly, Imlay (1938) describes the Taraises Formation from the west of Parras town in the State of Coahuila; this author reconsidered the information published by Burckhardt (1912), referring a Berriasian-Valanginian age for the unit. Afterwards, Imlay (1944) reported Berriasian ammonites from Tamaulipas State, northeast Mexico, highlighting the presence of the genera *Berriasella*, *Spiticeras*, *Neocosmoceras* and *Hemispiticeras*. Cantú-Chapa (1967) made a study of facies of Berriasian age from the Lower Tamaulipas Formation of Mazatepec, Puebla in central Mexico, containing abundant

specimens of the ammonites *Subthurmannia mazatepense*, *Subthurmannia dominguense*, *Subthurmannia* sp., *Groebericeras poblanense*, *Berriasella* aff. *zacatecana* and *Spiticeras* sp. Later, the same author (Cantú-Chapa, 1976) studied ammonites of early Berriasian age such as *Neolissoceras semisulcata* Burckhardt and *Subthurmannia* sp., and from the upper Berriasian such as *Berriasella neohispanica* Burckhardt and *Spiticeras* (Spiticeras) sp.; recovered from the well Bejuco 6, in Veracruz State. Contreras-Montero *et al.* (1991) displayed the late Berriasian ammonite *Berriasella* (*Picticeras*) *picteti* (Jacob) from “Cerro del Panteón” locality in Durango State.

Since then, few studies have been performed in Mexico regarding Berriasian ammonoids, standing out a recent contribution by Zell *et al.* (2015), on which the Berriasian-Valanginian boundary is defined in southern Mexico by means of ammonites and calpionellids.

In this work, we compare the currently studied ammonites with the south-European Berriasian ammonite record. The material was collected by systematic bed-by-bed sampling in a section located near the vicinity of the town Cuencamé de Cenicerros, Durango State, northern Mexico. Despite the small number of the herein studied specimens, these ammonites allow us to record the presence of the upper Berriasian in the lower part of the Taraises Formation. This lithostratigraphic unit was defined by Imlay (1936) in the type locality of “El Cañón de Taraises”, Coahuila State; where he also characterized its fossil record allowing to assign its age range from the Valanginian to the early Hauterivian. Later, the same author (Imlay, 1938) reassigned such age range of the Taraises Formation expanding its lower limit into the Berriasian. Here we characterize upper Berriasian ammonoids to accumulate updated data about the taxonomical and biostratigraphical significance of this fossil group for Mexico. Our data and future reports will allow the establishment of similarities and differences of the Mexican Berriasian ammonites with the standard Mediterranean ammonite zonation of Reboulet *et al.* (2014), a scheme that

we use here as the best available option, due to the lack of an American ammonite biozonation for the Berriasian stage.

## 2. Geological setting

The Taraises Formation has excellent exposures in northern Mexico. Imlay (1936) defined this formation as a limestone and marly limestone that contains abundant Valanginian and Hauterivian fauna. Nowadays, it is well-known that the lower limit of the unit extends into the Berriasian. The same author divided the formation into two members. The lower member is constituted by dark to grey limestone beds separated by thin marly intervals. It is more resistant to erosion than the upper member and can be clearly observed in the field, conspicuously overlaying the sandstones and Jurassic black shales from the La Casita Formation. Imlay (1936) describes the upper member as dark to grey thin-bedded limestones with intercalated marly intervals.

