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Original article

# *Cieneguiticeras*, a new genus of Tithonian oppeliids (Ammonoidea, Late Jurassic)☆

## *Cieneguiticeras*, un nouveau genre d'Oppeliidés du Tithonien (Ammonoidea, Jurassique supérieur)

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**Abstract**

The new genus *Cieneguiticeras*, assigned to the family Oppeliidae, is described on the basis of Andean lower-middle Tithonian ammonites from Arroyo Cieneguita, west-central part of the Neuquén-Mendoza Basin, Argentina. The macroconchs are closely homoeomorphic with *Neochetoceras* Spath and the microconchs have a 'glochiceratid'-type morphology. The stratigraphic range of *Cieneguiticeras* nov. gen. includes the lower and middle Tithonian by means of a succession of two or three species which are interpreted as members of a phyletic lineage. Ammonites from the Tithonian of Cuba, Mexico and France are more or less confidently included in this new genus.


*Keywords:* Ammonoidea; Oppeliidae; *Cieneguiticeras* nov. gen.; Tithonian; Neuquén-Mendoza Basin; Argentina

**Résumé**

Le nouveau genre *Cieneguiticeras*, attribué à la famille Oppeliidae, est décrit à partir d'ammonites andines du Tithonien inférieur et moyen d'Arroyo Cieneguita, partie centre-ouest du Bassin de Neuquén-Mendoza, Argentine. Les macroconques sont étroitement homéomorphes de *Neochetoceras* Spath et les microconques montrent une morphologie de type « glochicératide ». L'extension stratigraphique de *Cieneguiticeras* nov. gen. couvre le Tithonien inférieur et moyen grâce à la succession de deux ou trois espèces formant une même lignée phylétique. Des ammonites du Tithonien de Cuba, du Mexique et de France sont incluses avec plus ou moins de confiance dans ce nouveau genre.


*Mots clés :* Ammonoidea ; Oppeliidae ; *Cieneguiticeras* nov. gen. ; Tithonien ; Basin de Neuquèn-Mendoza ; Argentine

## 1. Introduction

Among the large amount of Andean Tithonian ammonites described for the first time by A. Steuer in his foundational monograph (Steuer, 1897, later translated and published as Steuer, 1921), there is a group of oppeliids which have been poorly recorded afterwards and diversely interpreted. This group comprises *Oppelia perlaevis* Steuer, 1897, *Oppelia perglabra* Steuer, 1897, *Haploceras falculatum* Steuer, 1897, and *Oppelia nimbata* (Oppel, 1863 in Steuer, 1897). All the specimens included by Steuer in these species come from a single outcrop in the left margin of the Arroyo Cieneguita, Mendoza Province (Fig. 1 (A)). The spelling of the name of this locality has suffered some alterations from the originally used one by Steuer (1897: 144) "Arroyo de la Cieneguita"; in this paper, we retain the original spelling condensed as Arroyo Cieneguita.

New collections in this and several other localities of the Neuquén-Mendoza Basin (NMB) have shown that these ammonites are rather abundant in the lower and middle

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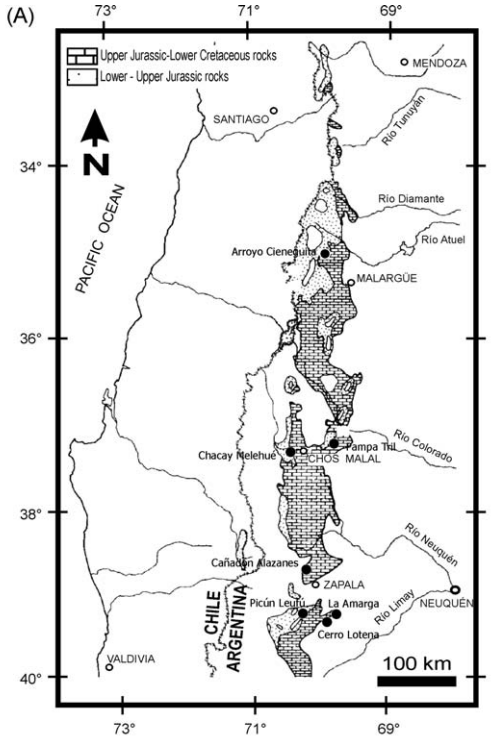


(B)

| Andean chronostratigraphic zonation | | Arroyo Cieneguita. Levels of Steuer (1897, transl. 1921) | Stratigraphic distribution of the species of Cieneguiticeras n. gen. |
|---|---|---|---|
| Upper Tithonian | Koeneni | | |
| | Alternans | II | *Cieneguiticeras* cf. *falculatum* |
| Middle Tithonian | Internispinosum | | |
| | Proximus | | *Cieneguiticeras falculatum* |
| | Zitteli | I | |
| Lower Tithonian | Mendozanus | | *Cieneguiticeras perlaevis* |

Fig. 1. **A.** Map showing the localities cited in the text and the marine Mesozoic outcrops of the Neuquén-Mendoza Basin (modified from Yrigoyen, 1979); **B**. Approximate stratigraphic distribution of the species of *Cieneguiticeras* nov. gen. in Arroyo Cieneguita referred to the levels Cieneguita-I and II of Steuer (1897, 1921) in the framework of the Andean chronostratigraphic zonation of the Tithonian. The stratigraphic range of the levels Cieneguita-I and II are based on Parent (2003) and discussion in text. The Andean zonation is based on Leanza (1980, 1981) and Parent et al. (2007); dotted lines indicate approximate or non-standard boundaries.

Tithonian. Most frequently, they have been overlooked or misinterpreted as *Pseudolissoceras zitteli* (Burckhardt, 1903). In the collections of the Museo Olsacher, Zapala, there are several specimens which have not been classified.

In this report, we present the results of the restudy of the material described by Steuer (1897, 1921) supported by new collections at Arroyo Cieneguita. These results indicate that these ammonites belong to a new oppeliid genus which is widely present in the lower and middle Tithonian of the NMB.

## 2. Systematic paleontology

The studied material, other than that described by Steuer (1897), was collected by the authors and housed at the Laboratorio de Paleontologia (Universidad Nacional de Rosario: LPB; collections of the Museo de Ciencias Naturales A. Moyano, Mendoza: MCNAM-PI) and Staatliches Museum für Naturkunde Stuttgart, Germany (SNMS). Photographs of type specimens described by Steuer (1897) were kindly provided by Mike Reich (Geoscience Center of the Georg-August-University Göttingen, Museum: GZG). Casts of specimens from Le Pouzin were kindly loaned by Abel Prieur (Paleontological collections, UMR-CNRS 5125, University Claude-Bernard Lyon 1).

