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Pseudosonninia, a new genus of oppeliid ammonite (Haploceratoidea) from the Callovian (Middle Jurassic) of the Neuquén Basin, Argentina

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Key words: ammonites, Callovian, Los Molles Fm., Chacay Melehué, Argentina.

Abstract. From the uppermost part of the Los Molles Formation (upper Lower and lower Middle Callovian) in Chacay Melehué (Neuquén Province, Argentina), a group of hecticoceratine ammonites with a conspicuous morphology not assimilable to any known genus of this subfamily has been recently discovered. These forms are inflated oxycones with a prominent, sharp keel developed from the juvenile phragmocone up to the adult peristome. The new genus *Pseudosonninia* is established on the basis of these ammonites, with *Pseudosonninia chacaymelehuensis* n. gen. n. sp. as its type species. The new genus seems to be endemic to the Neuquén Basin and is recorded here from the upper Lower and lower Middle Callovian of Chacay Melehué and Río de Los Patos.

INTRODUCTION

The Lower-Middle Callovian oppeliids from the upper part of the Los Molles Fm. are poorly known throughout the Neuquén Basin (Fig. 1A). Besides several papers mentioning different species (*e.g.* Keidel, 1910; Groeber, 1918, Groeber *et al.*, 1953; Stipanicic, 1965; Westermann, 1967; Hillebrandt, 1970; Dellapé *et al.*, 1979), there are a few with descriptions (Stehn, 1923; Riccardi *et al.*, 1989; Gröschke, Zeiss, 1990).

Recent field work in Chacay Melehué (Fig. 1) has allowed us to collect numerous ammonites from several horizons of the Lower Callovian Bodenbenderi and Proximum zones, as well as from the highest levels of the Los Molles Fm., a few meters below the Tábanos Fm., which are situated above the Proximum Zone. Among these ammonites there are hecticoceratine morphotypes mostly belonging to *Hecticoceras* Bonarelli, 1893, but others correspond to an undescribed genus.

The purpose of this paper is to describe, from this recent collection, the hecticoceratine ammonites from the uppermost part of the Los Molles Fm., especially the representatives of the new genus. The chronostratigraphic ammonite zonation adopted follows Parent and Garrido (2015).

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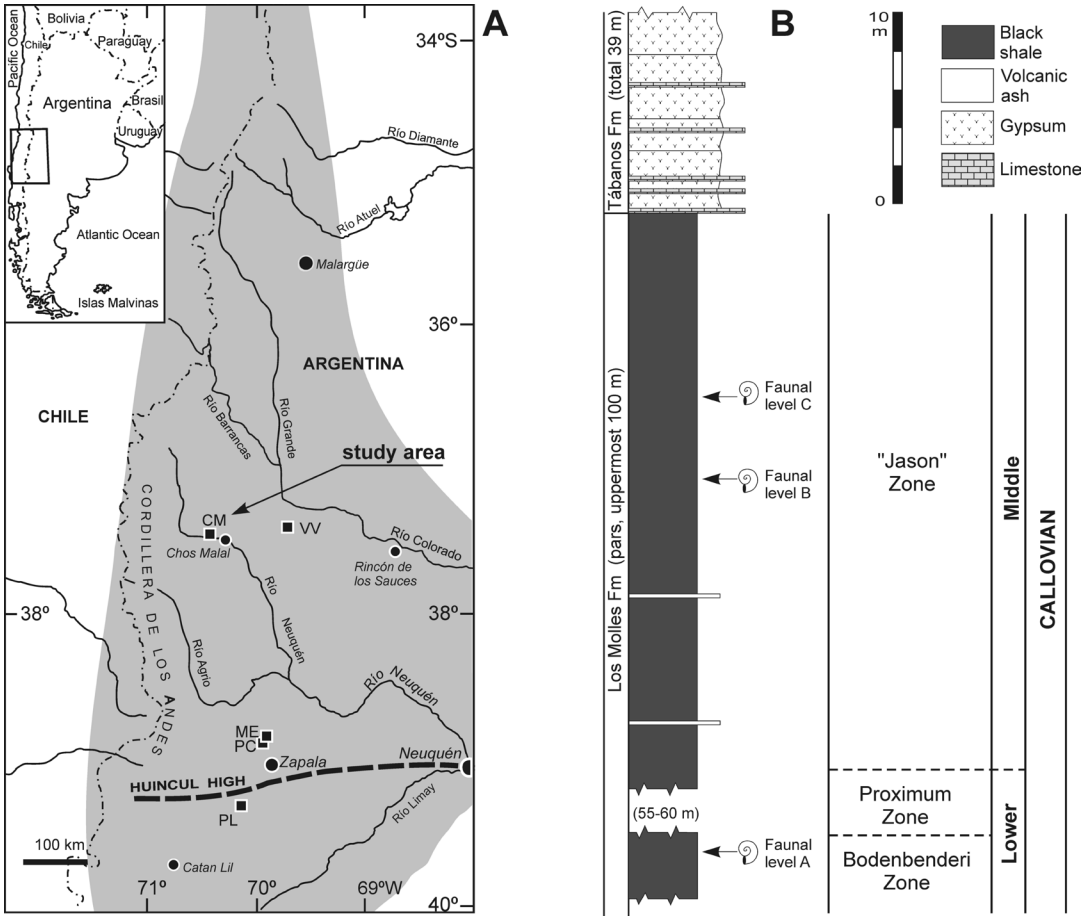