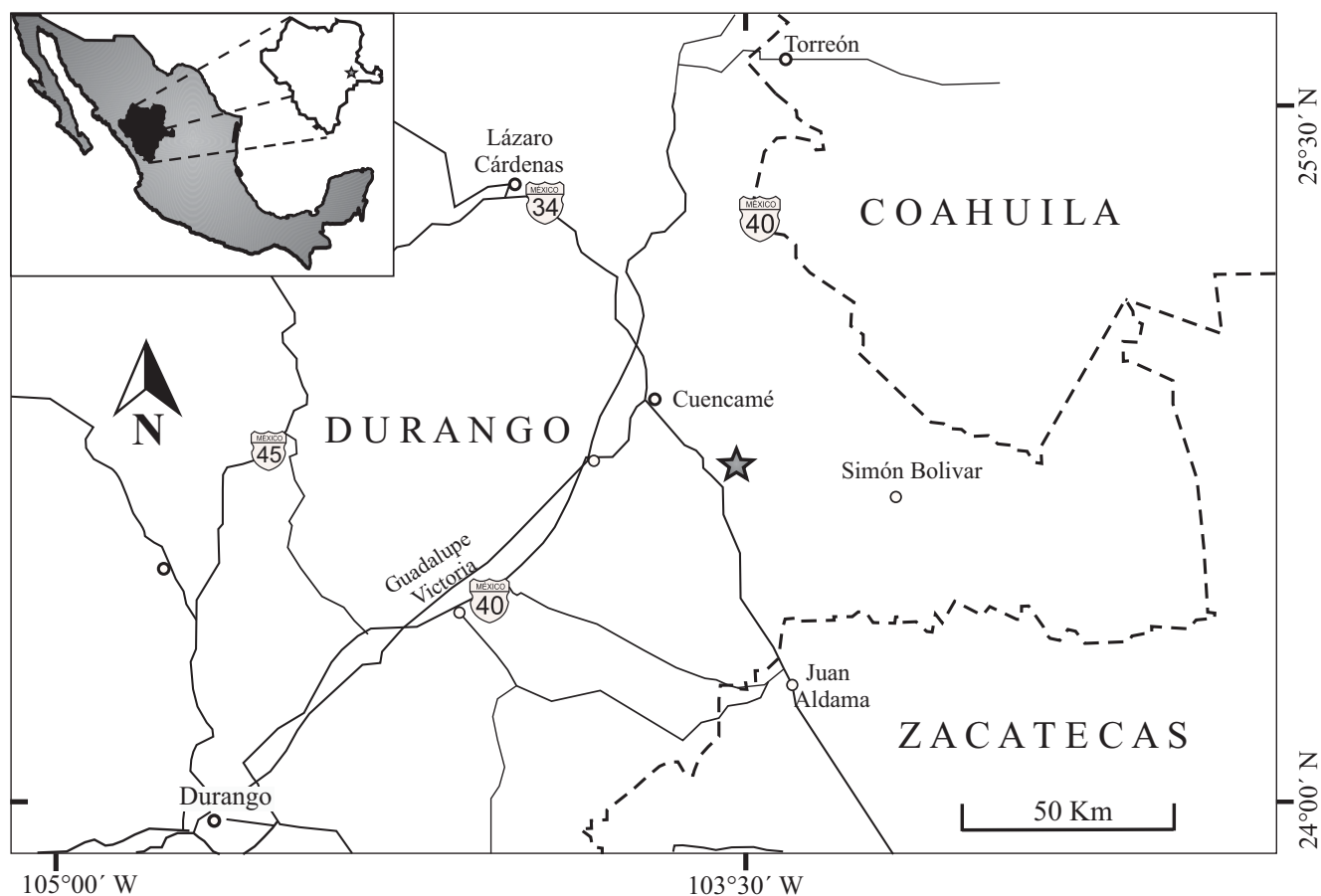
Regionally, during the Late Jurassic, a marine transgression started, and continued on the Early Cretaceous, covering most of northeast Mexico (Burckhardt, 1930; Imlay, 1938; Morán-Zenteno, 1994). Such event gave way, throughout the entire Berriasian-Barremian interval, to deposition of a heterogeneous sequence composed of various formations that reflects a spectrum from littoral and continental into basinal facies. The ammonite-bearing argillaceous limestones of the Taraises Formation (Imlay, 1936) were deposited during the Berriasian-Hauterivian interval in the southeast sector of the Sabinas Gulf. The section herein studied represents a portion of the late Berriasian sedimentation within this important Mesozoic paleogeographic element of northeast Mexico on a local extent. It is located to the east of the small city of Cuencamé de Ceniceros, Durango State (Figure 1). It is bounded by the parallel 24° 43' 30" and 24° 44' 30" north latitude and the meridian 103° 31' and 103° 32' west longitude according to the Cuencamé sheet map (Enciso de la Vega,

1968). The thickness of the studied section (Figure 2) is 21.85 m of an irregular alternation of thin-bedded limestones and thicker marls which can be, unambiguously, attributed to the lower member of the Taraises Formation. We named this section as CU-7 due to successive fieldwork campaigns in the area. The particular lithological features of the lower member of the formation in our study area are more similar to those from the "El Cerro del Aguajito", San Pedro del Gallo, Durango State studied by Burckhardt (1912); compared to the type area of the formation in Coahuila State. Burckhardt (1912) described the fossiliferous limestones of the Taraises Formation that overlay the La Casita Formation. Those materials correspond to thin-bedded brownish to yellowish limestones because of the presence of iron oxide. Despite the thinness and limited exposure of the fossiliferous limestones, we obtained a quite representative collection of Berriasian ammonites.

