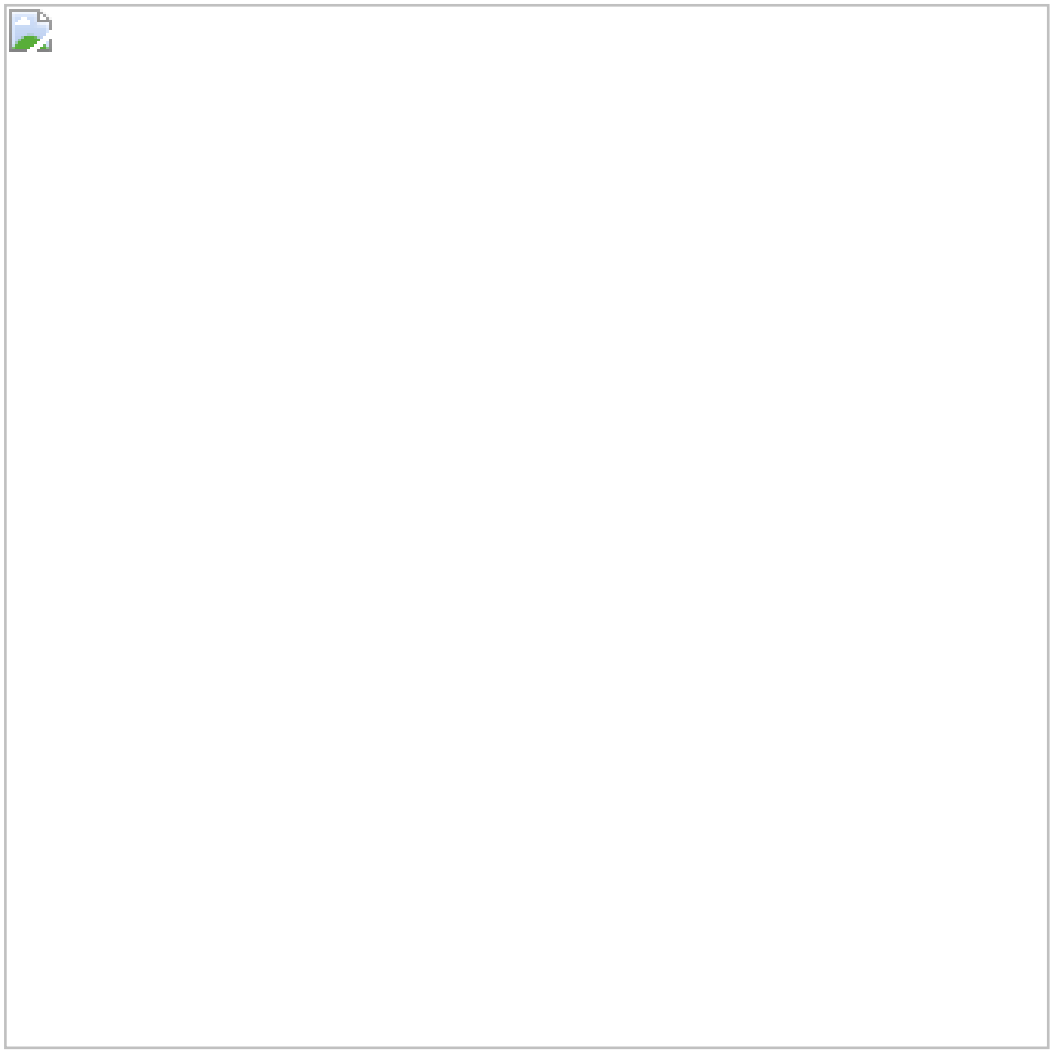

# New Early Jurassic Gastropods from West-Central Patagonia, Argentina

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Source: Acta Palaeontologica Polonica, 58(3) : 579-593

Published By: Institute of Paleobiology, Polish Academy of Sciences

URL: https://doi.org/10.4202/app.2011.0090

# New Early Jurassic gastropods from west-central Patagonia, Argentina

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Ferrari, S.M. 2013. New Early Jurassic gastropods from west-central Patagonia, Argentina. *Acta Palaeontologica Polonica* 58 (3): 579–593.

A new gastropod fauna is reported from Chubut province of west-central Patagonia. Members of Trochoidea, Pseudomelanoidea, Campaniloidea, and Nerinoidea are recorded from the Early Jurassic (Late Pliensbachian–Early Toarcian) of Mulanguiñeu Formation. The gastropod fauna consists of two new species: the pseudomelaniid *Pseudomelania feruglioi* sp. nov. and the protorculid *Anulifera chubutensis* sp. nov. Other members of the association are *Pseudomelania* sp.; the ampulloispirids *Globularia* cf. *catanlilensis*, *Globularia* sp., and *Naricopsina*? sp.; the nerineids *Nerinea*? sp. 1 and *Nerinea*? sp. 2; the trochids *Lithotrochus humblodtii*, *Lithotrochus* cf. *rothi*, and two indeterminable trochids species. An analysis of diversity was made considering all gastropod fauna recovered so far from five fossiliferous localities sampled in west-central Patagonia. The preliminary results of this study suggests that the Jurassic marine sequences of west central Chubut province are dominated by gastropods of Eucyclidae, Pseudomelaniidae, Procerithiidae, and Ampullinidae groups. However, the rarefaction curves of particular marine gastropod faunas in the Jurassic of Patagonia are still far from saturation requiring further collecting effort.

Key words: Gastropoda, Mulanguiñeu Formation, Pliensbachian, Toarcian, Jurassic, Chubut, Patagonia, Argentina.

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Received 28 June 2011, accepted 12 January 2012, available online 17 January 2012.



## Introduction

Early Jurassic marine gastropods from South America were studied so far by Bayle and Coquand (1851), Gottsche (1878, 1925), Behrendsen (1891, 1922), Möricke (1894), Burckhardt (1900, 1902), Jaworski (1925, 1926a, b), Weaver (1931), Feruglio (1934), Piatnitzky (1936, 1946), Wahnish (1942), Gründel (2001), Damborenea and Ferrari (2008), and Ferrari (2009, 2011a, 2012, 2013). The present paper provides new systematic and paleobiogeographic information about the gastropod faunas in the Early Jurassic (Pliensbachian–Toarcian) of Patagonia. Members of Trochoidea, Pseudomelanoidea, Campaniloidea, and Nerineoidea are recorded from the marine deposits of Mulanguiñeu Formation which crops out in the southwestern region of Chubut province (Fig. 1). The most extensive outcrops of this unit are on the western slope of Salar de Ferraroti and Lomas Occidentales near Río Genoa valley, and they lie unconformably over Late Paleozoic marine sediments referred to the Río Genoa Formation (Ferrari 2011a). The Mulanguiñeu Formation was dated as Early Jurassic (Pliensbachian–Toarcian) based on marine invertebrate faunas including bivalves, ammonites and brachiopods (Fernández Garrasino 1977). The gastropod fauna includes two new species: *Pseudomelania feruglioi* sp. nov. and *Anulifera chubutensis* sp. nov. Other members of this association are *Pseudomelania* sp., *Globularia* cf. *catanlilensis* (Weaver, 1931), *Globularia* sp., *Naricopsina*? sp., *Nerinea*? sp. 1, *Nerinea*? sp. 2, *Lithotrochus humboldtii* (von Buch, 1839), *Lithotrochus* cf. *rothi* (Damborenea and Ferrari, 2008), and the Trochidae? gen. et sp. indet. The new findings here reported from Lomas Occidentales, Cerro La Trampa, and Lomas de Betancourt localities (Fig. 1) contribute toward increasing the paleontological knowledge of the Jurassic marine gastropods of Argentina and South America. An analysis of diversity showed that the Jurassic marine gastropod associations are dominated by representatives of Eucyclidae, Pseudomelaniidae, Procerithiidae, and Ampullinidae groups, but are still very poorly known in west-central Patagonia and need a more exhaustive research in the future in order to obtain appropriate interpretation of the Argentinean gastropod taxonomic composition.

*Institutional abbreviations*.—MLP, Museo de Ciencias Naturales de la Universidad Nacional de La Plata, Argentina; MPEF, Museo Paleontológico "Egidio Feruglio", Trelew, Chubut, Argentina; SEGEMAR, Servicio Geológico y Minero Argentino, Buenos Aires, Argentina.