Body chamber is abbreviated with Bc and phragmocone with Ph; macroconch (female): [M], microconch (male): [m]. Measurements are indicated as follows (Table 1): diameter ($D$), diameter at the last adult septum ($D_{ls}$), adult diameter at peristome ($D_p$), umbilical width ($U$), whorl width ($W$), whorl height ($H_1$), and whorl ventral height ($H_2$), all given in millimeters length of body chamber ($L_{Bc}$) in degrees; number of primary ($P$) and ventral ($V$) ribs per half whorl (this form of counting ribs per half whorl is more sensitive for reflecting changes in ribbing density, and less exigent with quality of material, providing more complete sets of measurements which allow to consider incomplete specimens giving more complete sets of measurements).

Superfamily HAPLOCERATOIDEA Zittel, 1884
Family OPPELIIDAE Douvillé, 1890
Subfamily TARAMELLICERATINAE Spath, 1928
Genus ***Cieneguiticeras*** nov. gen.

**Derivation of the name**: After Arroyo Cieneguita, the type locality of the type species.

**Type species**: *Haploceras falculatum* Steuer, 1897.

**Included species**: *Cieneguiticeras* nov. gen. comprises two or three succeeding species recorded from the Tithonian of Arroyo Cieneguita: *C. perlaevis* (Steuer, 1897) [M and m] (Fig. 2), *C. falculatum* (Steuer, 1897) [M and m] (Figs. 3–5 (A–E)) and *C.* cf. *falculatum* (Steuer, 1897) (Fig. 5 (F)). Out of Arroyo Cieneguita the genus has been recorded in La Amarga, Cerro Lotena, Picún Leufú, Cañadón de los Alazanes, Pampa Tril, and Chacay Melehué (Fig. 1 (A)). Specimens from Tethyan localities of Cuba, Mexico, France and Yemen which can be at least tentatively included in *Cieneguiticeras* nov. gen. for morphological reasons are discussed below.

**Diagnosis**: Macroconch: Subplatycone inner whorls; outer whorls and body chamber suboxycone, involute, ventrally rounded. Inner whorls smooth or faintly ribbed on the uppermost part of the flank; outer whorls of phragmocone covered by undivided falcoid primary ribs, faint to very weak on lower half of flank, concave and widely spaced on the upper third; adult body chamber smooth and moderately uncoiled, about a half to three quarters whorl long. Microconch: adult about a third to a fourth part of the macroconch's size; inner whorls indistinguishable, body chamber slender platycone, uncoiled in variable degree, half a whorl long. End of phragmocone and body chamber covered by weak falcoid primary ribs reinforced on the mid flank, forming a row of lingulate structures which reach the peristome. Lappets moderately long and narrow.

Table 1
Biometric characterization of *Cieneguiticeras* nov. gen. mainly based on figured specimens. Measurements and abbreviations explained in text. Number of primary ribs per half whorl (*P*) refers to well formed lunuloid ribs on the upper flank (some adult macroconchs show growth line group forming undulations which are not counted as ribs).

| | | D | U/D | W/D | $H_1$/D | $H_2$/D | $H_2$/$H_1$ | P |
|---|---|---|---|---|---|---|---|---|
| *Cieneguiticeras perlaevis* (Steuer, 1897) | | | | | | | | |
| [M] Lectotype (Fig. 2(A)) | Ph | 52.00 | 0.09 | 0.26 | 0.57 | 0.42 | 0.74 | 6 |
| [M] Paralectotype A (Fig. 2(B)) | Bc | 102.00 | 0.09 | | 0.57 | | | |
| | Ph/Bc | 80.00 | 0.09 | 0.24 | 0.58 | | | |
| [m] (Fig. 2(C)) | Bc | 34.00 | | | | | | |
| | Ph/Bc | 27.00 | 0.17 | 0.33 | 0.56 | | | 0 |
| [m] (Fig. 2(D)) | Ph/Bc | 24.00 | 0.13 | | 0.58 | | | 0 |
| *Cieneguiticeras falculatum* (Steuer, 1897) | | | | | | | | |
| [M] Lectotype (Fig. 3(A)) | Ph/Bc | 30.00 | 0.17 | 0.33 | 0.50 | 0.33 | 0.66 | 13 |
| | Ph | 20.00 | 0.15 | 0.40 | 0.50 | | | 0 |
| [m] (Fig. 3(B)) | Ph/Bc | 13.00 | 0.15 | 0.26 | | | | |
| [m] (Fig. 3(C)) | Bc | 17.00 | 0.22 | 0.29 | 0.51 | 0.39 | 0.76 | 0 |
| | Ph/Bc | 10.50 | 0.22 | 0.35 | 0.50 | | | |
| [M] (Fig. 5(E)) | Ph/Bc | 38.00 | 0.18 | 0.37 | 0.50 | 0.37 | 0.74 | 10 |
| | Ph | 24.00 | 0.17 | 0.29 | 0.50 | | | |
| [m] (Fig. 5(C)) | Bc(*D*p) | 27.00 | 0.22 | 0.22 | 0.41 | 0.33 | 0.80 | 0 |
| [M] (Fig. 4(A)) | Bc | 113.50 | 0.10 | 0.18 | 0.56 | | | 0 |
| | Ph | 57.60 | 0.09 | 0.31 | 0.59 | 0.42 | 0.71 | 8 |
| | Ph | 33.00 | 0.12 | 0.30 | 0.58 | 0.45 | 0.78 | |
| | Ph | 20.00 | 0.15 | 0.36 | 0.63 | 0.44 | 0.70 | |
| | Ph | 11.20 | 0.22 | 0.38 | 0.58 | 0.43 | 0.74 | 0 |
| | Ph | 7.00 | 0.23 | 0.36 | 0.46 | 0.40 | 0.87 | 0 |
| | Ph | 2.20 | | 0.45 | | | | 0 |
| [M] (Fig. 5(A)) | Bc | 45.00 | 0.09 | 0.29 | 0.56 | | | |
| [M] (Fig. 5(D)) | Ph/Bc | 29.00 | 0.14 | 0.30 | 0.55 | 0.44 | 0.80 | |
| | Ph | 24.70 | 0.15 | 0.32 | 0.53 | 0.44 | 0.83 | |
| | Ph | 16.40 | | 0.32 | 0.48 | | | |
| *Cieneguiticeras* cf. *falculatum* (Steuer, 1897) | | | | | | | | |
| (Fig. 5(F)) | ?Ph | 23.00 | 0.22(e) | 0.27 | 0.48 | | | 12(e) |

(e): estimated values.