## 3. Systematic paleontology

Seven samples, mostly composed by poorly preserved phragmocones and an inner whorl were studied herein, among which five are figured in this work (Figure 3). Material is deposited at the Colección Paleontológica Nacional (National Paleontological Collection), held by the Instituto de Geología of the Universidad Nacional Autónoma de México, under catalogue numbers IGM 4903 through IGM 4907 as indicated in the explanation of Figure 3.

A detailed analysis of the ammonites allows their taxonomic ascription —mostly following the systematic arrangement proposed by Wright *et al.* (1996) and Klein (2005)—. For a better taxonomical characterization of specimens, some measurements of their morphological features are given (in millimeters). Those with asterisk are approximate. The measurements abbreviations are D: maximum diameter; Wh: whorl height; Ww: whorl width; and U: umbilicus diameter. For biostratigraphical purposes we used the standard Med-



**Figure 1** Geographic location of the studied section in Cuencamé de Ceniceros, Durango State, Mexico. The fossiliferous locality is marked with a star. Dashed lines indicate State boundaries, while continuous lines represent major highways.

iterranean ammonite zonation of Reboulet *et al.* (2014). The range of ammonite taxa is illustrated in Figure 2. In this regard, it is worth to note that, contrary to Wright *et al.* (1996), who regarded the genus *Fauriella* as being a synonym of *Subthurmannia*, in this work we follow the points of view of Le Hégarat (1973) and Nikolov (1982), who considered both genera to be valid. In consequence, we use the specific name *Fauriella boissieri*, instead of *Subthurmannia boissieri*, to characterize the uppermost zone of the Berriasian in the standard Mediterranean ammonite zonation.

Suborder Ammonitina Hyatt, 1889  
 Superfamily Perisphinctoidea Steinmann, 1890  
 Family Neocomitidae Salfeld, 1921  
 Subfamily Berriasellinae Spath, 1922