http://dx.doi.org/10.4202/app.2011.0090

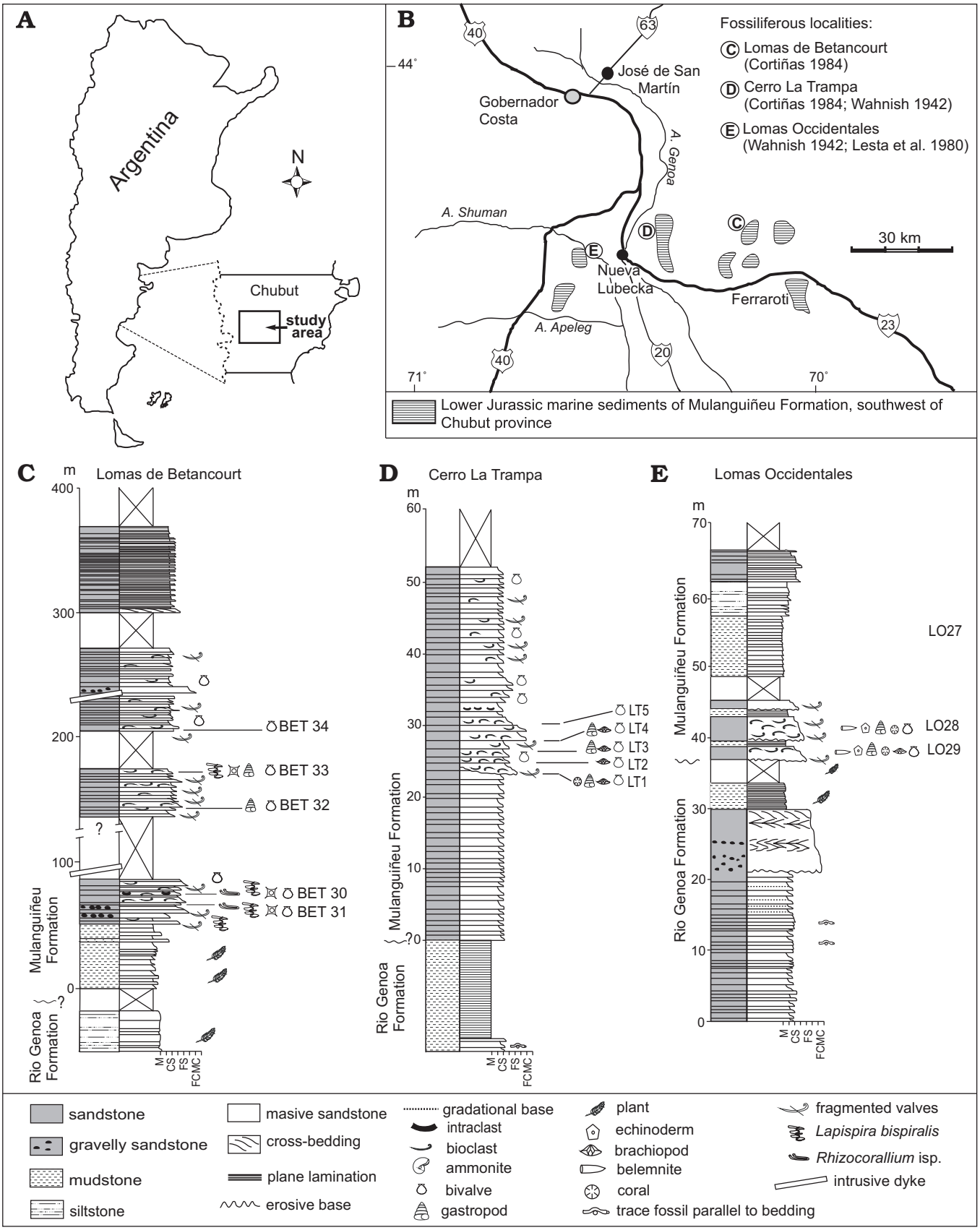


Fig. 1. **A**. Map of Argentina showing the study area in southwestern Chubut province. **B**. Location map of southwestern Chubut province showing the localities of the new gastropod fauna in Argentinean Patagonia. Stratigraphical log chart of Lomas de Betancourt (**C**), Cerro La Trampa (**D**), and Lomas Occidentales (**E**). Abbreviations: M, mudstone; CS, coarse sand; FS, fine sand; FCMC, fine conglomerate–medium conglomerate.

# Systematic paleontology

## Class Gastropoda Cuvier, 1797

## Subclass Orthogastropoda Ponder and Lindberg, 1996

## Order Vetigastropoda Salvini-Pläwen, 1980

## Superfamily Trochoidea Rafinesque, 1815

## Family Trochidae Rafinesque, 1815

## Genus *Lithotrochus* Conrad, 1855

*Type species*: *Turritella andii* d'Orbigny, 1842, junior synonym of *Pleurotomaria humboldtii* Buch, 1839; Early Sinemurian–Late Pliensbachian, Early Jurassic, South America.

*Remarks*.—Damborenea and Ferrari (2008) have recently discussed the systematic classification and provided an emended diagnosis of *Lithotrochus*. They pointed out that the genus is endemic to South America and has a wide distribution in the Andean region from northern Peru to the central Chubut province in Argentinean Patagonia.

*Stratigraphic and geographic range*.—Sinemurian–Pliensbachian, Early Jurassic (according to Damborenea and Ferrari 2008); Peru, Chile, and Argentina.

### *Lithotrochus humboldtii* (von Buch, 1839)

Fig. 2A.

1839 *Pleurotomaria humboldtii*; von Buch 1839: 9, pl. 2: 26.

non 1942 *Lithotrochus humboldti* (von Buch, 1839); Wahnish 1942: 60–61, pl. 2: 4.

2008 *Lithotrochus humboldtii* (von Buch, 1839); Damborenea and Ferrari 2008: 202, figs. 4.1–21, 7.1 (see here for complete synonymy list).

*Material*.—MPEF-PI 4127; fragmentary, re-crystallized teleoconch. LT 1 site from Cerro La Trampa locality, Chubut province, Argentina, Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 4127: height 35 mm; spire height 27.3 mm; width 35.1 mm; spire width 24.5 mm.

*Description*.—Dextral, anomphalous, medium sized, high spired and conical shell. The protoconch is not preserved. The three of four earlier teleoconch whorls are trochiform, becoming slightly cyrtoconoid during the last growth. The whorls are flat and the shell is gradated in outline, and the sutures are distinctly incised. The ornament is poorly developed on the shell surface; an adapical spiral keel or carina borders the periphery of each whorl. The base is flat and bordered by a strong spiral keel. The aperture is fragmentary.

*Remarks*.—According to the diagnosis given by Damborenea and Ferrari (2008), the single specimen here described shows the typical characters of *Lithotrochus humboldtii*. However, the present material does not show the diagnostic spiral cords of the species, probably due to its poorly preserved conditions. *L. humbildtii* was previously reported in the Early Jurassic (Pliensbachian) of Arroyo Pescado locality from Chubut province (see Damborenea and Ferrari 2008: fig. 4.21)

*Stratigraphic and geographic range*.—Early Sinemurian–Late Pliensbachian *Fanninoceras* Zone; Andean region of South America, from northern Peru to Argentinean Patagonia.

### *Lithotrochus* cf. *rothi* Damborenea and Ferrari, 2008

Fig. 2B.

*Material*.—MPEF-PI 3581; fragmentary, re-crystallized teleoconch. LO 29 site from Lomas Occidentales locality, Chubut province, Argentina, Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 3581: height 26 mm; spire height 17.6 mm; width 20.6 mm.

*Description*.—Dextral, anomphalous, conical, trochiform to cyrtoconoid, and medium sized shell. The protoconch is not preserved. The teleoconch consists of six whorls; the spire whorls are flat to slightly convex. The ornament is poorly developed; it consists of a spiral keel or carina that borders the periphery of each whorl. The aperture is circular and holostomatous, with a thin and smooth columellar lip. The base is slightly convex.

*Remarks*.—The cyrtoconoid shell with imbricate whorls and a peripheral carina suggest an assignment to *Lithotrochus*. The specimen here described strongly resembles *Litotrochus rothi* Damborenea and Ferrari (2008: 205, fig. 6) from the Late Pliensbachian (Early Jurassic) of Neuquén province, Argentina. However, some diagnostic features of the species, such as spiral threads on the base and prosocline collabral lamellae on the lateral flanks of the whorls are not preserved in *Lithotrochus* cf. *rothi*.

*Lithotrochus* cf. *rothi* could be the first occurrence of the species in the Early Jurassic marine deposits of Chubut province.

*Lithotrochus humboldtii* (von Buch 1839) from the Sinemurian–Pliensbachian (Early Jurassic) of South America is very similar to *Lithotrochus* cf. *rothi*; however, von Buch's species is larger than the species here described, has strong spiral keels on the whorl flank intercepted with fine and prosocline growth lines, the adult teleoconch has two strong peripheral spiral keels, and fine growth lines appear on the base (Damborenea and Ferrari 2008: 204, fig. 4).

### Trochidae? gen. et sp. indet. 1

Fig. 2C, D.

*Material*.—MPEF-PI 4120 and 4121; two fragmentary, recrystalized teleoconchs. LO 29 site from Lomas Occidentales locality, Chubut province, Argentina, Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—MPEF-PI 4120: height 65.5 mm; width 81. 4 mm. MPEF-PI 4121: height 67.2 mm; width 77.3 mm.

*Description*.—Dextral, anomphalous, trochiform, conical, large sized and low spired shell. The protoconch is not preserved. In the best preserved specimens, the teleoconch comprises three/four whorls, with flat to slightly convex outline. Sutures are weakly incised. The shell is smooth or the orna-

http://dx.doi.org/10.4202/app.2011.0090

ment is poorly developed. The base is flat and the aperture fragmentary.

*Remarks*.—The general shell morphology of the specimens here described suggests that they may belong to Trochidae. However, the material is very poorly preserved, so it is left in open nomenclature.

### Trochidae? gen. et sp. indet. 2

Fig. 2E.

*Material*.—MPEF-PI 4122; one fragmentary, re-crystallized teleoconch. LT 2 site from Cerro La Trampa locality, Chubut province, Argentina, Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—MPEF-PI 4122: height 12.7 mm; width 13.5 mm.

*Description*.—Trochiform, conical, low spired, and small sized shell. The protoconch is not preserved. The teleoconch consist of three flat whorls. Sutures are very weakly incised. The shell is smooth or the ornament is poorly developed. The base is flat, and the apertural characters are not preserved.

*Remarks*.—The single specimen here described seems to be a member of Trochidae; however, as the material shows very few diagnostic characters to be included certainly into the family, it is left in open nomenclature. Trochidae? gen. et sp. indet. 2 differs from Trochidae? gen. et sp. indet. 1 in having flatter whorls and in being smaller.