**Remarks**: The microconchs, typically ''glochiceratids'', may have the lateral sculpture on the body chamber very weak and, moreover, in some specimens may be very hard to observe, depending on their preservation. *Pseudolissoceras* Spath, 1925 (type species: *Neumayria zitteli* Burckhardt, 1903), which is commonly associated in the same stratigraphic horizons within the Zitteli Zone, is easily distinguishable: the macroconchs are smooth and more evolute throughout the ontogeny, and the microconchs lack a lateral ornamentation. Another ammonite genus typical of the same horizons of the NMB is *Pasottia* Parent, Schweigert, Scherzinger and Enay, 2008. The latter differs from *Cieneguiticeras* in the macroconchs which are completely smooth throughout their ontogeny, and the microconchs exhibit an acute umbilical shoulder along a very different geniculate adult body chamber.

*Neochetoceras* Spath, 1925 (type species: *Ammonites steraspis* Oppel, 1863) is very similar to *Cieneguiticeras* nov. gen. Nevertheless, *Neochetoceras* includes macroconch ammonites which differ from *Cieneguiticeras* nov. gen. mainly by the following features: the phragmocone and the body chamber are slender and typically lanceolate, with one or three keels, and the ribbing is fine and dense with abundant secondary or intercalatory ribs on the upper part of the flank. The ventral margins may be strongly accentuated as in *Neochetoceras mucronatum* Zeiss, 1968, and according to our personal observation the adult stage may become smooth, with a depressed venter, similar to that seen in *Streblites* Spath, 1928. Inner moulds of some typical specimens of *N. steraspis* show a very weak secondary ribbing and well-marked lunuloid primaries on the upper half of the flanks of the adult body chamber (Fig. 6 (A)), resembling the last whorl of the phragmocone of *Cieneguiticeras perlaevis* (Steuer). Adult sizes of macroconchs of both genera are similar, but the body chamber of *Cieneguiticeras* nov. gen. is smooth, whereas that of *Neochetoceras* tends to retain ribbing (Barthel and Schairer, 1977: pl. 9, figs. 5–7; pl. 10, figs. 1–7; Fig. 6(A–C) herein). Adult macroconchs from the Hybonotum Zone of SW Franconia show falcate ribs in the last whorl of the phragmocone persisting on the body chamber (Fig. 6(B–C)), closely resembling the last whorl of the phragmocone of *Cieneguiticeras* nov. gen. The corresponding microconchs of *N. steraspis*, known as *Lingulaticeras solenoides* (Quenstedt, 1848), are somewhat similar although larger than those of *Cieneguiticeras* nov. gen., but in the former the body chamber is rather smooth, lacking the well-marked row of linguiform structures on the middle of the flank which is diagnostic for *Cieneguiticeras* nov. gen. (Fig. 6(D)). Short ventrolateral secondary ribs and tubercles may occur in some early

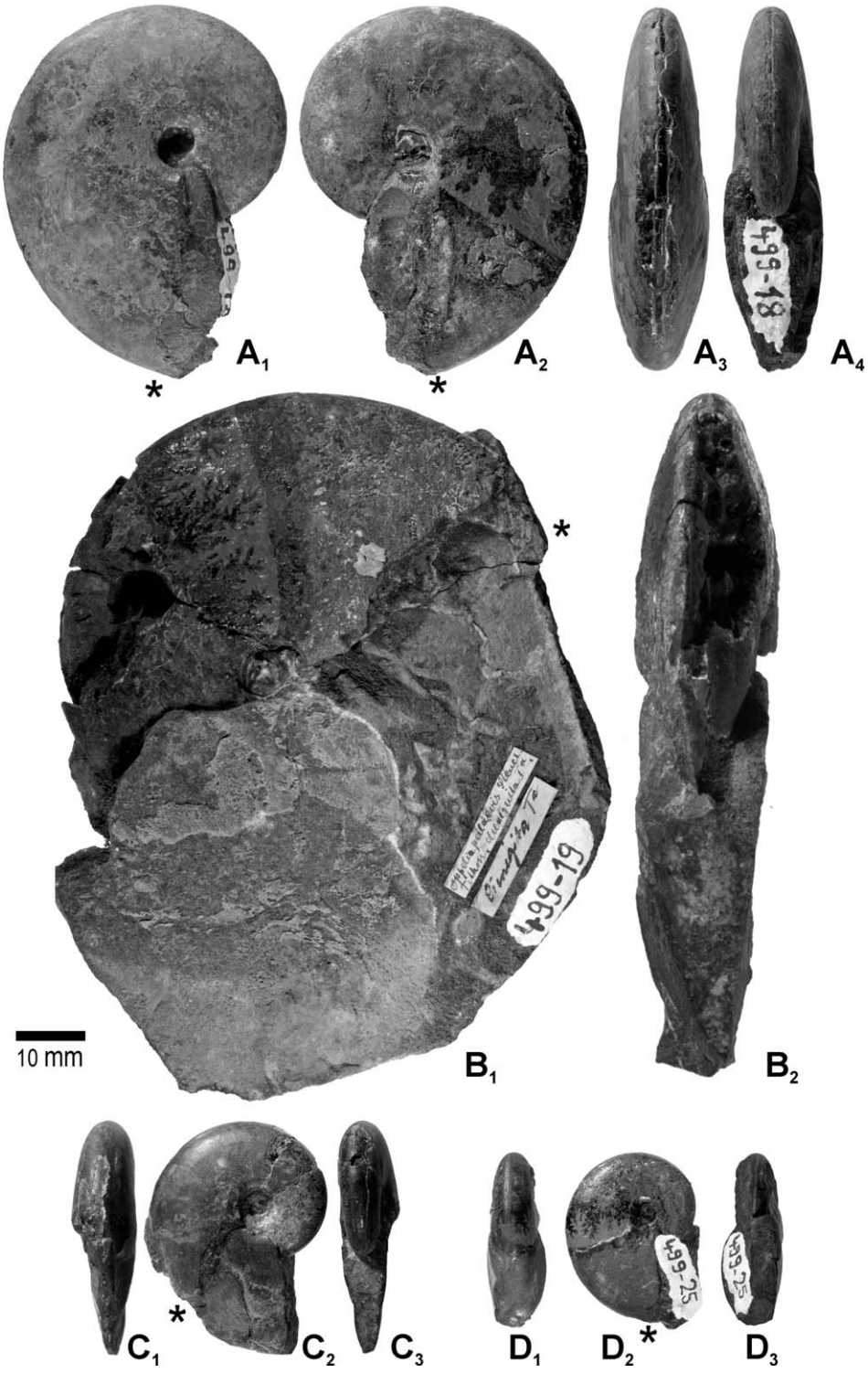


Fig. 2. *Cieneguiticeras perlaevis* (Steuer). A. Lectotype (GZG 499-18, refigured from Steuer, 1897, 1921: pl. 6 figs. 7, 8), adult macroconch phragmocone with the beginning of the body chamber; B. Paralectotype A (GZG 499-19), adult macroconch with incomplete body chamber; C. Adult microconch with incomplete body chamber (GZG 499-24, lectotype of *Oppelia perglabra* Steuer, 1897: pl. 7, figs. 13, 14, refigured); D. Adult microconch phragmocone (GZG 499-25, originally unfigured, paralectotype of *Oppelia perglabra* Steuer). Vaca Muerta Fm., Mendozanus–Zitteli Zones, Arroyo Cieneguita, Mendoza Province. The asterisk indicates the beginning of the body chamber.