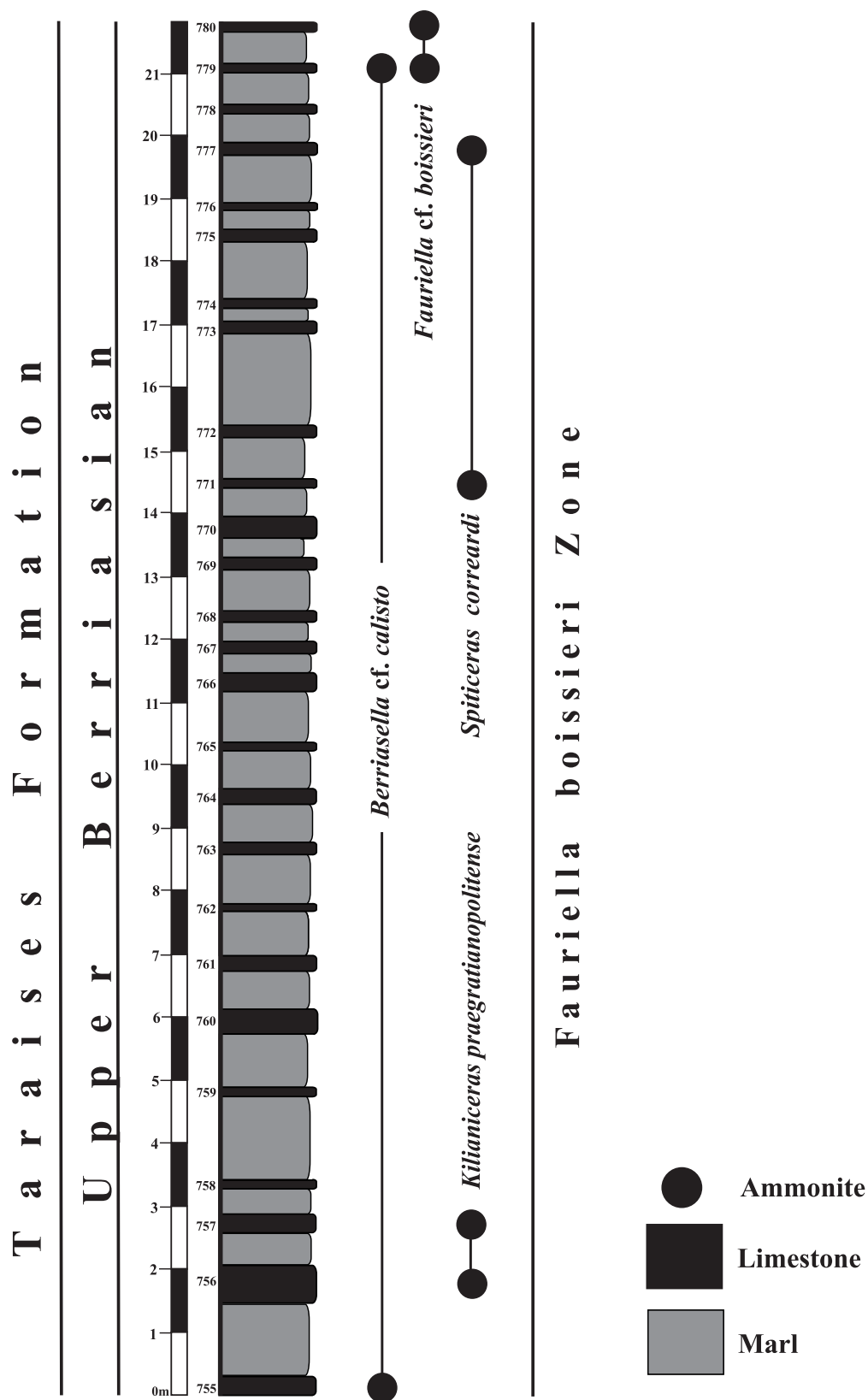
Genus *Fauriella* Nikolov, 1966

**Type species.** *Berriasella gallica* Mazenot, 1939

*Fauriella* cf. *boissieri* (Pictet, 1867)

Figure 3 D

- 1867 *Ammonites boissieri* Pictet, p. 79, pl. 15, figs. 1–3.
- 1993 *Fauriella boissieri* (Pictet) - Matsumoto and Skwarko, p. 414, figs. 3, 4, 19A–D.
- 2005 *Fauriella boissieri* (Pictet) - Klein, p. 259 (cum syn.).
- 2007 *Fauriella boissieri* (Pictet) - Arkadiev, p. 188, pl. 1, figs. 1–3.
- 2008 *Fauriella boissieri* (Pictet) - Arkadiev *et al.*, p. 413, pl. 3, figs. 6, 7.



**Figure 2** Lithology, ammonite distribution and referred biozone of the upper Berriasian section of this study (CU-7).



- 2010 *Fauriella boissieri* (Pictet) - Főzy *et al.*, p. 531, fig. 4a, b.  
 2013 *Fauriella boissieri* (Pictet) - Bujtor *et al.*, p. 286, figs. 5j-k.  
 2013 *Fauriella boissieri* (Pictet) - Krische *et al.*, p. 40, fig. 13A.  
 2014 *Fauriella boissieri* (Pictet) - Kenjo, p. 34, pl. 11, figs. 1–6, Pl. 12, figs. 1–4, pl. 13, fig. 1.

**Material.** Two incomplete specimens with only the last whorl preserved (Table 1). CU7-779a (illustrated in Figure 3) and CU7-780.

**Description.** Evolute shell with a compressed whorl section and flanks nearly flat. Umbilical region wide and deep, rounded umbilical shoulders. The section is compressed. The ornamentation is constituted by strong ribs, rectiradiate to slightly flexuous, that arise isolated or in pairs from a small umbilical tubercle. The ribs bifurcate in the upper third of the flank, the space between these is equal to the thickness. All ribs have an adoral projection in the upper third of the flank and cross the ventral region without interruption.