## Superorder Caenogastropoda Cox, 1959

## Order Ptenoglossa Gray, 1853

## Superfamily Pseudomelanoidea R. Hoernes, 1884

## Family Pseudomelaniidae R. Hoernes, 1884

## Genus *Pseudomelania* Pictet and Campiche, 1862

*Type species*: *Pseudomelania gresslyi* Pictet and Campiche, 1862, by subsequent designation of Wenz (1938); from the Neocomian, Lower Cretaceous of Switzerland.

*Remarks*.—Turriculate gastropods with a poorly developed ornament are commonly assigned to the problematic genus *Pseudomelania*. The type species of the genus, *Pseudomelania gresslyi* Pictet and Campiche, 1862, is very poorly known with no information on its protoconch. Since the original description of the genus was based on similar but independently derived species, Gründel (2001) suggested that *Pseudomelania* may probably be a polyphyletic unit. Kaim (2004) considered that *Pseudomelania* groups shells of simple morphology, and that it is impossible to say whether they represent many different species or a few species with a large variability in shell shape. He pointed out that protoconchs of the known species frequently included in this genus are unknown, and that they may belong to other groups of gastropods, such as eulimids or zygopleurids. In the present paper, the classification of Kaim (2004) is followed, and according to the diagnosis given by that author, the specimens here described are assigned to *Pseudomelania*.

*Stratigraphic and geographic range*.—Triassic–Cretaceous (Kaim 2004); Europe, Asia, Africa, Madagascar, New Zealand, Antarctica, and America.

### *Pseudomelania feruglioi* sp. nov.

Figs. 2F–I, 3A–D.

2001 *Pseudomelania* sp. 1 Gründel: 56, pl. 4: 5, 6.
2001 *Pseudomelania*? sp. 2 Gründel: 56, pl. 4: 7.
2001 *Pseudomelania* sp. 4 Gründel: 57, pl. 4: 8, 9.

*Etymology*: Dedicated to Egidio Feruglio (1897–1954), who strongly contributed toward the geological and paleontological knowledge of the Patagonian Jurassic.

*Type material*: Holotype, MPEF-PI 4155, relatively well preserved teleoconch; paratypes, MPEF-PI 4087 to 4092, poorly preserved teleoconchs; MPEF-PI 4093 to 4104, 4139; MLP 18507 and 18508; fragmentary and replaced teleoconchs.

*Type locality*: LO 28 and LO 29 sites from Lomas Occidentales locality; BET 33 site from Lomas de Betancourt locality, Chubut province, Argentina.

Table 1. Dimensions (in mm) of *Pseudomelania feruglioi* sp. nov. Abbreviations: H, height; Sh, spire height; W, width.

| | Type | H | Sh | W |
|---|---|---|---|---|
| MPEF-PI 4155 | holotype | 17.9 | 12 | 8 |
| MPEF-PI 4087 | paratype | 19 | 14 | 8.3 |
| MPEF-PI 4087 | paratype | 40.8 | – | 13 |
| MPEF-PI 4089 | paratype | 22.9 | – | 10.7 |
| MPEF-PI 4090 | paratype | 31 | – | 13.5 |
| MPEF-PI 4091 | paratype | 29.9 | – | 12 |
| MPEF-PI 4092 | paratype | 12.9 | 8.2 | 7 |
| MPEF-PI 4093 | | 14.5 | – | 7.2 |
| MPEF-PI 4094 | | 18 | – | 10.6 |
| MPEF-PI 4094 | | 22 | – | 9.7 |
| MPEF-PI 4094 | | 17 | 9.6 | 8.2 |
| MPEF-PI 4094 | | 10.1 | 6.8 | 5.4 |
| MPEF-PI 4094 | | 23.4 | – | 11 |
| MPEF-PI 4095 | | 15.3 | 9.2 | 7.5 |
| MPEF-PI 4096 | | 18.9 | 12.3 | 8 |
| MPEF-PI 4097 | | 16.8 | – | 8 |
| MPEF-PI 4098 | | 17.3 | – | 8 |
| MPEF-PI 4099 | | 16.3 | 10 | 8.4 |
| MPEF-PI 4100 | | 22.6 | – | 10.6 |
| MPEF-PI 4101 | | 48.2 | 35.5 | 17.2 |
| MPEF-PI 4102 | | 25 | – | 11.8 |
| MPEF-PI 4102 | | 24.7 | – | 11.4 |
| MPEF-PI 4102 | | 39.4 | – | 14.2 |
| MPEF-PI 4102 | | 35 | – | 12.2 |
| MPEF-PI 4102 | | 25.4 | – | 11.2 |
| MPEF-PI 4102 | | 30 | | 13.5 |
| MPEF-PI 4104 | | 46.5 | – | 23.2 |
| MPEF-PI 4104 | | 18.5 | – | 9.3 |
| MPEF-PI 4104 | | 20.8 | – | 12.8 |
| MPEF-PI 4104 | | 12 | – | 9.2 |
| MPEF-PI 4104 | | 31 | – | 16.3 |

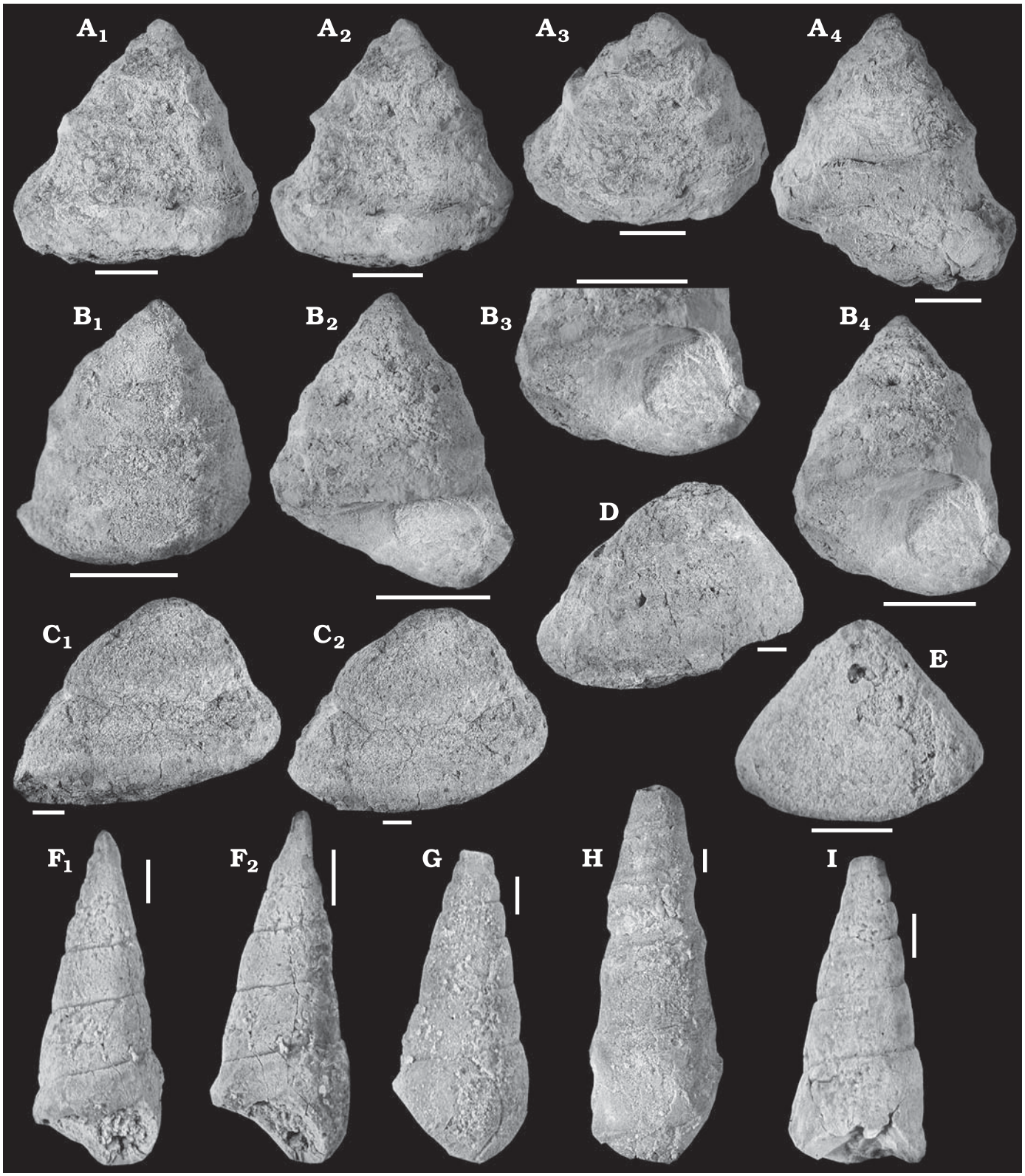


Fig. 2. Early Jurassic gastropods from Lomas Occidentales and Cerro La Trampa fossiliferous localities. **A**. *Lithotrochus humboldtii* (von Buch, 1839), MPEF-PI 4127; teleoconch in lateral ($A_1$, $A_2$), latero-apical ($A_3$), and apertural ($A_4$) views. **B**. *Lithotrochus* cf. *rothi* Damborenea and Ferrari, 2008, MPEF-PI 3581; teleoconch in lateral ($B_1$) and apertural ($B_2$) views; apertural detail ($B_3$); teleoconch in basal and apertural view ($B_4$). **C**, **D**. Trochidae gen. et sp. indet. 1. **C**. MPEF-PI 4120, teleoconch in lateral views ($C_1$, $C_2$). **D**. MPEF-PI 4121, teleoconch in lateral view. **E**. Trochidae? gen. et sp. indet. 2., MPEF-PI 4122, teleoconch in lateral view. **F**–**I**. *Pseudomelania feruglioi* sp. nov. **F**. MPEF-PI 4155, holotype, juvenile teleoconch in apertural ($F_1$) and oblique apertural ($F_2$) views. **G**. MPEF-PI 4087, paratype, juvenile teleoconch in lateral view. **H**. MPEF-PI 4101, adult teleoconch in lateral view. **I**. MPEF-PI 4098, juvenile teleoconch in lateral view. Scale bars: A–E 10 mm, F–I 3 mm.