Fig. 1. A. Neuquén Basin with indication of the localities mentioned in the text; **B.** Log-section of the study area: litho-, bio- and chronostratigraphy of the uppermost part of the Los Molles Fm. and the lower part of the Tábanos Fm.
The position of the studied faunal-levels A to C indicated. Zonation after Riccardi *et al.* (1989), and Parent and Garrido (2015)

PL – Picún Leufú, PC – Portada Covunco, ME – Manzano Escondido, VV – Vega de la Veranada, CM – Chacay Melehué

STRATIGRAPHIC POSITION OF THE STUDIED AMMONITES

In the study area the Los Molles Fm., Pliensbachian-Middle Callovian in age (Gulisano and Gutiérrez-Pleimling, 1995), is a 1000–1100 m thick sequence of black shales with thin levels of volcanic ash, limestones, and marls. It is overlain by evaporites of the Tábanos Fm., a unit very variable in thickness in the region, reaching 39 m in the studied section. Below our faunal-level A ammonites are abundant (see Riccardi *et al.*, 1989; Riccardi, Westermann, 1991; Parent, 1997, 1998). The ammonites studied herein come from the uppermost 15 m of the Los Molles Fm., from faunal-levels B and C (Fig. 1B).

The ammonites, nautiloids and inoceramid bivalves recorded from the faunal-levels A to C are as follows, from top to bottom:

Faunal-level C ("Jason" Zone, lower Middle Callovian)

Pseudosonninia chacaymelehuensis n. gen., n. sp. [M & m] (described below)

Pseudosonninia aff. *chacaymelehuensis* n. gen., n. sp. [M] (described below)

Oxycerites aff. *oppeli* Elmi, 1967 [M] (one phragmocone of about 60 mm in diameter; very narrow umbilicate and compressed, with a keel and two faint shoulders; suture line very finely frilled)

Cenoceras sp. A (in Parent and Garrido 2015)

Faunal-level B
("Jason" Zone, lower Middle Callovian)

"*Hecticoceras prahecquense* (Peticlerc, 1915)"
(described below)

Pseudosonninia aff. *chacaymelehuensis* n. gen., n. sp. [M]
(described below)

Araucanites n. sp. A [M]
(large, involute, inflated smooth bodychamber)

"*Choffatia*" sp. A [M & m] (these ammonites belong to an undescribed genus of perisphinctoids with smooth, serpenticonic innermost whorls, median whorls with fine, sharp, prorsiradiate ribs, and subadult-adult whorls with almost radial primaries bifurcating into finer secondaries in the upper flank, and forming a gentle ventral chevron, one of each three ribs remains simple; dimorphic, microconchs with short lappets).

Rehmannia paucicosta (Tornquist, 1898) [M]

Rehmannia brancoi (Steinmann, 1881) [M]

Faunal-level A
(Bodenbenderi Zone, Lower Callovian)

Eurycephalites rotundus (Tornquist, 1898) [M & m]

Eurycephalites rotundus/extremus (Tornquist, 1898) [M]

Xenocephalites stipanicici Riccardi *et al.*, 1989

"*Choffatia*" sp. A [M & m] (as from faunal-level B)

Retroceramus stehni Damborenea, 1990
(abundant large specimens)

Faunal-level A belongs to the Bodenbenderi Zone as indicated by the very abundant occurrence of *E. rotundus*, including large-sized, globose macroconchs resembling *E. extremus*. These latter could likely correspond to the large microconch *X. stipanicici* which occurs in abundance in this level.