**Discussion.** The characteristic ornamentation of *Fauriella boissieri* is very similar to the specimen illustrated in this work. Preservation of herein studied ammonoids, particularly in their last whorl, permits a direct comparison with the specimens illustrated by Le Hégarat (1973, Pl. 21, figs. 1-3; Pl. 48, fig. 1) and Company (1987, Pl. 4, fig. 7; Pl. 18, fig. 6). The only differences are that, in the Mexican specimens, the tubercles, from which the ribs arise, are smaller and the ribs interspaces are bigger. The specimens showed by Matsumoto and Skwarko (1993, figs. 19 A, D) and by Wippich (2001, Pl. 13, fig. 1), are closer to our specimens in their more rigid costulation, their interspaces dimensions, and in the fact that their ribs cross the ventral region without interruption. The species *Fauriella boissieri* is characterized by possessing

a smooth siphonal band; however, this cannot be observed in our specimens. Nonetheless, Company (1987) mentioned that this siphonal band disappears during ontogenetic development.

**Distribution.** The range of *Fauriella boissieri* is upper Berriasian (*Fauriella boissieri* Zone) to lowermost Valanginian. This species has been reported in France (Mazenot, 1939; Le Hégarat, 1973), Spain (Tavera, 1985; Company, 1987), Austria (Krische *et al.*, 2013; Bujtor *et al.*, 2013), Crimea (Arkadiev, 2007; Arkadiev *et al.*, 2008), Hungary (Főzy *et al.*, 2010), Bulgaria (Nikolov, 1966), Italy (Faraoni *et al.*, 1997), the Alps (Immel, 1987), Morocco (Wippich, 2001), Papua New Guinea (Matsumoto and Skwarko, 1993) and Madagascar (Collignon, 1962).

Genus *Berriasella* Uhlig, 1905

**Type species.** *Ammonites privasensis* Pictet, 1867

*Berriasella* cf. *calisto* (d'Orbigny, 1850)

Figure 3 H

1850 *Ammonites calisto* d'Orbigny, p. 551, Pl. 213, figs. 1, 2.

2005 *Berriasella* (*Berriasella*) *calisto* (d'Orbigny) - Klein, p. 166 (cum syn).

2008 *Berriasella calisto* (d'Orbigny) - Arkadiev *et al.*, p. 416, Pl. 4, fig. 2.

2013 *Berriasella* (*Berriasella*) *calisto* (d'Orbigny) - Bujtor *et al.*, p. 283, fig. 5A.

2014 *Berriasella calisto* (d'Orbigny) - Kenjo, p. 31, Pl. 9, figs. 5, 6, Pl. 10, figs. 1–10.

2015 *Berriasella* cf. *calisto* (d'Orbigny) - Boorová *et al.*, p. 116, fig. 9C.

**Material.** Two fragmented and poorly preserved specimens. CU7-755 (illustrated in Figure 3) and CU7-779b.

**Description.** Shell with flattened flanks (Wh: CU-755=31\*mm; Wh: CU7-779b=13 mm). Ventral region and umbilicus cannot be observed. Ornamentation consists on flexuous ribs that arise on the umbilical region. Some ribs bifurcate at the last third of the flank where they also become projected forward.

Table 1. Dimensions of specimens of *Fauriella* cf. *boissieri* (Pictet, 1867).

Specimen	D(mm)	Wh(mm)	Ww(mm)	U(mm)
CU7-779a	88.5*	34.9	20.1	29.1
CU7-780	65	30.5	---	28.4

**Discussion.** When compared with the holotype, and other typical representatives of the species, the studied specimens display a very similar shell structure and ribbing design. Nevertheless, our specimens show a distinctly higher proportion of non-bifurcate ribs.

**Distribution.** This species has strong biostratigraphic significance because it is restricted to the upper Berriasian, in particular to the upper part of the *Fauriella boissieri* Zone (*Tirnovella alpillensis* and *Thurmanniceras otopeta* subzones). The taxon has been reported from France (Mazenot, 1939; Le Hégarat, 1973), Spain (Company, 1982; Tavera, 1985), Bulgaria (Nikolov, 1982), Poland (Pszczółkowski and Myczynski, 2004), Crimea (Arkadiev *et al.*, 2008), Austria (Vašíček *et al.*, 1999; Bujtor *et al.*, 2013; Boorová *et al.*, 2015), Hungary (Főzy *et al.*, 2010), Madagascar (Collignon, 1962), Mexico (Burckhardt, 1910, 1919) and Argentina (Leanza and Wiedmann, 1989).