representatives of *Neochetoceras*. The sexual dimorphic pair *Neochetoceras subnudatum* (Fontannes, 1879) [M] / *Lingulaticeras pseudopercevali* Schweigert, 1998 [m], from the Late Kimmeridgian Ulmense Subzone, hoelderi horizon, differs from the earliest representatives of *Cieneguiticeras* nov. gen., *C. perlaevis* [M and m], in the finely ribbed body chamber of the microconch of the former (see Schweigert, 1998: pl. 2, fig. 3). These similarities between both genera strongly suggest

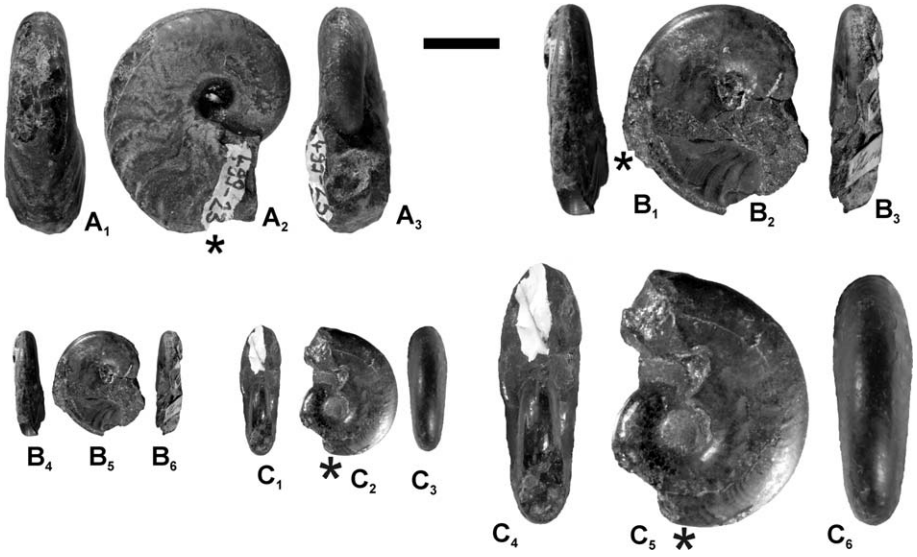


Fig. 3. *Cieneguiticeras falculatum* (Steuer). A. Lectotype (GZG 499-23, refigured from Steuer, 1897, 1921: pl. 7, figs. 10, 11), adult macroconch phragmocone with the beginning of the body chamber; B. Adult microconch with partial body chamber (GZG 499-26, refigured from Steuer, 1897, 1921: pl. 7, fig. 16, as *Oppelia nimbata*), double-sized ($B_1$–$B_3$) and natural size ($B_4$–$B_6$) views; C. Adult microconch with almost complete body chamber (GZG 499-27, refigured from Steuer, 1897, 1921: pl. 7, fig. 17, as *Oppelia nimbata*; holotype of *Glochiceras steueri* Leanza, 1980), natural size ($C_1$–$C_3$) and double-sized ($C_4$–$C_6$) views. Vaca Muerta Fm., upper Proximus Zone, Arroyo Cieneguita, Mendoza Province. The asterisk indicates the beginning of the body chamber. Scale bar = 10 mm for $A_1$–$A_3$, $B_4$–$B_6$ and $C_1$–$C_3$; 5 mm for $B_1$–$B_3$ and $C_4$–$C_6$.

close phyletic relationships but the differences are significant enough for a generic separation.

*Uhligites* Kilian, 1907 (type species: *Streblites kraffti* Uhlig, 1903; SD Roman, 1938) has similar aspect in shell morphology with *Cieneguiticeras* nov. gen. Nevertheless, the macroconchs of *Uhligites* differ by a denser ribbing, composed of flexuous primaries and abundant secondaries and intercalatory ribs on the upper flank (Arkell, 1957: fig. 336.1; Yin and Enay, 2004: fig. 6.6–13), and by the possession of a floored keel. The microconchs are also similar in shell shape, but those of *Uhligites* have a distinctive serrate or crenulate keel from the end of the adult phragmocone reaching the body chamber (Yin and Enay, 2004: fig. 6.1–5).

*Cieneguiticeras perlaevis* (Steuer, 1897) [M & m]
Fig. 2(A–D), Table 1

*1897. *Oppelia perlaevis* nov. sp. - Steuer, transl. 1921, p. 102, pl. 6, Figs. 7–9 (suture).

*1897. *Oppelia perglabra* nov. sp. - Steuer, transl. 1921, p. 104, pl. 7, Figs. 13–15 (suture).

?1900. *Oppelia* aff. *perlaevis* Steuer - Burckhardt, p. 46, pl. 24, Figs. 5 and 6, pl. 29, Fig. 11 (suture).

1980. *Pseudolissoceras zitteli* (Burckhardt) - Leanza, p. 19, pl. 1, Fig. 2.

*pars* 1980. *Glochiceras steueri* nov. sp. - Leanza, p. 20, pl. 1, Fig. 3.

**Lectotype and paralectotypes**: Steuer (1897, 1921: 103) based the species on three syntypes collected by G. Bodenbender in Arroyo Cieneguita, but he did not designate a holotype. The best preserved specimen and only one illustrated by Steuer (1897, 1921: pl. 6, figs. 7, 8), an adult phragmocone from the level ''Cieneguita I'' (type horizon; Fig. 1(B)), is herein designated as the lectotype (GZG 499-18; Fig. 2(A)). The largest one (GZG 499-19; Fig. 2(B), paralectotype A), also from the level ''Cieneguita I'', is a moderately well-preserved adult macroconch with parts of the body chamber, from which (Steuer, 1897, 1921: pl. 6, fig. 9) reproduced the septal suture line. The third syntype (paralectotype B) was collected from higher up in the section, in the level ''Cieneguita II''.

**Additional material studied**: Two macroconch phragmocones (MCNAM-PI 24377-24378) and an incomplete microconch (MCNAM-PI 24380) from basal beds of the section of Arroyo Cieneguita. The two syntypes of *Oppelia perglabra* (Steuer, 1897), [m] collected by G. Bodenbender in Arroyo Cieneguita from the level ''Cieneguita I'':

- The specimen figured by Steuer (1897, 1921: pl. 7, figs. 13, 14), a rather well-preserved microconch with incomplete body chamber (GZG 499-24), is herein designated as the lectotype of *O. perglabra* (Fig. 2(C));
- The paralectotype (GZG 499-25), a phragmocone (Steuer, 1897, 1921: pl. 7, fig. 15, suture; Fig. 2(D)).