The Proximum Zone was defined by Riccardi *et al.* (1989: 561) as an interval of about 60 m of shales of the uppermost part of the Los Molles Fm. The figure 2 in the latter paper shows the Proximum Zone as an interval below the last meters of shales which underly the evaporites of the Tábanos Fm. Our faunal-levels B and C belong to this short uppermost interval, which thus must be considered as overlying the Proximum Zone. The next higher levels with ammonites correspond to the base of the Lotena Fm. (overlying the Tábanos Fm.) and belong to the Patagoniensis standard Zone of the lower Upper Callovian. Thus, we assign the faunal-levels B and C to the "Jason" Zone according to Parent and Garrido (2015), which would be lower Middle Callovian as can be interpreted from Hillebrandt and Gröschke (1995). We have found a loose specimen of *Hecticoceras ardescicum* Elmi, 1967 from the interval between our faunal-levels A (Bodenbenderi Zone) and B ("Jason" Zone), which likely comes from the Proximum Zone.

SYSTEMATIC PALAEONTOLOGY

Conventions. The material described is housed in the Museo Provincial de Ciencias Naturales "Prof. J.A. Olsacher", Zapala (MOZ-PI) and casts in the Laboratorio de Paleontología, Universidad Nacional de Rosario (LPB-M). Bodychamber is abbreviated with Bc and phragmocone with Ph; macroconch (female): [M], microconch (male): [m]. Measurements are indicated as follows: diameter (D), diameter at the last adult septum (D_{ls}) and diameter at adult peristome (D_p), all given in millimeters [mm]; length of bodychamber (L_{BC}) in degrees [°].

Order Ammonitida Fischer, 1882

Suborder Ammonitina Fischer, 1882

Superfamily Haploceratoidea Zittel, 1884

Family Oppeliidae Douvillé, 1890

Subfamily Hecticoceratinae Spath, 1925

Remarks. A consistent classification of the Hecticoceratinae seems impossible for now. In a previous paper (Parent, Garrido, 2015) we have concluded, after discussion of papers based on samples of adult macroconch specimens with precise stratigraphic control, that most of the Hecticoceratinae could consist of a single lineage of broadly variable species assignable to *Hecticoceras* Bonarelli, 1893 (type species: *Nautilus hecticus* Reinecke, 1818). This classification would be a provisional solution. However, given the world-wide distribution of the Hecticoceratinae, it is rather logical to assume that there must be many local lineages which would need separate names. The new genus described below is one of these cases, in which a group of ammonites first recorded in the Neuquén Basin, exhibits a conspicuous morphology, which it is not possible to incorporate in to the morphologic spectrum defined by the available morphogenera.

Genus *Pseudosonninia* nov.

Type species. *Pseudosonninia chacaymelehuensis* n. gen., n. sp.

Etymology. After the close resemblance with the phragmocone of some strongly keeled and tuberculate ammonites of the genus *Sonninia* Douvillé, 1879.

Diagnosis. Macroconchs inflated, oxyconic, strongly keeled up to the adult peristome.

Definition. Inner whorls evolute, with rounded whorl section, passing to compressed platyconic; smooth to weakly ribbed.

Macroconch: subadult and adult whorls moderately involute with inflated-oxyconic whorl section, strongly keeled; lower half of flanks may be smooth or tuberculate, ventral ribs strongly forward projected, ending beside the sharp prominent, unfloored keel.

Microconch: small, platyconic with rounded venter; faint falcoid ribs in the bodychamber; lappets long.

Distribution. Currently known from the Callovian of Chacay Melehué, Neuquén Province (Fig. 1) and Río de Los Patos, San Juan Province.

Species included. The type species and *Pseudosonninia* aff. *chacaymelehuensis* (described below).

Remarks and comparison. The assignation of the new genus *Pseudosonninia* to the Hecticoceratinae is based on the morphology and ornamentation of the inner whorls, the mode of the sexual dimorphism, and the adult morphology and ornamentation of the microconch, all of which match those of typical hecticoceratines (see Arkell *et al.*, 1957; Elmi, 1967; Bonnot *et al.*, 1999). In spite of the broad morpho-ornamental variations shown by the Hecticoceratinae, the strongly keeled and inflated oxyconic shell of *Pseudosonninia* n. gen. stands far from the limits of this range of variation. Thus, considering that the ammonites of the new genus occur apparently isolated in the Neuquén Basin, we conclude that they belong to a hitherto undescribed genus within the Hecticoceratinae.