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*Type horizon*: Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—See Table 1.

*Diagnosis*.—Dextral, anomphalous and turriculate shell; teleoconch comprises seven/ten whorls; juvenile teleoconch whorls slightly convex to flat; mature teleoconch whorls with a strong spiral keel on the upper portion; convex and smooth base; holostomatous and oval aperture.

*Description*.—Dextral, anomphalous, turriculate, high spired, and medium to large sized shell. The protoconch is not preserved. In the most complete specimens the teleoconch comprises seven/ten flat whorls; the earlier whorls of the teleoconch are slightly convex, becoming flat toward the mature whorls. Sutures are weakly incised in a spiral furrow. Ornament is poorly developed on the shell surface. The early teleoconch whorls are smooth. The mature ornament of the teleoconch stabilizes on the fifth whorl; a strong spiral keel appears on the upper portion of the each whorl. Some specimens show a second and weak spiral keel in an abapical position. The collabral ornament is not clearly developed. The base is convex and smooth, and lacks spiral and collabral elements. The aperture is holostomatous and oval, with a thick columellar lip.

*Remarks*.—The present material shows the characters which are typical of *Pseudomelania* (according to the genus concept in Kaim 2004). Most representatives of the genus are characterized by the presence of a thick and turriculate shell, with flat teleoconch whorls, and a poorly developed ornament pattern with strong spiral keels near the sutures.

The first mention of *Pseudomelania* in the Jurassic of Argentina may probably belong to Tornquist (1898), who described a specimen under the name of *Cerithium postuliferum* Tornquist, 1898 (172, pl. 10: 10) from the Early Jurassic of San Juan province. Tornquist (1898) considered *C. postuliferum* as closely related to *Chemnitzia lonsdalei* Morris and Lycett, 1850; thus, *C. postuliferum* may be a certain representative of *Pseudomelania*. Tornquist's (1898) species share some features with *Pseudomelania feruglioi* sp. nov., including a high spired shell with poorly developed ornament; however, *C. postuliferum* has two lateral bumps located in an adapical and abapical position and separated by a medial depression. The latter character is not present in the material here described. Jaworski (1926b: 198, 199) described *Pseudomelania* aff. *repeliana* d'Orbigny, 1909 and *Pseudomelania*? cf. *bicarinata* Wright, 1859 from the Early Jurassic of Mendoza province. *P.* aff. *repeliana* differs from the Chubutean species in lacking a spiral and adapical keel on the mature teleoconch whorls; moreover, the lateral portion of the whorls in *P.*? cf. *bicarinata* is slightly more concave than in *P. feruglioi*, and two strong spiral keels border the adapical and abapical sutures. However, these species were not figured by the author. Gründel (2001) described four species of *Pseudomelania* from the Jurassic of Chile, which resembles the Patagonian species. Three of these species treated by Gründel in open nomenclature are included here in the synonymy of *P. feruglioi* (see above). The remaining species, *Pseudomelania* sp. 3 (Gründel 2001: 57. pl. 4: 13, 14) from the Toarcian (Early Jurassic) of Chile resembles *P. feruglioi* in lacking a collabral ornament and in having a convex base; but Gründel's (2001) species has two adapical and abapical spiral keels on mature teleoconch whorls; the abapical one is bordered by a conspicuous nodose rows. The presence of spiral keel near the sutures gives to the whorl face a concave outline. The material described by Cox (1965: 147, pl. 24: 10) as *Pseudomelania aspasia* (d'Orbigny, 1850) from the Middle Jurassic of Tanzania is similar to the species here described in general shell morphology and poorly developed ornament. However, the latter species differs in the absence of spiral keels near the sutures, and in having an oval aperture with a rounded anterior end and sharpened posterior end. The specimen assigned by Cox (1965: 148, pl. 24: 12) to *Pseudomelania vittata* (Phillips, 1829) from the Kimmeridgian (Upper Jurassic) of Tanzania differs from the Patagonian species in having two strong spiral keels on the last teleoconch whorl, which give the whorl surface a concave outline. *Pseudomelania* (*Rhabdoconcha*) *wilderriensis* Cox (1965: 151, pl. 25: 10) from the Oxfordian (Upper Jurassic) of Kenya is similar to *P. feruglioi* in general shell morphology; but Cox's (1965) species is larger, the teleoconch has more convex whorls, and a more developed ornament pattern consisting on fine spiral striations and prosocline growth lines. Collabral ornament is not clearly developed in *P. feruglioi*. *Pseudomelania*? sp. Szabó (1983: 34, pl. 3: 10) from the Bajocian (Middle Jurassic) of Hungary has prosocline to slightly opistocline growth lines; these characters are not typical for the Chubutean species. *Pseudomelania trochiformis* (Piette, 1857) (Kaim 2004: 97, fig. 77) from the Middle Jurassic–Early Cretaceous of France and Poland is similar to *P. feruglioi*; however, the European species is smaller, and lacks spiral ornament. *Pseudomelania turbinata* (Stoliczka, 1861) (Szabó 2008: 97, fig. 90) from the Sinemurian (Early Jurassic) of Austria differs from the species here described in being smaller, in having more convex whorls, and fine and sigmoidal growth lines on the shell surface; *P. feruglioi* does not show sigmoidal growth lines. The specimens described by Hudleston (1887–1896: 237, pls. 16: 9, 18: 1, 2, 21: 1) as *Pseudomelania procera* Eudes-Deslongchamps, 1842 from the Middle Jurassic of England are related to *P. feruglioi*; but they have a more elongated spire, with a maximum height of 70–80 mm, and have fine growth lines on the shell surface. *Pseudomelania coarctata* Eudes-Deslongchamps, 1842 from the Middle Jurassic of England differs from the Patagonian species in having a more gradate shell and more developed collabral elements (Hudleston 1887–1896: 242, pls. 18: 9, 19: 1). *Pseudomelania lonsdalei* Morris and Lycett (1850: 49, pl. 7: 13; Hudleston 1887–1896: 243, pl. 19: 2) from the Middle Jurassic of England differs from the Chubutean species in having a medial furrow on each teleoconch whorl. *Pseudomelania remtsaensis* Cox, 1969 from the Bathonian (Middle Jurassic) of India has more convex whorls than *P. feruglioi* (Szabó and Jaitly 2004: 14, pl. 2: 1–5), while *Pseudomelania calloviensis* (Hébert and Eudes-Deslong-

champs, 1860) from the Bathonian (Middle Jurassic) of India lacks spiral keels bordering the sutures (Szabó and Jaitly 2004: 14. pl. 2: 9, 10).

*Stratigraphic and geographic range*.—Lower Pliensbachian (Early Jurassic) to Early Oxfordian (Late Jurassic); Andean region of South America, from northern-central Chile and Argentinean Patagonia.

### *Pseudomelania* sp.

Fig. 3E.

*Material*.—MPEF-PI 4105 and 4506; fragmentary, re-crystallized teleoconchs. LO 29 site from Lomas Occidentales locality, Chubut province, Argentina, Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 4105: height 25.2 mm; width 13.2 mm.

*Description*.—Dextral, anomphalous, turriculate, medium sized and high spired shell. The protoconch is not preserved. The fragmentary teleoconch consists of four straight to slightly convex whorls. Sutures are incised in a deep spiral furrow. The shell is smooth or lacks a well developed ornament, though on last whorl a weak abapical spiral keel may appear. The base is flat and ornamented by seven regularly spaced spiral keels. The aperture is not preserved.

*Remarks*.—The material shows the typical characters of *Pseudomelania* (according to the genus concept of Kaim 2004). However, due to lack of well preserved specimens, it is left in open nomenclature until more material is available.

*Pseudomelania* sp. together with *Pseudomelania feruglioi* sp. nov. are the first occurrences of the genus in the Early Jurassic marine deposits of Chubut province.

*Pseudomelania* sp. differs from *P. feruglioi* sp. nov. in having sutures deeply impressed in a spiral furrow, flat base with regularly spaced spiral keels, and lacks of adapical spiral keel on mature teleoconch whorls.

## Family Protorculidae Bandel, 1991

## Genus *Anulifera* Zapfe, 1962

*Type species*: *Zygopleura* (*Anulifera*) *variabilis* Zapfe, 1962, from the Rhaetian (Late Triassic) of Austria.