**Occurrence and distribution**: The type material of *Oppelia perlaevis* and *Oppelia perglabra* comes from the level ''Cieneguita I'' (only the paralectotype B of *O. perlaevis* comes from the level ''Cieneguita II''). The age of this bed was formerly supposed to be late middle Tithonian; nevertheless, new collections in this locality have indicated an older age, most likely Mendozanus to Zitteli Zones (Fig. 1(B)). This conclusion is based on the recognition that the specimen cited by Steuer (1897, 1921) as *Reineckeia* cf. *stephanoides* (Oppel, 1863) – later misinterpreted as *Windhauseniceras internispinosum* (Krantz, 1926) by Parent (2003) – actually belongs to *Catutosphinctes windhauseni*

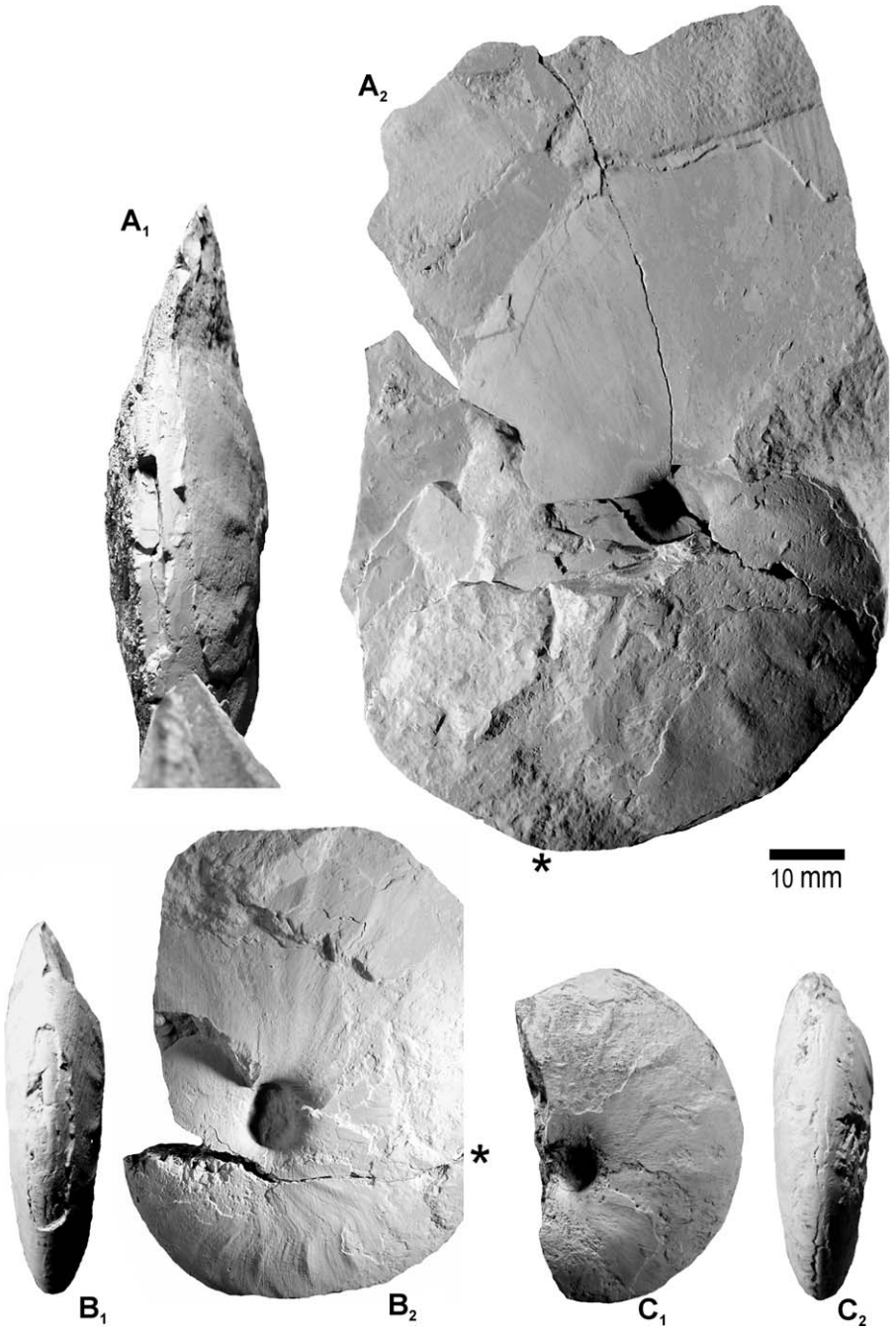


Fig. 4. *Cieneguiticeras falculatum* (Steuer). A. Complete adult macroconch (MCNAM-PI 24408); B. Almost complete adult macroconch (MCNAM-PI 24405/1); C. Adult macroconch phragmocone (MCNAM-PI 24406). Vaca Muerta Fm., upper Proximus Zone, Arroyo Cieneguita, Mendoza Province. The asterisk indicates the beginning of the body chamber.

(Weaver, 1931). The latter species is well-represented by macro- and microconchs in the new samples, like in the lower part of the range-zone of *Pseudolissoceras zitteli* at its type locality La Amarga (Fauna B in Parent et al., 2006). Moreover, the new samples of these levels in Arroyo Cieneguita include, in association with *C. windhauseni*, well-preserved specimens of *P. zitteli* and *Pasottia andina* Parent et al., 2008. On the other hand, this level lies below the type horizon of *C. falculatum* where time-diagnostic ammonites indicating the Proximus to lower Internispinosum Zones occur (see discussion below). Besides Arroyo Cieneguita, this species has been also recorded from the Zitteli Zone in Cerro Lotena (Leanza, 1980: pl. 1, fig. 2 [M] and pl. 1, fig. 3 [m]), Picún Leufú and Pampa Tril.