The macroconchs of *Brightia* Rollier, 1922 (type species *Hecticoceras nodosum* Bonarelli, 1893) show some superficial resemblance to the tuberculate forms of the new genus with their projected secondaries with periumbilical bullae. Nevertheless, adults of *Brightia* are smaller (at peristome), more compressed and bear a lateral groove; their ontogeny is different as well, with tubercles developed from the inner/innermost whorls onwards (Palframan 1969), and only a faint or no keel (*e.g.* Jeannet, 1951; Rogov, 2000; Niederhöfer, Dietl, 2014: pl. 2: 1, 2). *Guerrericeras* Sandoval and Westermann (in Sandoval *et al.*, 1990; type species: *Clydoniceras inflatum* Westermann, 1984, in Westermann *et al.*, 1984), an inflated member of the Hecticoceratinae from the Bodenbenderi Zone of Mexico, differs in its having a subquadratic whorl section and a carinate-bisulcate venter, and furthermore it is stratigraphically older.

Pseudosonninia n. gen. seems to be a short-lived Andean lineage. It could have originated from *Guerrericeras* by modification of the ventral area, passing to the non-tuberculate, early forms of *Pseudosonninia*, then developing the lateral tubercles. Another possibility is that the new genus originated from local forms of *Hecticoceras*, like the morphotype described below as "*Hecticoceras prahecquense* (Peticlerc, 1915)".

Pseudosonninia chacaymelehuensis n. gen. n. sp.

Figs. 2, 3

Etymology. After Chacay Melehué, the type locality of the species.

Material. Holotype (Fig. 2A): an adult macroconch, almost complete (MOZ-PI-3553/1). Paratype (Fig. 2C): complete adult microconch (MOZ-PI-3553/2). 5 more or less complete macroconch specimens (MOZ-PI-3553/3-7). All from the type horizon (faunal-level C) of the type locality (Fig. 1).

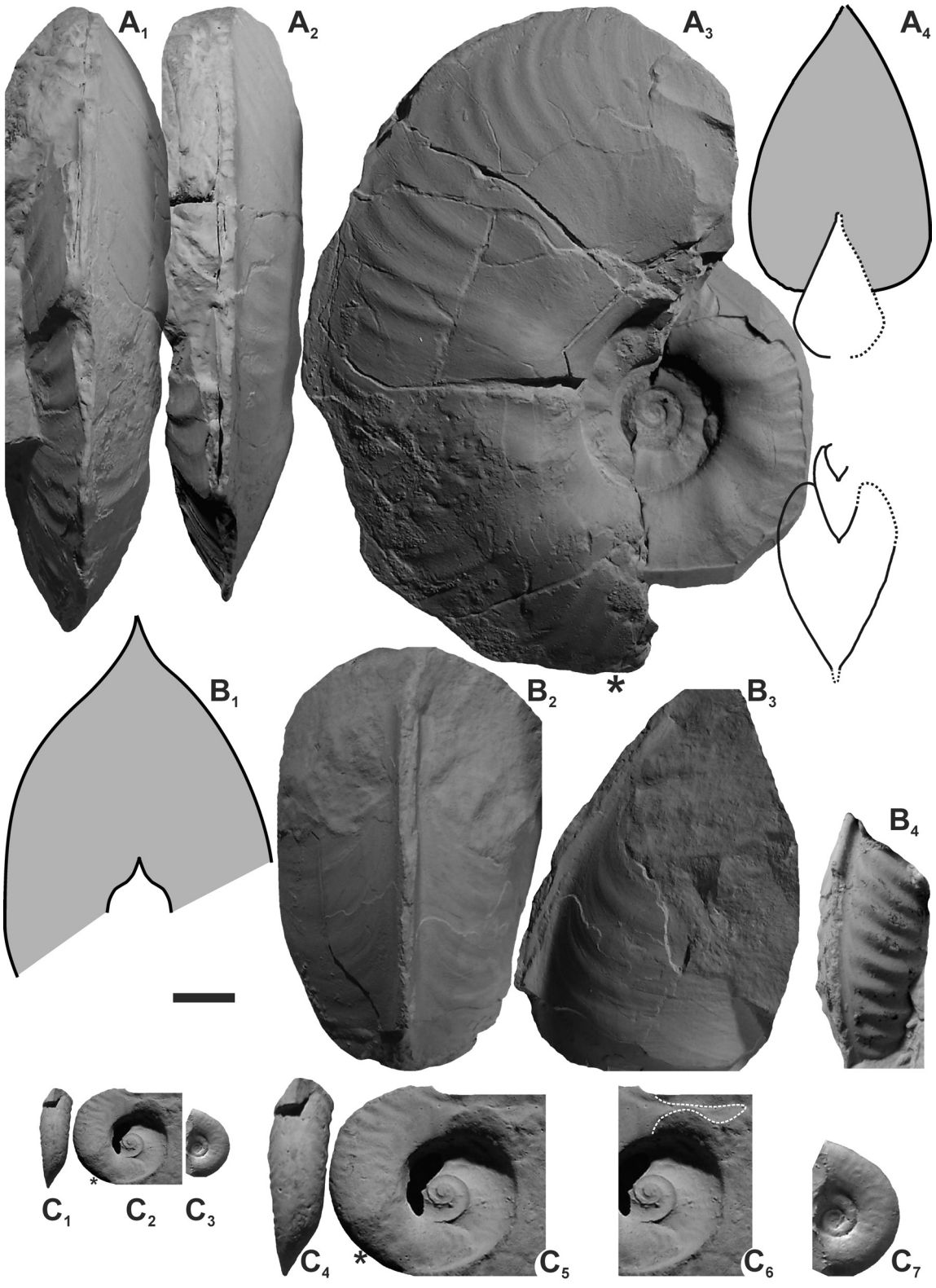
Type locality and horizon. Chacay Melehué, faunal-level C, top of Los Molles Fm. (Fig. 1B), "Jason" Zone, lower Middle Callovian.