*Remarks*.—Nützel and Senowbari-Daryan (1999) placed *Anulifera* into the family Proconulidae due to the presence of fine spiral grooves on the teleoconch, the presence of knobby spiral rows, the general shell morphology and the relatively large size. They also stated that the spiral ornament of the base resembles that of *Atorcula* (see Nützel 1998) which has a typical protorculid larval shell. However, the embryonic shell of *Anulifera* remains unknown, so the placement of the genus into the Protorculidae still needs confirmation (Nützel and Senowbari-Daryan 1999). *Anulifera* differs from *Zygopleura* and *Stephanozyga* in the ornament pattern. Members of *Stephanozyga* lack spiral grooves on the teleoconch, and zygopleurids may have axial parasigmoidal ribs or be externally smooth. According to Nützel and Senowbari-Daryan (1999) and Nützel et al. (2010) the genus is characteristic of the Late Triassic of Asia and Alps (Tethys). The species here described is the first occurrence of *Anulifera* in the Jurassic of South America.

*Stratigraphic and geographic range*.—Norian–Rhaetian (Late Triassic) to Pliensbachian–Toarcian (Early Jurassic); Europe, Asia, South America.

### *Anulifera chubutensis* sp. nov.

Fig. 3F–G.

2001 *Zygopleura* sp. Gründel; Gründel 2001: 54, pl. 4: 4.

*Etymology*: Referred to the Chubut province, where the material was found.

*Type material*: Holotype, SEGEMAR 25000 (cast MPEF-PI 4107), re-crystallized fragmentary teleoconch collected by Esther Wahnish; paratype, SEGEMAR 25001 (cast MPEF-PI 4108), re-crystallized fragmentary teleoconch collected by Esther Wahnish.

*Type locality*: Lomas Occidentales locality, Chubut province, Argentina.

*Type horizon*: Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 4107: height 83.5 mm; width 43.2 mm.

*Diagnosis*.—Dextral, turriculate, large sized and high spired shell; juvenile teleoconch whorls flat; mature teleoconch whorls slightly convex; a spiral row of 18 nodes appear on mature whorls; base convex with irregular spiral keels; aperture holostomatous and oval; columellar lip thickened.

*Description*.—Dextral, anomphalous, turriculate, large sized and high spired shell. The protoconch is not preserved. The fragmentary teleoconch comprises three whorls; the juvenile teleoconch whorls are flat, becoming slightly convex toward the mature whorls. Last whorl is more expanded than the earlier whorls. The sutures are weakly incised. The shell is externally smooth or lacks a well developed ornament. Spiral elements are absent probably due to the poor preservation. An abapical spiral row of 18 conspicuous nodes borders the sutures on each teleoconch whorl. Weak opisthocline axial ribs appear from each node; but, collabral elements are not developed on the shell surface. The base is slightly convex, ornamented by weak and irregular spiral keels. The aperture is holostomatous and oval, with a thickened columellar lip.

*Remarks*.—The general shell morphology, the ornament pattern, consisting of conspicuous nodose rows on the teleoconch whorls, and the base with spiral furrows suggests an assignment to *Anulifera* (compare Nützel and Senowbari-Daryan 1999).

*Anulifera chubutensis* sp. nov. is the first occurrence of the genus in the Early Jurassic of South America. *Zygopleura* sp. recorded by Gründel (2001: 54, pl. 4: 4) from the Sinemurian of Chile most likely also belongs to *Anulifera chubutensis*. *Pustulifer peruviana* Haas, 1953 from the Upper Triassic of Peru (Haas 1953: 148, pl. 9: 20–24) is very similar to the species here described; however, the former species is bigger than *A. chubutensis*, has fewer nodes (ten/ twelve), and the mature teleoconch whorls are flat to slightly concave. *Anulifera variabilis* (Zapfe, 1962) (Zapfe 1962: 65, pl. 2:

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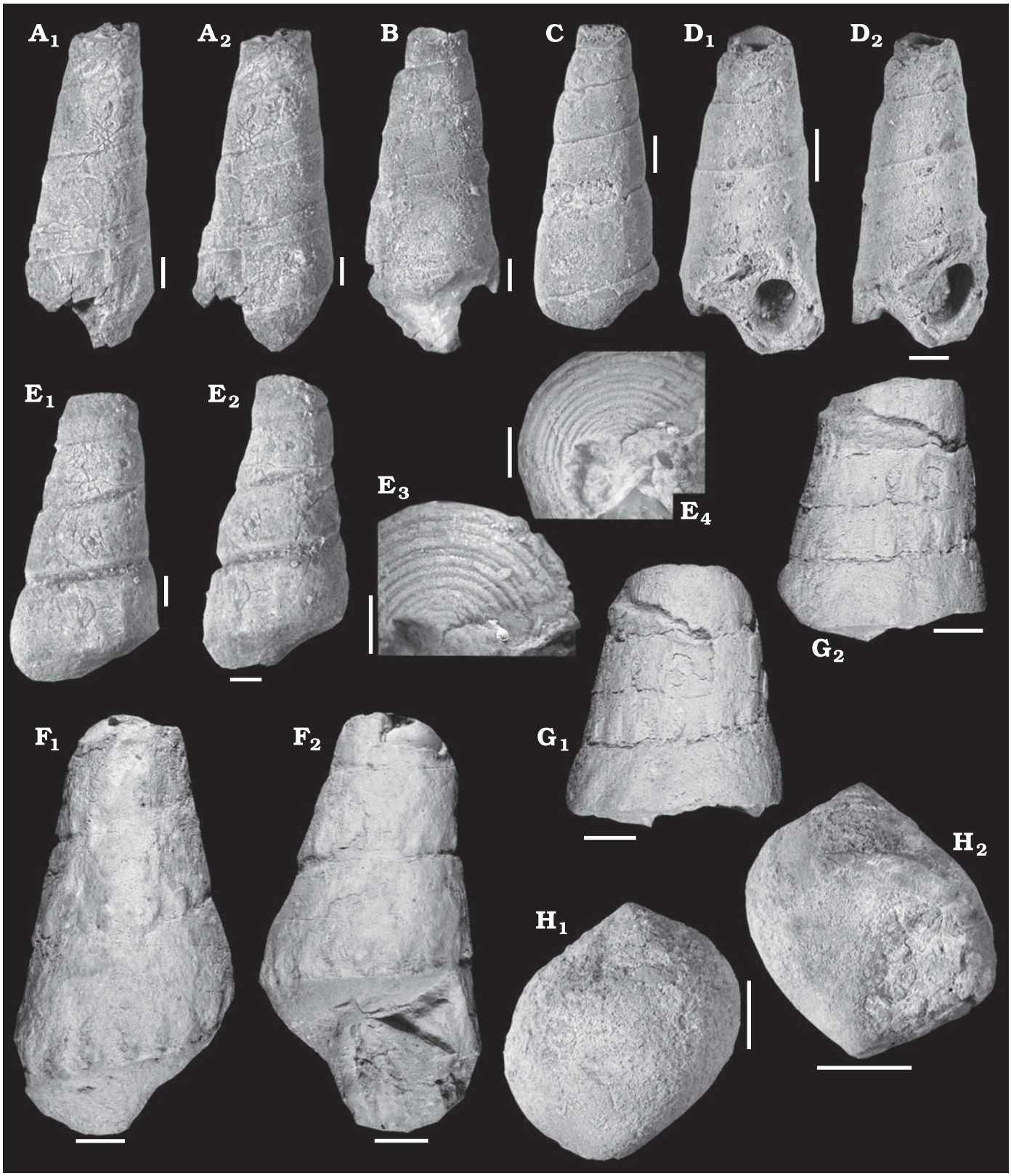


Fig. 3. Early Jurassic gastropods from Lomas Occidentales fossil locality. **A**–**D**. *Pseudomelania feruglioi* sp. nov. **A**. MPEF-PI 4090, paratype, adult teleoconch in lateral views ($A_1$, $A_2$). **B**. MPEF-PI 4091, paratype, adult teleoconch in lateral view. **C**. MPEF-PI 4096, juvenile teleoconch in lateral view. **D**. MPEF-PI 4089, paratype, adult teleoconch in apertural views ($D_1$, $D_2$). **E**. *Pseudomelania* sp. adult teleoconch in lateral views ($E_1$, $E_2$), basal views showing ornament details ($E_3$, $E_4$). **F**, **G**. *Anulifera chubutensis* sp. nov. **F**. SEGEMAR 25000 (MPEF-PI 4107), holotype, teleoconch in lateral ($F_1$) and apertural ($F_2$) views. **G**. SEGEMAR 25001 (MPEF-PI 4108), fragmentary teleoconch in lateral views ($G_1$, $G_2$). **H**. *Globularia* aff. *catanlilensis* (Weaver, 1931). MPEF-PI 4110, teleoconch in lateral ($H_1$) and apertural ($H_2$) views. Scale bars: A–E 3 mm, F–H, 10 mm.

1–4; Nützel et al. 2010: 10, fig. 6.9–6.11), the type species of *Anulifera* from the Upper Triassic of Austria is very similar to the Chubutean species; Zapfe's (1962) form, however, has less convex whorls, more developed spiral elements, and the base is angular and bordered by a strong spiral keel. *Anulifera binodosa* (Fallahi, Gruber, and Tichy, 1983) (Nützel and Senowbari-Daryan 1999: 118, pl. 5: 3–8; Nützel et al. 2010: 10, fig. 6.1–6.6) from the Upper Triassic of Iran resembles *A. chubutensis* in shell size and general morphology; the Iranian species, however, has two nodose rows bordering the abapical suture, being the adapical nodes more developed than the abapical ones; and has many spiral striations or furrows and opisthocyrt growth lines on the shell surface. The last characters are not developed in the species here described. *Zygopleura*? *seminodosa* Nützel and Senowbari-Daryan, 1999 (Nützel and Senowbari-Daryan 1999: 113, pl. 4: 4, 5) from the Upper Triassic of Iran differs from the Chubutean species in being smaller, with flat to slightly concave whorls, sigmoidal growth lines on the shell surface, and smooth base. According to Nützel et al. (2010), *Anulifera binodosa* is very close related to *A. variablilis*. The authors suggested that it is actually possible that both species are synonyms and represent a single variable species.