Family Olcostephanidae Haug, 1910

Subfamily Spiticeratinae Spath, 1924

Genus *Kilianiceras*, Djanélidzé, 1922

**Type species.** *Stephanoceras damesi* Steuer, 1897

*Kilianiceras praegratianopolitense* Djanélidzé, 1922

Figure 3 A–C, E–F

? 1922 *Spiticer* (*Kilianiceras*) *damesiforme* n. sp. -

Djanélidzé, p. 119, Pl. 9, figs. 1a, b.

1922 *Spiticer* (*Kilianiceras*) *praegratianopolitense* n. sp.

- Djanélidzé, p. 122, Pl. 8, figs. 1a, b.

1987 *Spiticer* (*Kilianiceras*) *praegratianopolitense*

Djanélidzé - Immel, p. 69, Pl. 3, fig. 4.

**Material.** Two quite well-preserved specimens (Table 2), one of them slightly crushed and the second with only the inner whorls visible. CU7-756 and CU7-757, both illustrated in Figure 3.

**Description.** Evolute shell with a compressed whorl section. Flattened flanks with an umbilical wall relatively high and inclined. Umbilicus wide and staggered. The cross section is higher than wide. Ornamentation in the inner whorls is constituted by simple, rectiradiate and strong ribs that arise from twenty-five small tubercles on the umbilical wall. A second line of tubercles appears on the ribs at mid-flank, from which two strong prosiradiate ribs bifurcate to later cross the ventral region, showing an attenuated siphonal band. The spaces between the ribs are twice the thickness of the ribs. In addition, in one specimen two strong and relatively deep constrictions can be observed cutting the ribs obliquely. In the last whorl the ornamentation is characterized by twenty-two compressed radial tubercles in the lower third of the flank, where the main ribs bifurcate or trifurcate in approximately twenty six prorsiradiate ribs. Between each bifurcation there are two residual ribs. All the ribs are projected showing a chevron-like pattern on the ventral region. Additionally, one accessory rib can be observed.

**Discussion.** The shape of the tubercles, and the number of ribs and their bifurcations, are the key elements to identify this species. Although our specimens are smaller than those illustrated by Djanélidzé (1922, p. 122, Pl. 8 fig. 1 a–b) and by Immel (1987, p. 69, Pl. 3, fig. 4), we can assign them with certainty to this taxon.

**Distribution.** *Kilianiceras praegratianopolitense* is restricted to the upper Berriasian and the lowermost Valanginian. The species has been reported from the Berriasian of France (Djanélidzé, 1922), Spain (Allemann *et al.*, 1975) and the early Valanginian of Austrian Alps (Immel, 1987).

Genus *Spiticer* Uhlig, 1903

**Type species.** *Ammonites spitiensis* Blanford, 1864

*Spiticer* *correardi* Djanélidzé, 1922

Figure 3 G

1922 *Spiticer* *correardi* Kil. in litt. - Djanélidzé, p. 160, Pl. 18, figs. 3 a–c.

Table 2. Dimensions of specimens of *Kilianiceras praegratianopolitense* Djanélidzé, 1922

Specimen	D(mm)	Wh(mm)	Ww(mm)	U(mm)
CU7-756	35.4	11.5	13.5	19.1
CU7-757	82.7	23.5	16.6	37.5



2005 *Spiticerias correardi* Djanélidzé - Klein, p. 52 (cum syn.).

2015 *Spiticerias* (*Spiticerias*) cf. *correardi* Djanélidzé - Boorová *et al.* p. 108, fig. 10B.

**Material.** Two poorly preserved specimens (Table 3). CU7-771 (illustrated in Figure 3) and CU7-777.

**Description.** Small depressed involute shell with rounded flanks. Umbilical shoulder rounded with an inclined wall. Small shallow umbilicus. Inner whorls cannot be observed. Ornamentation constituted by thin prorsiradiate ribs that appear in pairs from twelve small peri-umbilical tubercles. Later, the ribs bifurcate at mid-flank crossing without interruption the ventral region. The specimens show two strong constrictions parallel to the ribs or inclined forward, one of them in the middle part of the last whorl and the other close to the aperture.