Description. Strongly dimorphic. Macroconch: innermost whorls evolute, suboval in whorl section and smooth. From about D = 10 mm becomes compressed, platyconic; smooth. From D = 15–20 mm, moderately involute, with very faint falcate ribbing consisting of prosocline primaries bi- or trifurcating on mid-flank; venter rounded and narrow. At D > 20 mm the whorl section inflates gradually with undifferentiated venter bearing a high plain keel (more or less rounded in the inner mould); ribbing remains falcate with stout bulliform primaries, which give rise to three rursiradiate, concave secondaries strongly projected forward while approaching the venter and fading off besides the keel. The adult bodychamber retains the high keel up to the peristome, while the bulliform primaries become gradually fainter. In the holotype D_{ls} = 78 mm, estimated D_p = 120–130 mm.

Microconch: inner whorls indistinguishable from the macroconch at comparable diameter, below D = 10–15 mm.

Fig. 2. *Pseudosonninia chacaymelehuensis* n. gen. n. sp., Chacay Melehué, faunal-level C, "Jason" Zone

A. Holotype (MOZ-PI-3553/1), adult macroconch with bodychamber; the phragmocone is partially reconstructed with a plaster cast. A_4: whorl section, bodychamber in gray; **B.** Aperture of an adult macroconch bodychamber; whorl section with bodychamber in gray (B_1), ventral (B_2) and lateral views (B_3), and plaster cast of the ventral area of the previous whorl (B_4, phragmocone); **C.** Paratype, a complete adult microconch; ventral (C_1, ×1; C_7, ×2) and lateral views (C_2, ×1; C_5, ×2); phragmocone plaster cast (C_3, ×1; C_7, ×2); contour of the lappets (C_6, x2). Natural size (×1) otherwise indicated. Asterisk at last septum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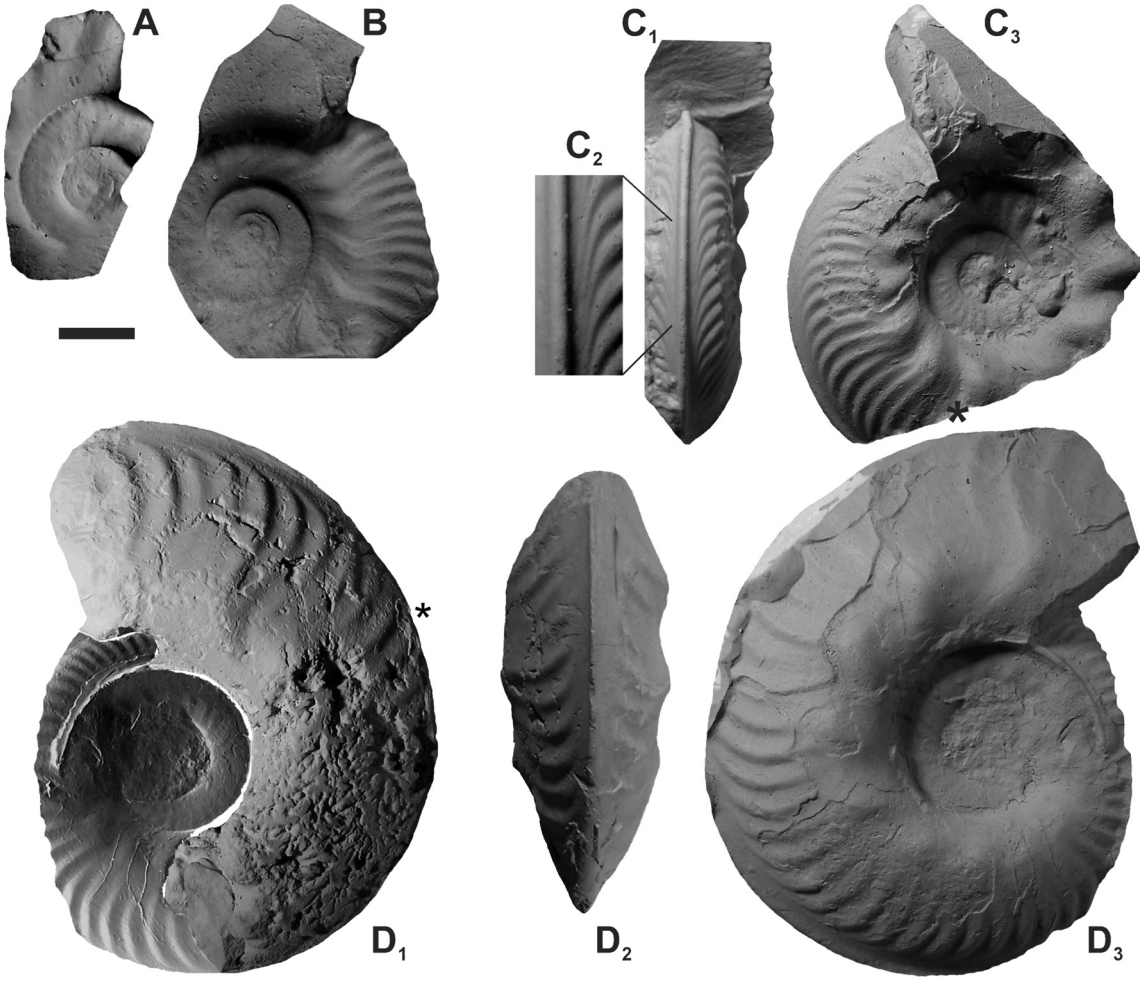