*Stratigraphic and geographic range*.—Late Pliensbachian to Early Toarcian; Chubut province, Argentinean Patagonia

## Superfamily Campaniloidea Douvillé, 1904

## Family Ampullinidae Cossmann, 1919

## Genus *Globularia* Swainson, 1840

*Type species*: *Ampullaria sigaretina* Lamarck, 1804, from the Eocene of France.

*Remarks*.—Several species of *Globularia* were previously assigned to the genus *Natica* (Family Naticidae) (e.g., d'Orbigny 1850; Cernohorsky 1871; Hudleston 1877–1896) which appeared in the fossil record in the Early Cretaceous (e.g., Bandel 1993; Tracey et al. 1993; Kase and Ishikawa 2003). Older species of similar morphology have been transferred to *Globularia* (family Ampullinidae) (e.g., Cox 1965; Szabó and Jaitly 2004). Moreover, Bandel (1999) pointed out that members of the Jurassic Ampullinidae are actually more closely related to the Cretaceous Pseudamauridae than to the extant Naticidae. According to Bandel (1999) this was evidenced by the genus *Ampullospira* Harris, 1897 from the English Middle Jurassic, having similar ontogeny as *Pseudamaura* Fischer, 1885 from the Cretaceous. *Ampullospira* is the type genus of the Ampullospiridae (a synonym of Ampullinidae), and therefore the entire groups should be removed from the Naticidae. Ampullinidae may actually belong to the stem group of the Pseudamauridae or both groups might be even synonymous (Bandel 1999). Subsequently, Dieni (2008) argued that Naticidae and Ampullinidae are unrelated from the phylogenetic point of view.

*Globularia* is an extint representative of Ampullinidae (which, according to Kase and Ishikawa 2003; Dieni 2008, its sole extant species is *Cerninia fluctuata* Sowerby, 1825) and has an abundant fossil record in the Mesozoic worldwide. Members of this genus, ascribed by previous authors to *Natica* were reported from the Early Jurassic of South America, extending its southernmost occurrence to the Chubut province (Feruglio 1934; Wahnish 1942). The species referred to *Natica* from the Jurassic of South America are no longer considered as real representatives of Naticidae and thus are transferred to *Globularia*.

*Stratigraphic and geographic range*.—Triassic?, Jurassic–Holocene; Cosmopolitan.

### *Globularia* cf. *catanlilensis* (Weaver, 1931)

Figs. 3H, 4A–C.

1934 *Natica* aff. *catanlilensis*; Feruglio 1934: 49, pl. 5: 2a, b, 3a, b.
1942 *Natica catanlilensis*; Wahnish 1942: 61, pl. 2: 1a, b.

*Material*.—MPEF-PI 4110 to 4119, MLP 18512 and 18513; fragmentary and re-crystallized teleoconchs. LO 29 site from Lomas Occidentales locality; LT s and LT 1 sites from Cerro La Trampa locality, Chubut province, Argentina, Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—See Table 2.

Table 2. Dimensions (in mm) of *Globularia* cf. *catanlilensis* (Weaver, 1931). Abbreviations: H, height; Sh, spire height; W, width; Sw, spire width; Hw, width of last whorl.

| | H | Sht | Wh | Sw | Hw |
|---|---|---|---|---|---|
| MPEF-PI 4110 | 29.2 | 8.8 | 27.2 | 12.2 | 24.5 |
| MPEF-PI 4111 | 50 | 12.4 | 36.2 | 19 | 42.5 |
| MPEF-PI 4112 | 43 | 17.5 | 38 | 21.6 | 34.2 |
| MPEF-PI 4112 | 36.3 | 10.5 | 38.2 | 19 | – |
| MPEF-PI 4113 | 40.8 | – | 35.3 | – | – |
| MPEF-PI 4114 | 41 | 15 | 36.4 | – | – |
| MPEF-PI 4116 | 63.2 | 20.4 | 54 | 26.9 | – |
| MPEF-PI 4117 | 47.7 | – | 50.3 | – | – |
| MPEF-PI 4118 | 50.7 | 14 | 36.2 | | 45.4 |

*Description*.—Dextral, anomphalous, globular, naticiform, low spired and medium to large sized shell. The protoconch is not preserved. The teleoconch comprises five whorls; the last teleoconch whorl is much higher than the spire. Last whorl aproximately as high as wide. The spire is blunt, acute; the upper portion of the whorls is flat with a sutural ramp of 4 mm wide, becoming strongly convex toward the lower portion. Sutures are deeply incised. The shell is smooth or lacks a well developed ornament; some specimens have weak spiral keels on last teleoconch whorl, and growth lines are not developed. The base is strongly convex and the aperture oval; the aperture has a narrow adapical end becoming wider toward the abapical end. The outer lip is convex, and the inner lip concave with an embedded callus. Umbilical characters are absent.

*Remarks*.—The globular, naticiform, low spired and convex shell, smooth or with weak spiral keels, and the closed umbilical area suggest an assignment to *Globularia*.

http://dx.doi.org/10.4202/app.2011.0090

The material here analyzed agrees with the descriptions of *Natica catanlilensis* (Weaver 1931: 378, pl. 42: 277–278) from the Early Jurassic of Neuquén province (Argentina), with *Natica* aff. *catanlilensis* (Feruglio 1934: 49, pl. 5: 2a, b, 3a, b) and with *Natica catanlilensis* (Wahnish 1942: 61, pl. 2: 1a, b), the last two recorded from the Early Jurassic of Chubut province, Argentina. Here, I decide to include the material described by these authors into the genus *Globularia* (see above), and to keep the open nomenclature suggested by Feruglio (1934), until more and better preserved material is available.

*Globularia khadirensis* Szabó and Jaitly (2004: 18, pl. 2: 17–19, 22, 23) from the Bathonian (Middle Jurassic) of India resembles *G.* cf. *catanlilensis*; but the former species has a larger shell, with a more step-like sutural ramp, an axial furrow bordering the inner lip and a false umbilicus. The material described by Szabó and Jaitly (2004: 18, pl. 2: 11–13) as *Globularia michelini* (d'Archiac, 1843) from the Callovian (Middle Jurassic) of India differs from the Patagonian species in having a parietal lip forming a narrow callus on the base, and a slightly reflected columellar lip. *Globularia hemisphaerica* (Roemer, 1836) (Cox 1965: 166, pl. 28: 9) from the Upper Jurassic of Kenya differs from the species here described in having a more globular shell, with a lower and more convex spire; the last teleoconch whorl is larger and more convex; moreover, it has weak collabral lines. *Globularia phasianelloides* (d'Orbigny, 1852) (Cox 1965: 166, pl. 29: 1a, b) from the Oxfordian–Kimmeridgian (Upper Jurassic) of Kenya has a higher spire than the Chubutean species, with slightly convex whorls. *Globularia hennigi* Cox (1965: 167, pl. 28: 5a–c) from the Upper Jurassic of Kenya differs from *G.* cf. *catanlilensis* in being smaller and having prosocline growth lines. *Ampullospira quennelli* Cox (1965: 165, pl. 29: 2 a–c, 3a–c) from the Callovian (Middle Jurassic) of Tanzania is very similar to the species here described; however, the spire whorls of the African species are more convex and it has a concave sutural edge as well as and slightly opisthocline growth lines. *Natica proxima* Hudleston, 1882 (1877–1896: 260, pl. 20: 7) from the Middle Jurassic of England differs from the Patagonian species in having a distinctive umbilical area with a callus developed in the inner lip. *Natica adducta* Phillips, 1829 (Hudleston 1877–1896: 257, pl. 20: 3) from the Middle Jurassic of England resembles *G.* cf. *catanlilensis*; but the European species is smaller than the Chubutean species and has fine growth lines on the shell surface.

*Stratigraphic and geographic range*.—Early Jurassic; Andean region of Argentina, Neuquén and Chubut provinces.

### *Globularia* sp.

Fig. 4D.

*Material*.—MPEF-PI 4119; fragmentary and re-crystallized teleoconch. LT 1 site from Cerro La Trampa locality, Chubut province, Argentina, Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—MPEF-PI 4119: height 49 mm; spire height 27.2 mm; width 42 mm; spire width 25.6 mm; last whorl height 29 mm.

*Description*.—Dextral, anomphalous, naticiform, globular, low spired, medium sized shell with gradate outline. The protoconch is not preserved. The teleoconch comprises four fragmentary whorls; the last one more expanded than the earlier whorls. Last teleoconch whorl is about half of the maximum height of the shell. The upper portion of the whorls forms a very narrow sutural ramp which gives the periphery of the shell a strongly angular shape, becoming wide and concave toward the lower portion. The suture is weakly incised. The shell is smooth or lacks a well developed ornament. The base is convex and the aperture fragmentary, with the inner lip concave. Umbilical characters are absent.

*Remarks*.—The present material shows the typical characters of *Globularia*, due to the imperfect conditions, however, I decided to leave this species in open nomenclature.

*Globularia* sp. is similar to *Globularia* cf. *catanlilensis* (Weaver, 1931); however, *Globularia* sp. has a more gradate outline shell, and the last teleoconch whorl has a height approximately equal to its width.

## Genus *Naricopsina* Chelot, 1886

*Type species*: *Lobostoma guarangeri* Davoust, 1885, from the Bathonian (Middle Jurassic) of Europe.