**Discussion.** The herein studied specimens show a similar ribbing pattern compared with the lectotype of Djanélidzé (1922, pl. 18, figs. a–c). However, it has to be mentioned that our specimens only record the inner whorls of this species. Mexican specimens are also very similar in the rib pattern to the exemplar showed by Boorová *et al.* (2015, fig. 10B) but with fewer tubercles. The ornamentation pattern can be compared to that of *Spiticerias polytrophyum* Djanélidzé (1922, pl. 7, figs. 2 a–b; pl. 18, figs. 4 a–b), differing only in that *S. polytrophyum* has a more robust ornamentation.

**Distribution.** The stratigraphic range of *Spiticerias correardi* is not well established (Boorová *et al.*, 2015) but seems to span from the upper Berriasian to the lower Valanginian. The Mexican specimens described here belong to the upper Berriasian *Fauriella boissieri* Zone. *Spiticerias correardi* has been recorded from the Berriasian of France (Djanélidzé,

1922), and the early Valanginian of Bulgaria (Nikolov, 1960) and Austria (Boorová *et al.*, 2015).

## 4. Discussion

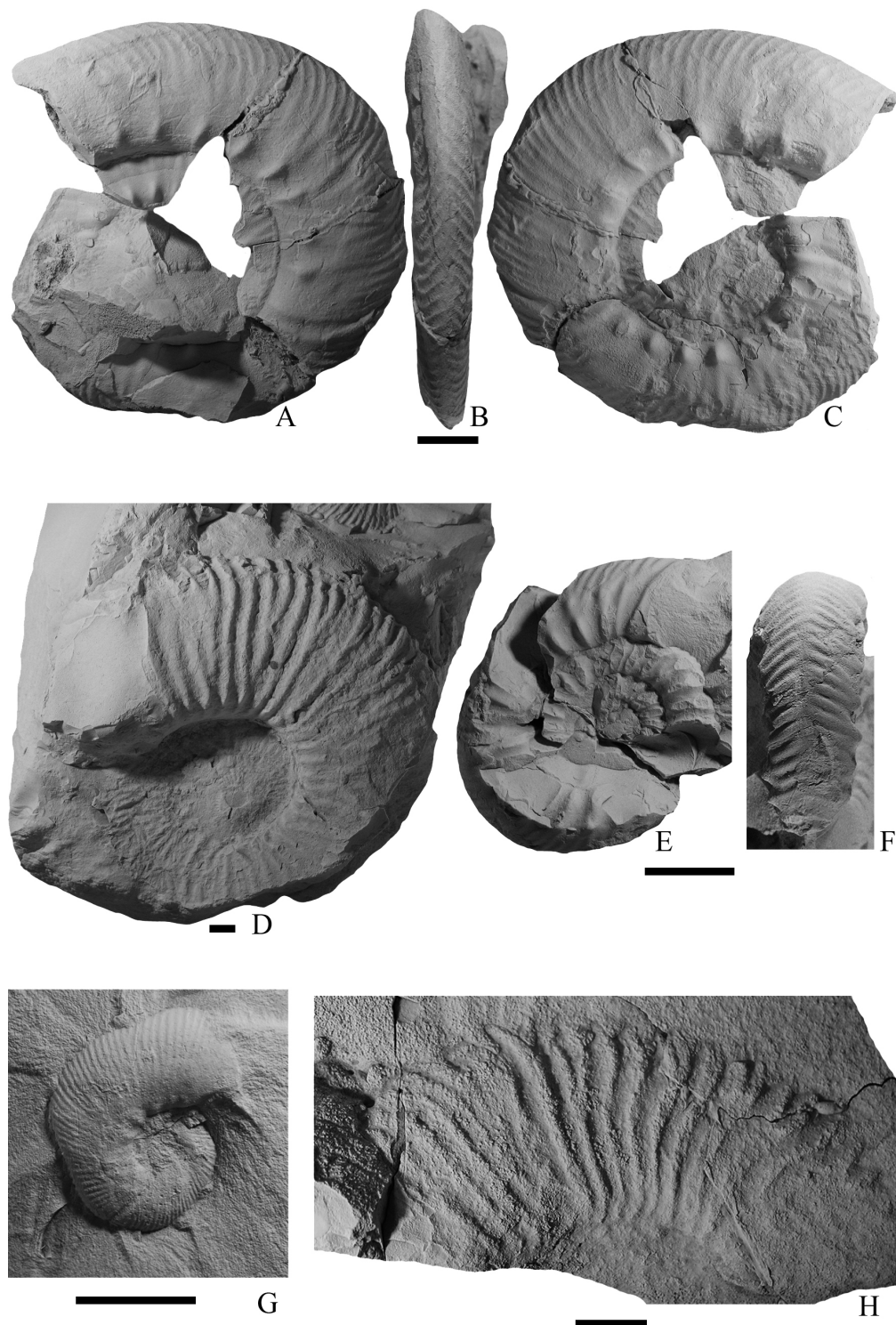
Based on ammonites herein described, section CU-7 from Cuencamé de Ceniceros, Durango State, correlates to the base of the lower member of the Taraises Formation, and can be attributed to a record of sedimentation of the latest Berriasian. Even though its stratigraphic record can span into the lowermost Valanginian, *Fauriella boissieri* is considered the index species of the latest Berriasian Boissieri Zone for the Mediterranean Domain and southeast France (Company, 1987; Le Hégarat, 1973). The record of *F. cf. boissieri* in this work is restricted to the top of the studied section. However, it is coincident with the last stratigraphic record of *Berriasella cf. calisto*; recovered from both, the base and the top of the studied section. *B. cf. calisto* has a strong biostratigraphic significance for our interpretation, since it is restricted to the upper Berriasian, in particular to the upper part of the *Fauriella boissieri* Zone (*Tirnovella alpillensis* and *Thurmanniceras otopeta* subzones) of the standard Mediterranean ammonite zonation (Le Hégarat, 1973; Tavera, 1985; Company, 1987; Arkadiev and Bogdanova, 2004; Bujtor *et al.*, 2013; Boorová *et al.*, 2015). Thus, the stratigraphic section, subject of this study, is indicative of sedimentation of the latest Berriasian Boissieri Zone, and records the presence of other ammonites such as *Spiticerias correardi*, species whose stratigraphic range is until now not well established according to Boorová *et al.* (2015).