Fig. 3. *Pseudosonninia chacaymelehuensis* n. gen. n. sp., Chacay Melehué, faunal-level C, "Jason" Zone

A. Inner whorls of an incomplete macroconch showing the smooth innermost whorls followed by faint ribbing on the middle whorls; **B.** Almost complete adult macroconch showing the onset of tuberculation; **C.** Plaster cast of an almost complete adult macroconch showing the sharp keel (C_1) and a magnification (×2) of the ending of the ventral ribbing beside the keel (C_2); **D.** Almost complete adult macroconch; D_1: septal suture line; D_3: plaster cast showing the complete specimen. Natural size (×1), except C_2 (×2). Asterisk at last septum

In the short bodychamber there are short rursiradiate ribs on the upper flank. At mid-flank height long, narrow spatulate lappets occur, with a total length corresponding to one half of the diameter at the peristome. Diameter at peristome D_P = 17 mm, D_{ls} = 12 mm, L_{BC} = 105°.

Remarks and comparison. These ammonites have been previously mentioned as *Hecticoceras* n. sp. A in Parent (2006: fig. 11). The microconch described by Riccardi *et al.* (1989: pl. 10: 6, 7) as *Eulunulites lunula* (Zieten) is rather similar to the present microconch (Fig. 2C), but much larger (double-sized), and the upper ribs are concave; on the other hand, this specimen comes from a deeper stratigraphic position, within the Proximum Zone.

Distribution. Currently known from Chacay Melehué, in the uppermost part of the Los Molles Fm., faunal-level C, lower Middle Callovian, "Jason" Zone (Fig. 1B).

***Pseudosonninia* aff. *chacaymelehuensis* n. gen. n. sp.**

Fig. 4A–C

?1923. *Hecticoceras lunula* Zieten – Stehn: 67, pl. 5: 1.

1989. Hecticoceratinae sp. indet. sp. – Riccardi *et al.*: pl. 10: 3.

1989. *Clydoniceras* sp. – Riccardi *et al.*: fig. 2.

?1997. *Oxycerites* sp.? – Álvarez: 130, pl. 14: B, C.