*Remarks*.—Gründel (2001) proposed the Family Naricopsinidae based on the genus *Naricopsina*; however, Kaim et al. (2004) considered Naricopsinidae as junior synonym of Ampullinidae and placed *Naricopsina* within the last family. They based their inclusion on the umbilical characters of *Naricopsina*, which are typical of Ampullinidae (see e.g., Kase and Ishikawa 2003). In the present paper, the genus *Naricopsina* is considered as a member of Ampullinidae.

*Stratigraphic and geographic range*.—Early Jurassic?, Middle Jurassic–Upper Cretaceous (Maastrichtian); Europe, Africa, Asia, America.

### *Naricopsina*? sp.

Fig. 4E.

*Material*.—MPEF-PI 3560; teleoconch fragment preserved as external mould. BET 32 site from Lomas de Betancourt locality, Chubut province, Argentina, Mulanguiñeu Formation, Upper Pliensbachian–Lower Toarcian, Lower Jurassic.

*Dimensions*.—MPEF-PI 3560: height 9 mm; width 10.7 mm.

*Description*.—Conical, turbiniform to naticiform and low spired shell with strongly gradate outline. The protoconch is not preserved. The fragmentary teleoconch comprises four strongly convex whorls. The suture is deeply incised in a concave spiral furrow. The shell surface is smooth, and neither axial elements nor growth lines are observed. On the upper portion of last whorl a weak spiral keel appears. The aperture and base are not preserved.

*Remarks*.—The naticiform shell with strongly convex whorls, the deeply incised sutures and the poorly developed ornament suggest an assignment to *Naricopsina*. However, apertural,

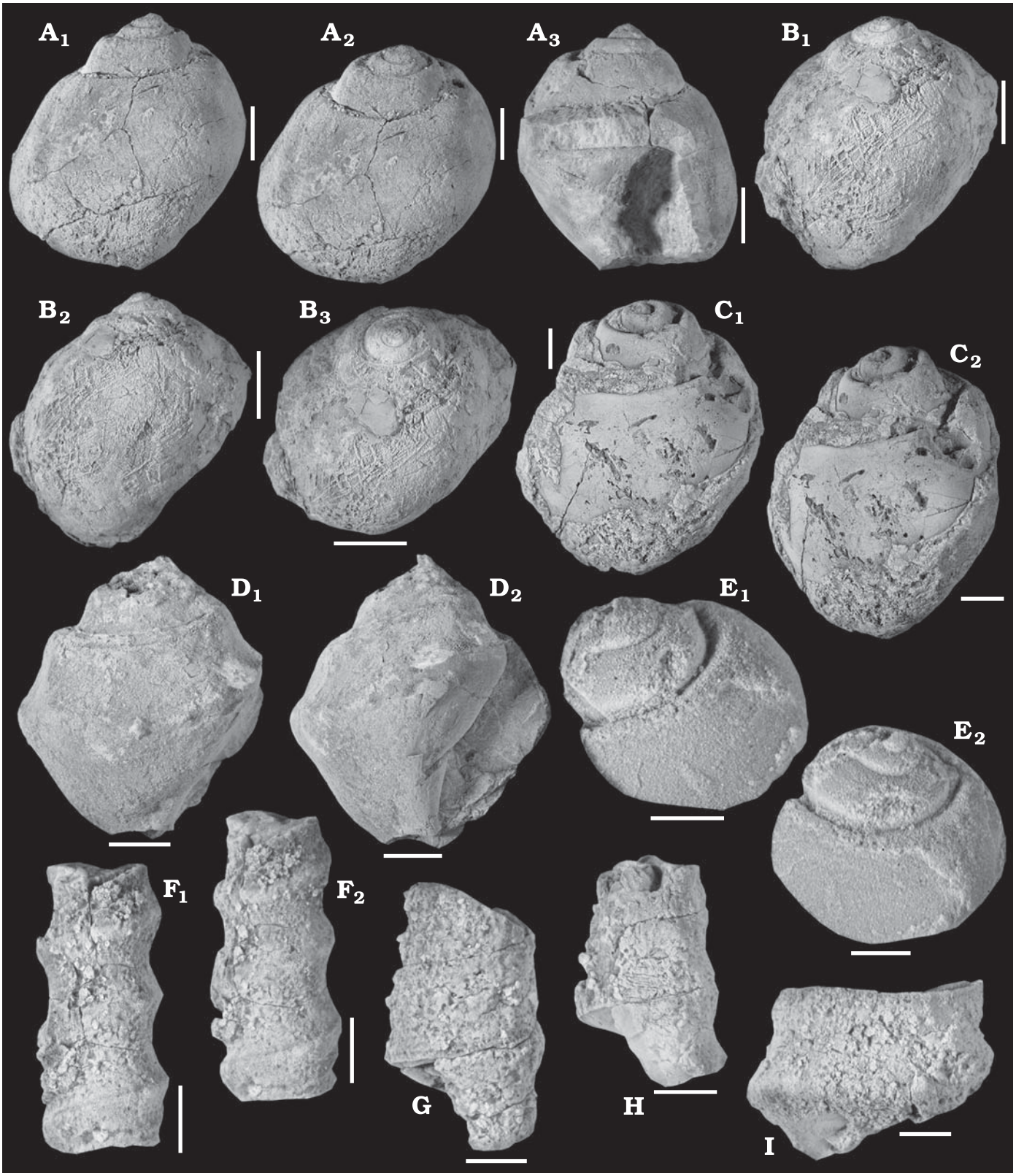


Fig. 4. Early Jurassic gastropods from Lomas Occidentales and Cerro La Trampa fossiliferous localities. **A**–**C**. *Globularia* cf. *catanlilensis* (Weaver, 1931). **A**. MPEF-PI 4112; teleoconch in lateral ($A_1$, $A_2$) and apertural ($A_3$) views. **B**. MPEF-PI 4114; teleoconch in lateral ($B_1$, $B_2$) and latero-apical ($B_3$) views. **C**. MPEF-PI 4116, teleoconch in lateral views ($C_1$, $C_2$). **D**. *Globularia* sp. MPEF-PI 4119; teleoconch in lateral ($D_1$) and apertural ($D_2$) views. **E**. *Naricopsina*? sp.; MPEF-PI 3560, teleoconch in latero-apical views ($E_1$, $E_2$). **F**. *Nerinea*? sp. 1. MPEF-PI 4123, fragmentary teleoconch in lateral views ($F_1$, $F_2$). **G**–**I**. *Nerinea*? sp. 2. **G**. MPEF-PI 4124, fragmentary teleoconch in lateral view. **H**. MPEF-PI 4125, fragmentary teleoconch in lateral view. **I**. MPEF-PI 4126, fragment of last teleoconch whorl in lateral view. Scale bars: A–D 10 mm, E–I 3 mm.

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basal and umbilical characters are not preserved in the single specimen available, so it is left in the open nomenclature.

*Naricopsina*? sp. is the first, though uncertain, report of the genus in the Early Jurassic of South America.

*Naricopsina guerangeri* (Davoust, 1885) (Gründel 2001: 62, pl. 5: 7-3) from the Middle Jurassic of Europe is comparable to the Chubutean species; however, *N. guerangeri* has orthocline to slightly sinuous and distinctly prosocline growth lines, with their apical part prosocyrt; growth lines are absent in the Patagonian species. *Naricopsina montreuilensis* (Hébert and Eudes-Deslongchamps, 1860) (Gründel 2001: 64, pl. 6: 1–5) from the Callovian (Middle Jurassic) of Europe differs from *Naricopsina*? sp. in having stronger collabral elements. *Naricopsina*? *sinuosa* Gründel, 2001 from the Callovian (Middle Jurassic) of Europe (Gründel 2001: 65, pl. 6: 1–6) resembles the species here described although the European species has fine and slightly opisthocyrt growth lines near the adapical suture and on the base; these characters are absent in *Naricopsina*? sp. *Naricopsina laevis* (Stoliczka,1861) (Szabó 2008: 98, fig. 91) from the Sinemurian (Early Jurassic) of Europe differs from *Naricopsina*? sp. in having strongly prosocline and fine growth lines. The material described by Szabó and Jaitly (2004: 19, pl. 2: 37–39) as *Naricopsina cornelia* (Laube, 1868) from the Callovian (Middle Jurassic) of India is comparable to the Patagonian species; the Indian specimen, however, has irregularly spaced and strongly prosocline growth lines.

## Superfamily Nerineoidea Zittel, 1873

## Family Nerineidae Zittel, 1873

## Subfamily Nerineinae Zittel, 1873

## Genus *Nerinea* Deshayes, 1827

*Type species*: *Nerinea mosae* Deshayes, 1827, from the Oxfordian (Middle Jurassic) of France.

*Stratigraphic and geographic range*.—Upper Triassic–Upper Cretaceous (Maastrichtian) (Sirna 1995); Europe, Africa, Asia, New Zealand, America.

### *Nerinea*? sp. 1

Fig. 4F.

*Material*.—MPEF-PI 4123; fragmentary re-crystallized teleoconch. LO 29 site from Lomas Occidentales locality, Chubut province, Argentina, Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 4123: height 12.2 mm; width 5.6 mm.

*Description*.—Fragmentary, turriculate, high spired and small sized shell. The protoconch is not preserved. The teleoconch comprises 3.5 whorls; the outline of the whorls flanks is strongly concave; the sutural portion of the whorls is strongly angular and peripheral. Sutures are weakly incised. The ornament consists of a strong and peripheral spiral keel located in an adapical position on each whorl. The basal and apertural characters are not preserved.