**Description**: Lectotype: adult macroconch phragmocone subplatycone, more or less compressed ($W/D = 0.26$); umbilicus narrow ($U/D = 0.09$) with subvertical wall and rounded shoulder. The whorl section is suboval, higher than wide ($W/H_1 = 0.46$), with slightly convex flanks and a rather wide and rounded venter. Sculpture composed of short, distant, lunuloid ribs ($P = 6$ at max $D = 52$ mm) confined to the upper flank and ending before the rounded, poorly defined ventrolateral

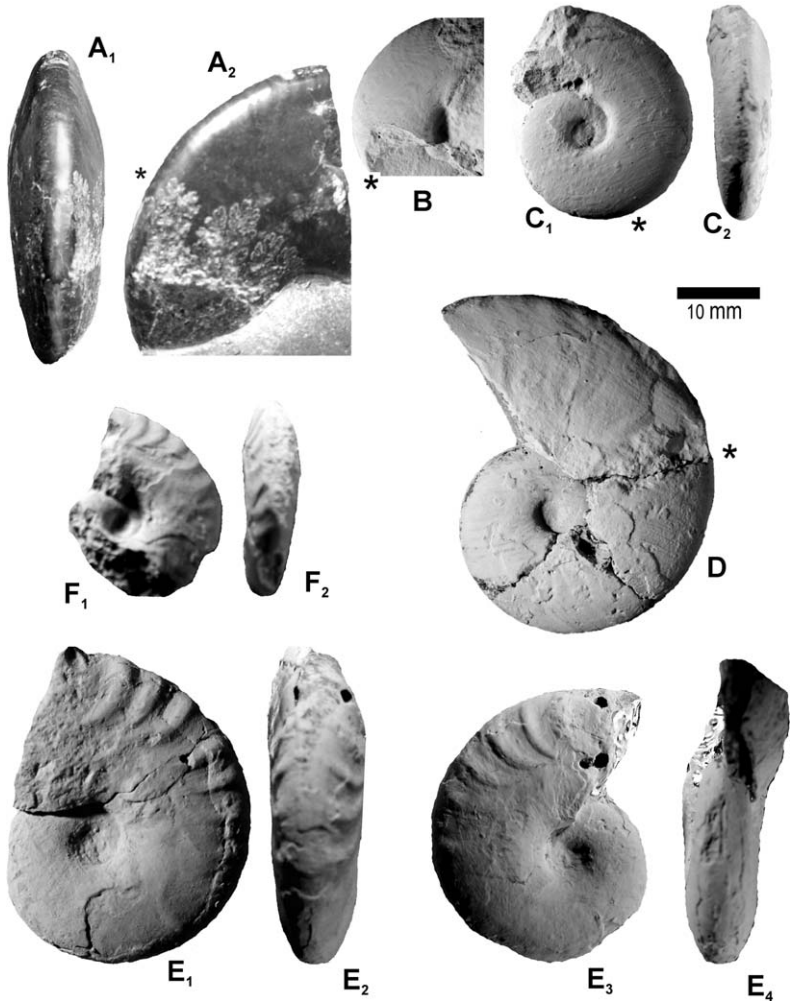


Fig. 5. **A–E.** *Cieneguiticeras falculatum* (Steuer). A: Macroconch showing the last septal suture line (MCNAM-PI 24404/14); B: Apertural portion of an adult microconch showing the structure of the peristome and lappet (MCNAM-PI 24412/3); C: Complete adult microconch with very weak sculpture on flanks (MCNAM-PI 24410/1); D: Adult macroconch with beginning of the body chamber, specimen with weak sculpture (MCNAM-PI 24398); E: Adult macroconch with beginning of the body chamber, specimen with strong sculpture (MCNAM-PI 24406/2); $E_3$–$E_4$: part of the last whorl removed for showing the smooth inner whorl. **F**. *Cieneguiticeras* cf. *falculatum* (Steuer) (MCNAM-PI 24452/0). Vaca Muerta Fm., upper Proximus Zone, Arroyo Cieneguita, Mendoza Province. The asterisk indicates the beginning of the body chamber.

shoulder; the lower half of the flanks is smooth. The paralectotype A [M] is practically identical with the lectotype but preserving a half whorl of poorly preserved body chamber. Additional material collected from a slightly deeper stratigraphic position is poorly preserved but otherwise identical.

The microconchs (*Oppelia perglabra*) are smaller, platycone, compressed, with high, flat flanks and a rather narrow, rounded venter; from the last whorl of the phragmocone the flanks are covered with weak falcoid ribbs reinforced at midflank and forming the diagnostic row of linguiform structures which persist on the body chamber.

The intraspecific variation of the species cannot be asserted from the scarce material available.

**Remarks**: The sexual dimorphic correspondence between the nominal species *Oppelia perlaevis* and *Oppelia perglabra* is based on their association in the same stratigraphic levels, indistinguishable inner whorls and the same kind of septal suture line up to where they can be observed and as illustrated by Steuer. Differences with *C. falculatum* are discussed below.

*Cieneguiticeras falculatum* (Steuer, 1897) [M & m]
Figs. 3–5(A–E), Table 1

*1897. *Haploceras falculatum* nov. sp. - Steuer, transl. 1921, p. 104, pl. 7, Figs. 10–12.

1897. *Oppelia nimbata* Oppel - Steuer, transl. 1921, p. 103, pl. 7, Figs. 16 and 17.

*pars* 1980. *Glochiceras steueri* nov. sp. - Leanza, p. 20.

2001. *Neochetoceras*? sp. - Parent, p. 27, Fig. 8A–C.

2006. ‘‘*Neochetoceras*’’ sp. - Parent, Scherzinger and Schweigert, p. 260, Fig. 4A, B.

**Lectotype**: Steuer (1897, 1921: 104) based this species on an undefined number of syntypes collected by G. Bodenbender in Arroyo Cieneguita, but he did not designated a holotype. The only figured specimen (Steuer, 1897, 1921: pl. 7, figs. 10, 11), a well-preserved macroconchiate phragmocone, is herein designated as the lectotype (Fig. 3(A)). Its type horizon is the level ‘‘Cieneguita II’’ (Fig. 1(B)).