Material. Three incomplete adult macroconchiate bodychambers (MOZ-PI-3553/17-18, 20) and several fragmentary specimens from faunal-levels B and C.

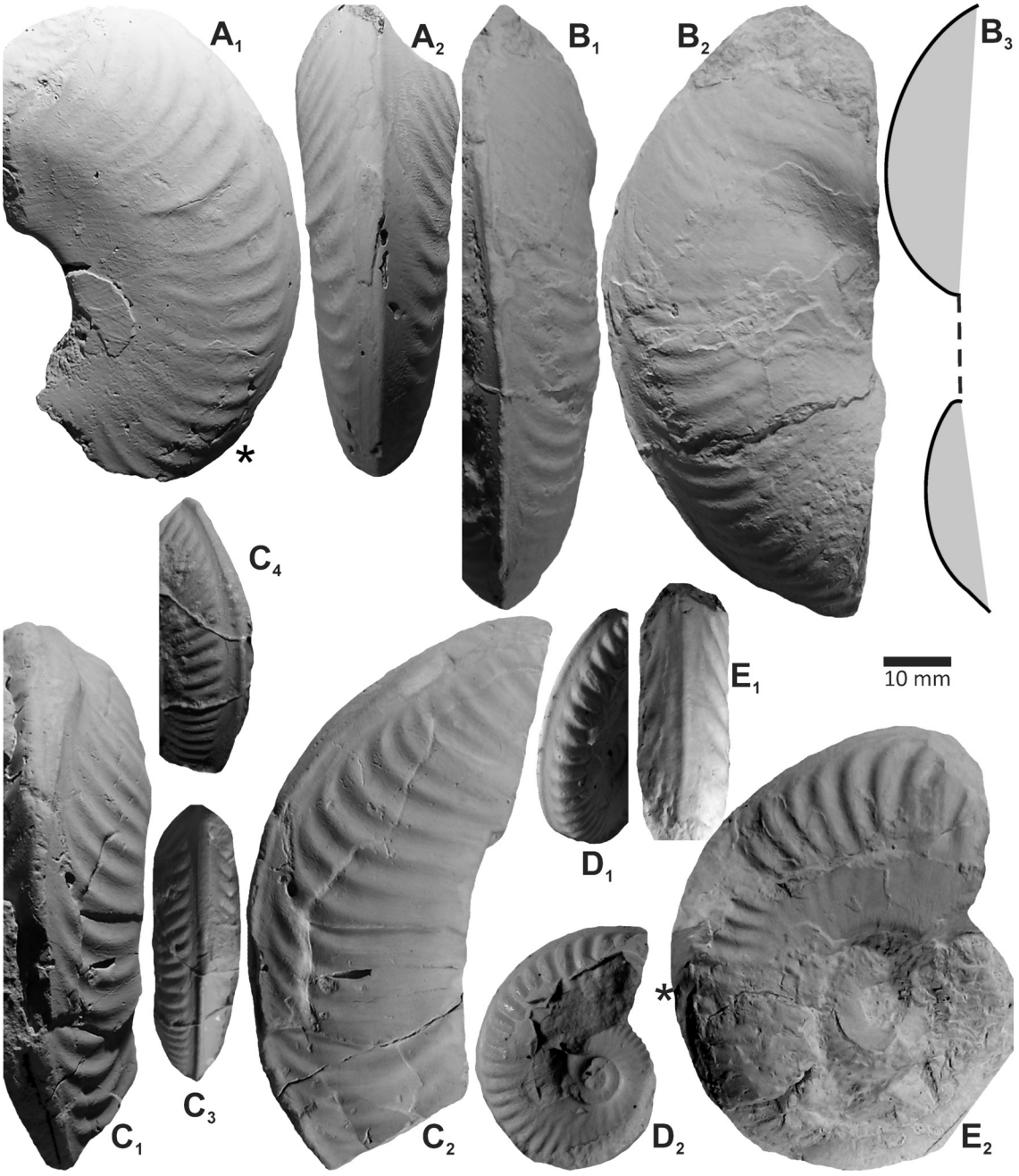

Fig. 4. A–C. *Pseudosonninia* aff. *chacaymelehuensis* n. gen. n. sp., Chacay Melehué, faunal-levels B and C, "Jason" Zone; **A.** Incomplete adult macroconch bodychamber (faunal-level B); **B.** Incomplete adult macroconch bodychamber with incipient bullae (faunal-level C); **C.** Distorted incomplete adult macroconch bodychamber (faunal-level B); C_3, C_4: different views of the ventral area of the previous whorl (phragmocone, plaster cast); **D, E.** "*Hecticoceras prahecquense* (Peticlerc, 1915)", Chacay Melehué, faunal-level B, "Jason" Zone; **D.** ?Microconch phragmocone showing the well-marked keel with prominent ventral ribbing (D_1); **E.** Almost complete adult macroconch. Natural size (×1). Asterisk at last septum