## 5. Conclusions

The base of the lower member of the Taraises Formation in a section near Cuencamé de Ceniceros (Durango State, Mexico) has provided an ammonite fauna composed of *Berriasella cf. calisto*,

Table 3. Dimensions of specimens of *Spiticerias correardi* Djanélidzé, 1922.

Specimen	D(mm)	Wh(mm)	Ww(mm)	U(mm)
CU7-771	17.7	7.5	---	9.2
CU7-777	15.1	7.2	---	8.6



**Figure 3** Ammonites from Cuencamé de Cenicerros, Durango, Mexico, attributed to the upper Berriasian standard Mediterranean ammonite Zone *Fauriella boissieri*. A-C (CU7-757) IGM-4903, E-F (CU7-756) IGM-4904 *Kilianiceras praegratianopolitense* Djanélizdé, 1922, A, left side; B, ventral side; C, right side; E, right side and the umbilical region; F, ventral side. D (CU7-779a) IGM-4905 *Fauriella* cf. *boissieri* (Pictet, 1867). G (CU7-771) IGM-4906 *Spiticeras correardi* Djanélizdé, 1922. H (CU7-755) IGM-4907 *Berriasella* cf. *calisto* (d'Orbigny, 1850). In all cases scale bar equals 1 cm.

*Fauriella* cf. *boissieri*, *Spiticeras correardi*, and *Kilianiceras praegratianopolitense*. Despite some minor morphological differences, this ammonite assemblage shows strong affinities with those reported from the uppermost Berriasian in the Mediterranean region. Furthermore, it allows the assignation of the studied stratigraphic interval to the upper part of the *Fauriella boissieri* Zone (*Tirnovella alpillensis* and *Thurmanniceras otopeta* Subzones) of the standard Mediterranean ammonite zonation (Reboullet *et al.*, 2014).

This work constitutes the first report for Mexico of the upper Berriasian species *Kilianiceras praegratianopolitense*, *Spiticeras correardi* and *Fauriella* cf. *boissieri*.

## 6. Acknowledgements

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