**Additional material studied**: Six more or less complete macroconchs (MCNAM-PI 24398, 24404/14, 24405/1, 24406,

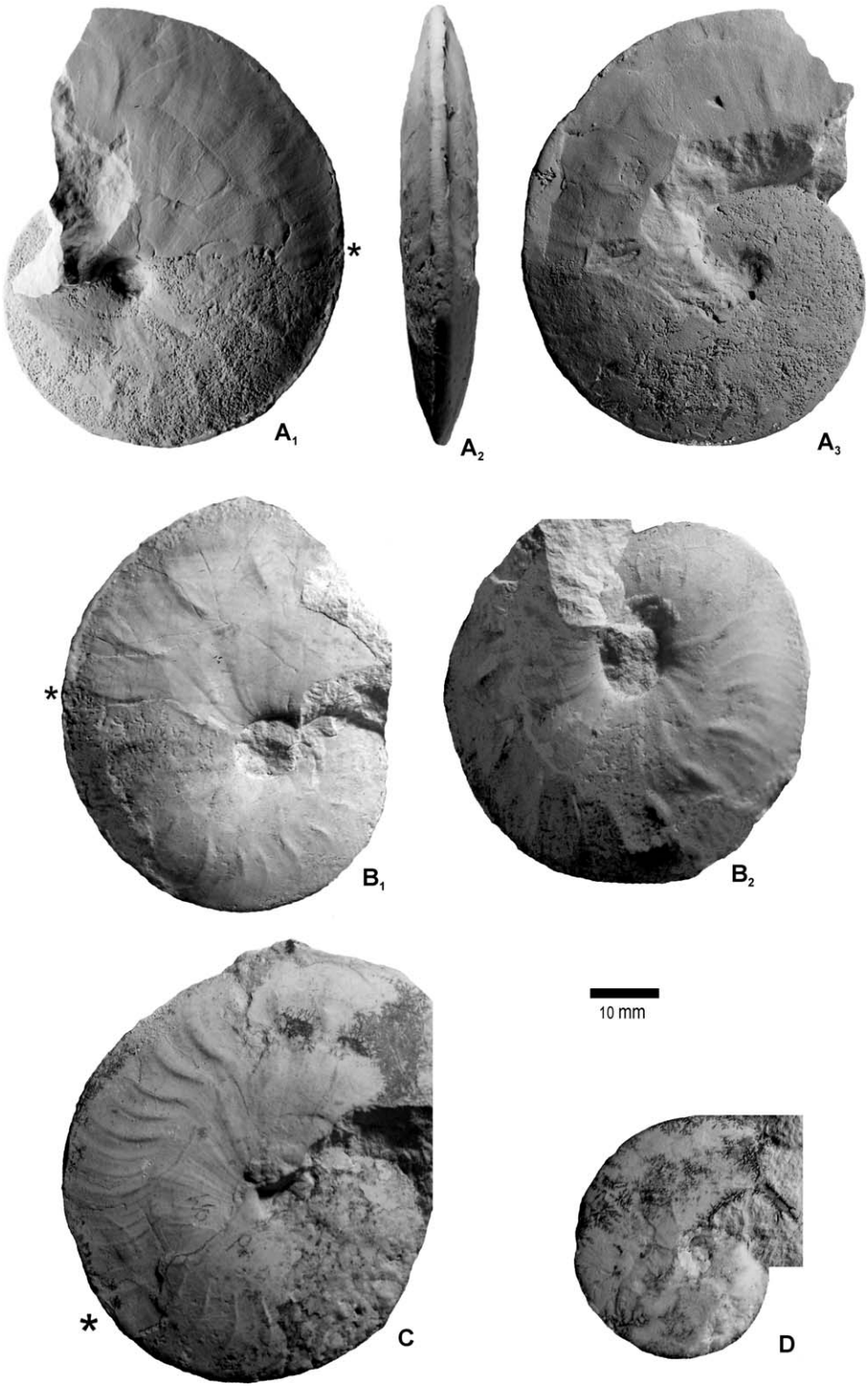


Fig. 6. **A–C.** *Neochetoceras steraspis* (Oppel). A: Adult macroconch with a half body chamber (LPB 1098), leg. M. Röper, Solnhofen; B, C: Adult macroconchs, both with a half body chamber (SNMS 67535/1–2). **D.** *Lingulaticeras solenoides* (Quenstedt), complete microconch (SNMS 67536). Lower Tithonian (Hybonotum Zone), Mörnsheim Formation at Mörnsheim, SW Franconia, quarry named ''Mörnsheimer Hummelberg-Reserve''. The asterisk indicates the beginning of the body chamber.

24406/2 and 24408) and two microconchs (MCNAM-PI 24410/1 and 24412/3) from beds of the level ''Cieneguita II'' of Arroyo Cieneguita. The two specimens described by Steuer (1987, 1921: 103, pl. 7, figs. 16, 17) as *Oppelia nimbata* (Oppel) from level ''Cieneguita II'' (Fig. 3(B, C)); these specimens are more or less complete microconchs (GZG 499-26-499-27), of which that in Fig. 3(C) is the holotype of *Glochiceras steueri* Leanza, 1980.

**Occurrence and distribution**: The type specimens and the new material (topotypes) described were all collected in Arroyo Cieneguita from the level ''Cieneguita II'', the type horizon (Fig. 1(B)). The new collections include a typical faunal association of the Proximus Zone collected from a single faunal horizon: *Catutosphinctes proximus* (Steuer) [?M & m], *Toulisphinctes rafaeli* (Oppel, 1863) [M & ?m], *Aspidoceras cienguitense* Steuer, 1897 [M], and *Pseudhimalayites steinmanni* (Haupt, 1907) [M & m], among others.

**Description**: The lectotype is a phragmocone (max $D = 30$ mm), apparently with incipient uncoiling. Involute ($U/D = 0.17$) and inflate ($W/D = 0.33$) platycone with suboval whorl section ($W/H_1 = 0.66$), flat flanks, rounded clear-cut umbilical shoulder and well-rounded venter. The inner whorls are smooth. The flanks of the outermost preserved whorl exhibit faint falcoid ribs from about $D = 20$ mm onwards, then they become stronger and well-marked ($P = 13$ at max $D$); all of them start on the umbilical shoulder. These ribs are faint and prosocline on the lower third of the flank, where they inflect passing to concave, undivided lunuloid primaries which reach the ventrolateral shoulder where they fade out abruptly. A macroconch closely matching the lectotype is shown in Fig. 5(E).

Macroconchs. Innermost whorls ($D = 3$–$6$ mm) smooth, evolute with rounded whorl section. After about $D = 6$ mm the phragmocone becomes more compressed and involute, suboval in whorl section. Ribbing appears around $D = 25$–$30$ mm in different specimens and shows some variation in strength, but usually as in the lectotype. The adult phragmocone shows only well separate, short and rounded lunuloid primaries on the upper flank, dying out close to the obsolete ventrolateral shoulder. In the largest, well preserved specimen available (Fig. 4(A)) the phragmocone ends at $D_{ls} = 75$ mm and in other (Fig. 4(B)) is estimated at about 60 mm. The body chamber is suboxycone, almost smooth and slightly uncoiled. The peristome is plain, sigmoidal, only slightly expanded on the umbilical shoulder (Fig. 4($A_2$)). In some specimens may persist growth lines that group locally forming undulations. The intraspecific variation is hard to separate from the variations in the aspect of the shell surface due to preservation. Shell shape shows few variation between specimens, the most variable is the whorl section maximum width at comparable diameter (cf. Fig. 4 ($A_1$, $B_1$)). The sculpture shows some variation, different specimens may be strongly to weakly ribbed on the adult phragmocone.