Description. Adult bodychamber moderately involute, with suboval whorl section, becoming inflated towards the peristome. Maximum preserved diameters D = 90–100 mm. A well-developed keel is present from at least the adult phragmocone onwards. The lower part of the flanks tend to be smooth, and the upper part is covered by concave ribs strongly projected forward, fading off besides the keel. Towards the peristome appear wide rounded bullae on the low-

er half of the flanks. The ventral area of the adult phragmocone bears strong ribs strongly projected forward and ending beside a sharp, prominent unfloored keel.

Remarks and comparison. These ammonites are very similar to the adult phragmocone of *P. chacaymelehuensis* n. gen. n. sp., differing by the absence of tubercles in the adult bodychamber; on the other hand, they mostly occur in a slightly deeper stratigraphic position. There is a superficial resemblance with the Bathonian genus *Clydoniceras* Blake, 1905 (type species: *Ammonites discus* Sowerby, 1813) in the overall shell-shape, the short projected ribs and the unfloored keel; however, our specimens are more evolute and inflated, with the normal suture line of the Hecticoceratinae. The indication of the occurrence of *Clydoniceras* sp. in the Proximum Zone of Chacay Melehué (Riccardi *et al.*, 1989: fig. 2) refers to specimens like the present ones (Westermann pers. comm. 2011). The specimen figured as Hecticoceratinae indet. in Riccardi *et al.* (1989: pl. 10: 3), coming from a stratigraphic position close to faunal-level B, perfectly matches the specimens of the present species. The specimen figured by Stehn (1923: pl. 5: 1) is quite identical, but it comes from a not well-defined level somewhere above *Eurycephalites gottschei* (Tornquist, 1898), the zonal index of the Gottschei Zone (lowermost Callovian).

Distribution. Faunal-levels B and C, "Jason" Zone, lower Middle Callovian (Fig. 1B). There is an ammonite from about the Bodenbenderi-Proximum zones interval of Río de Los Patos, San Juan Province (Álvarez, 1997: pl. 14: B, C) which seems assignable to *P*. aff. *chacaymelehuensis* n. gen. n. sp.

Genus Hecticoceras Bonarelli, 1893

Type species: *Nautilus hecticus* Reincecke, 1818 by original designation.

"*Hecticoceras prahecquense* (Peticlerc, 1915)"

Fig. 4D, E

Material. One almost complete adult macroconch (MOZ-PI-2584), and the impression of a phragmocone (MOZ-PI-3553/21).

Description. Compressed platyconic shell shape, moderately involute from the inner whorls, about $D = 10$ mm, up to the adult bodychamber. Ribbing falcoid, very faint primaries in the lower half of the flanks and densely ribbed by lunuloid ribs in the upper half ($P = 22$ through $D = 20$–38 mm, and $P = 27$ at $D = 70$ mm). The venter bears a well-marked keel. In the adult specimen, the bodychamber is sligthly uncoiled from its beginning at $D_{ls} = 50$ mm.

Remarks. The present specimens match perfectly at different sizes with the holotype of *H. prahecquense* (Peticlerc, 1915: pl. 2: 4). Nevertheless, there are many closely comparable specimens in the literature which are described under different generic and specific names (see *e.g.* Elmi, 1967: 758). For this reason it is considered here merely a morphospecies, a morphotype of a species, which, for the time being, has a poorly known spatio-temporal distribution, sexual dimorphism, and range of variation.

Distribution. Faunal-level B, "Jason" Zone, lower Middle Callovian (Fig. 1B).

CONCLUSION

In Middle Callovian rocks of the uppermost part of the Los Molles Fm. in Chacay Melehué a new genus of inflated oxyconic hecticoceratines with a prominent keel has been recognized. It is herein named *Pseudosonninia* n. gen., including *Pseudosonninia chacaymelehuensis* n. gen. n. sp. (type species) and *P*. aff. *chacaymelehuensis*. *Pseudosonninia* n. gen. is currently only known from the Neuquén Basin (Chacay Melehué and Río de Los Patos). The origin of these forms could likely be in *Guerrericeras*, a hecticoceratine known from the Lower Callovian of Mexico.

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