The septal suture line is finely frilled; E narrow and moderately deep, $S_1$ wide and high, L narrow, deep and pentafurcate, $S_2$ higher with a deep incision on ventral side, $U_2$ deep and profusely incised, $U_3$ and $U_5$ smaller and shallower (Fig. 5(A)); dorsal suture not observed. Standard Wedekind's nomenclature as described by Kullmann and Wiedmann (1970).

Microconchs. Smaller, about a fourth part of the adult size of the macroconchs, with identical inner whorls at comparable diameter. Last half whorl of phragmocone and adult body chamber covered with faint to well-marked, falcoid ribs forming on mid-flank a row of linguiform structures which persist up to the peristome. The latter is slightly expanded, with a short rostrum, a deep sinus and a pair of moderately long lappets. In well-preserved specimens, the terminal ventral end of the peristome shows rounded ribs (Fig. 5(B and C)). The variation in the microconchs is confined to the last whorl of the phragmocone and body chamber which can be more or less inflated, and some specimens exhibit feeble ventral ribs close to the rostrum.

**Remarks**: The sexual dimorphic correspondence between *Haploceras falculatum* and the specimens of *Oppelia nimbata* (Oppel in Steuer, 1897) is based on their consistent association in the same stratigraphic level, identical inner whorls, typical relationship of adult sizes between sexes in ammonites and the same septal suture line. Macroconchs of *C. falculatum* differ from those of *C. perlaevis* in being more evolute with denser and stronger ribbing on the adult phragmocone. Adult size of the macro- and microconchs of both species are nearly the same, microconchs of *C. falculatum* are somewhat smaller. The body chamber of the microconchs of *C. falculatum* are covered by falcoid ribs well marked on the upper flank while those of *C. perlaevis* are almost smooth or weakly ribbed (most specimens show only the mid-flank row of linguiform structures).

*Cieneguiticeras* cf. *falculatum* (Steuer, 1897)
Fig. 5(F), Table 1

**Material**: A single specimen (MCNAM-PI 24452/0) from Arroyo Cieneguita.

**Occurrence**: The specimen was collected from a bed of black marls yielding an assemblage of ammonites not yet studied in detail. Among them can be cited: *Windhauseniceras internispinosum*, *Catutosphinctes proximus* (Steuer, 1897), topotypes very similar to the lectotype, *Corongoceras* sp., *Argentiniceras*? sp. and *Substeueroceras*? sp., suggesting a stratigraphic interval Internispinosum–Aternans Zones. Moreover, this bed with *C.* cf. *falculatum* lies below the main occurrence of *Corongoceras alternans* (Gerth, 1925), *Micracanthoceras* sp., *Durangites*? sp. and *Substeueroceras* sp. On the other hand, this bed lies few meters above the type horizon of *C. falculatum*, which is assigned to the Proximus Zone. It can be safely concluded that the biostratigraphic position of *C.* cf. *falcatum* is in some part of an interval Internispinosum–Alternans Zone (Fig. 1(B)).

**Remarks**: The specimen is a small phragmocone (about 23 mm in diameter), slightly uncoiled, probably a subadult macroconch. Its shell is compressed and widely umbilicate. The innermost whorls seem to be like those of *C. falculatum*, but the outermost half whorl is more compressed, suboxycone with falcoid ribbing, concave and prominent on the upper half of the flank. This specimen seems to represent a derivative of *C. falculatum* but the material is insufficient for drawing conclusions.

The present specimen is very similar in ribbing style, adult size and shell shape to some of the Tithonian microconch oppeliids from Madagascar grouped under *Paraglochiceras* Collignon, 1960, especially *P.* aff. *propinquum* (Waagen, 1875) in Collignon (1960: pl. 144, fig. 578) from the local Kobelli

Zone. There is a close resemblance between *C.* cf. *falculatum* and *Salinites grossicostatum* (Imlay, 1939). Nevertheless, the occurrence of a well defined keel, at least on middle phragmocone whorls, in the latter species is a conspicuous and significant difference.

## 3. Additional ammonites provisionally assigned to *Cieneguiticeras* nov. gen

The specimen from the Tithonian of Yemen figured as *Uhligites kraffti* (Uhlig, 1903) by Howarth (1998: pl. 1, fig. 10) shows some resemblance with the adult phragmocone of *C. falculatum* in sculpture and outline (cf. Fig. 4(A–C)) but the specimen is too poorly preserved for comparison.

There are several ammonites recorded worldwide in the literature which have been assigned to *Neochetoceras* but they do not have the diagnostic morphology or sculpture of this genus. Some of them exhibit the diagnostic features of *Cieneguiticeras* nov. gen. as follows:

- *Neochetoceras* sp. aff. *N. mucronatum* Zeiss, 1968 in Myczyński (1989: pl. 1, fig. 5) and *Neochetoceras* aff. *steraspis* (Oppel, 1863) in Myczyński (1989 : pl. 1, figs. 6, 8–10). These macroconch specimens from the lower Tithonian of Cuba are rather poorly preserved. They could be assigned to *Cieneguiticeras* nov. gen., but their preservation prevents a closer identification. The most similar species is *C. falculatum* because of the oxycone aspect and density of the lunuloid ribbing on the upper flank of the terminal phragmocone and beginning of the body chamber.
- *Neochetoceras* sp. [M] in Cecca and Enay (1991: pl. 1, fig. 9) and *Glochiceras blaschkei* Cecca and Enay (1991: pl. 2, figs. 6–9) [m], from the Fallauxi Zone of Le Pouzin, France. We have studied plaster casts of these specimens. Resemblance with the corresponding sexual dimorphs of *C. falculatum* is very close, thus they can be assigned tentatively to *Cieneguiticeras* nov. gen. awaiting to obtain new French material of macroconchs for an observation of the inner whorls.
- *Phylloceras mazapilense* Burckhardt (1906: pl. 34, figs. 1–7), Cuesta de la Caja, Mexico. The septal suture line, outline and ornamentation of these macroconchs perfectly match with *Cieneguiticeras* nov. gen. The most similar species is *C. perlaevis*. Considering the association of ammonites listed by Burckhardt (1906: 172) as reviewed by Callomon (in Hillebrandt et al., 1992), the type material seems to come from the middle or upper Tithonian.

## 4. Conclusion

Several early to middle Tithonian ammonites of Arroyo Cieneguita described more than 100 years ago, poorly recorded afterwards and diversely interpreted, define a homogeneous group of Oppeliid ammonites. This group is assigned to the new genus *Cieneguiticeras*, conforming a phyletic lineage composed of *C. perlaevis* (Mendozanus to Zitteli Zones), *C. falculatum* (Proximus Zone) and *C.* cf. *falculatum*, a species poorly known from a single specimen collected in beds of the Internispinosum to Alternans Zones. *Cieneguiticeras* nov. gen. is widely represented throughout the NMB and very likely in Tethyan localities of Cuba, Mexico and France.

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