*Remarks*.—According to Morris and Lycett's (1850) diagnosis, the material here described shows the typical characters of *Nerinea*, such as a turriculate shell shape, conical or cylindrical, with a number of whorls and aperture subquadrate. However, due to lack of apertural, basal and columellar characters in the specimen under consideration, it is left in open nomenclature until a new material in better preserved conditions is available.

The South American nerineid, *Nerinea* sp. described by Bayle and Coquand (1851: 23, pl. 4: 8) from the Early Jurassic of Chile is similar to the species here described. Although the Chilean species does not show apertural characters and columellar folds, the authors suggested that their material belongs to *Nerinea*. The material designed by Jaworski (1925: 116) to *Nerinea bathonica* Rigeaux and Sauvage, 1869 from the Bathonian (Middle Jurassic) of Peru resembles *Nerinea*? sp.1 in general shell morphology and in lacking an ornament; but, the Peruvian species is larger than *Nerinea*? sp. 1, and the concavity of the whorl flanks decreases on the mature whorls. Jaworski (1925), however, did not figure the Peruvian species. The Patagonian form is comparable to some members of *Cossmannea* Pchelintsev, 1927 described by Cox (1956) and Gründel (2001) from the Middle Jurassic (Bathonian–Callovian) of Peru and Chile, respectively. *Cossmannea* (*Cossmannea*) sp. 1 and *Cossmannea* (*Cossmannea*) sp. 2 described by Gründel (2001: 64, pl. 5: 3–6) from the Callovian (Middle Jurassic) of Chile differs from *Nerinea*? sp.1 in being larger. *Cossmannea nascaensis* described by Cox (1956: 1181, pl. 127: 4–6) and *Cossmannea peruviana* Cox (1956: 1182, pl. 127: 7, 8), both from the Middle Jurassic of Peru, have more concave whorls and a more developed spiral peripheral keel than the Chubutean species, respectively. The specimen ascribed by Morris and Lycett (1850: 33, pl. 7: 6) to *Nerinea* (*Trochalia*) *eudesii* (Eudes-Deslongchamps, 1842) from the Middle Jurassic of England resembles *Nerinea*? sp.1. However, the English species has fine spiral lines and the sutures are bordered by a spiral keel. The specimen assigned by Morris and Lycett (1850: 35, pl. 7: 19) to *Nerinea punctata* Voltz, 1836 from the Middle Jurassic of England differs from the Chubutean species in having whorls with a more flattened outline and two or three spiral keels with nodose rows. *Nerinea granulata* (Phillips, 1829) (Lycett 1863: 10, pl. 21: 12) from the Middle Jurassic of England differs from the species here described in having flatter whorls which are slightly contracted towards the base, and in having irregularly spaced spiral keels.

### *Nerinea*? sp. 2

Fig. 4G–I.

*Material*.—MPEF-PI 4124 to 4126; fragmentary and replaced teleoconchs. LO 29 site from Lomas Occidentales locality, Chubut province, Argentina, Mulanguiñeu Formation, Lower Jurassic, Upper Pliensbachian, Lower Toarcian.

*Dimensions*.—MPEF-PI 4124: height 10.8 mm; width 6 mm. MPEF-PI 4125: height 10.2 mm; width 7 mm.

*Description*.—Dextral, anomphalous, turriculate and small sized shell. The protoconch is not preserved. The fragmentary teleoconch consists of three/four flat to slightly concave whorls. Sutures are weakly incised. The shell is smooth or lacks a well developed ornament; a weak peripheral spiral keel borders the sutures on each teleoconch whorl. The base is flat, angular, and is bordered by a strong spiral keel. The aperture is quadrangular.

*Remarks*.—The present material shows some typical characters of *Nerinea*; however, due to the lacks of well preserved specimens, it is left in open nomenclature until a new material is available.

*Nerinea*? sp. 2 differs from *Nerinea*? sp. 1 in having more flattened whorls; however, none of these species show crucial characters for a correct taxonomic assignment, such as columellar folds and apertural elements.

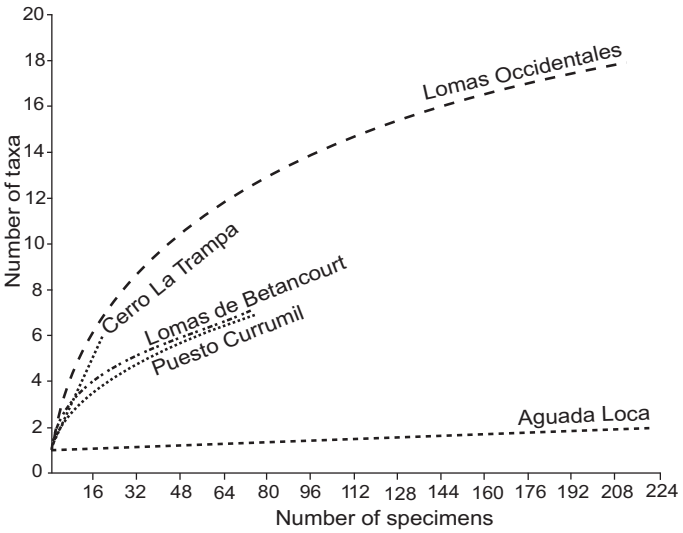


Fig. 5. Rarefaction curves of five fossiliferous localities sampled so far form the Early Jurassic marine deposits of west-central Patagonia.

# Concluding remarks

The taxonomic classifications of most gastropod taxa described so far from the Early Jurassic of Argentina and South America are outdated in comparison to those of gastropods from other Jurassic localities of the southern hemisphere (Antarctica: Edwards 1980; Thompson and Turner 1986; Africa: Cox 1965; New Zealand: Bandel et al. 2000), and also Europe (see references in Ferrari 2009). In order to obtain a new and updated information on the taxonomic composition of South American Early Jurassic marine gastropods, Ferrari (2011a, b, 2012, 2013) initiated a detailed research program, including the investigation of new fossiliferous localities in Argentina, the sampling of new gastropod material with accurate geographical and stratigraphical data and the revision of all the Early Jurassic gastropod groups described by previous authors. The new gastropod fauna described in the present paper from the Early Jurassic marine deposits of Patagonia support the recent information supplied by Ferrari (2009, 2011a, 2012, 2013) and present preliminary data on the biodiversity of the Jurassic marine gastropod faunas in the Chubutena basin of Patagonia. The representatives of *Anulifera* and *Naricopsina*? sp. described herein are the first occurrences of these genera in the Early Jurassic of South America. Moreover, *Lithotrochus* cf. *rothi*, together with the genera *Pseudomelania* and *Globularia* are recorded for the first time in the Chubutean Jurassic, and extend the distributional pattern in the Andean region of South America from the northern Peru through north-central Chile to the Argentinean Patagonia.

An analysis of diversity was performed including entire accessible data of marine gastropod faunas recovered so far from the Early Jurassic of Patagonia (Ferrari 2011b). The analysis was based on statistical software (PAST; Hammer et al. 2001) which calculated rarefaction curves and neighbor joining clustering for the including samples (Fig. 5). The data considered in the analysis integrated members of fifteen families reported from five Jurassic marine localities in Chubut province; the localities are Lomas Occidentales, Cerro La Trampa, Aguada Loca, Lomas de Betancourt, and Puesto Currumil. The gastopods are represented by 597 specimens from more from about 20 genera: *Scurriopsis*, *Calliotropis*, *Lithotrochus*, *Ataphrus*, *Striatoconulus*, *Chartronella*, *Lewisiella*, *Pleurotomaria*, *Leptomaria*, *Hamusina*, *Colpomphalus*, *Jurassiphorus*, *Cryptaulax*, *Procerithium*, *Pseudomelania*, *Anulifera*, *Globularia*, *Naricopsina*, and *Nerinea*, which involve a total of 32 species. Some of the primary results of this study shows that Lomas Occidentales locality displays the highest diversity of gastropod genera represented by a large number of specimens, and this coincides with the mass occurrence of the pseudomelaniid *Pseudomelania* (19.57% of all gastopods)—which is most likely represented by a single species *Pseudomelania feruglioi* sp. nov. Other common gastropods in Lomas Occidentales are ataphrids *Ataphrus mulanguiniensis* Ferrari, 2011a (1.94%) and *Chartronella paganiae* Ferrari, 2011a (3%), and some procerithiid genera. In contrast, Aguada Loca locality showed the lowest diversity with the only occurrence of the eucyclid *Calliotropis* (37.56%); however, this genus is represented by a large number of specimens. On the other hand, Cerro La Trampa, Lomas de Betancourt, and Puesto Currumil localities reveled moderate levels of gastropod diversity represented by the ampullinid *Globularia* (3.53%)—dominated by the occurrence of *Globularia* cf. *catanlilensis* sp. nov.; and the procerihiids *Cryptaulax* (13.73%) and *Procerihium* (6.7%)—most likely represented by *Cryptaulax damboreneae* Ferrari, 2009 and *Procerithium nulloi* (Ferrari, 2009), respectively. Three different sets of samples are clearly discernible in neighbour joining clustering (Fig. 6). These are *Calliotropis–Pseudomelania* dominated samples from Aguada Loca and Lomas Occidentals localities; *Cryptaulax–Procerihium* dominated sample from Lomas de Betancourt and Puesto Currumil localities; and the other consisting in *Globularia* dominated samples from Cerro La

http://dx.doi.org/10.4202/app.2011.0090

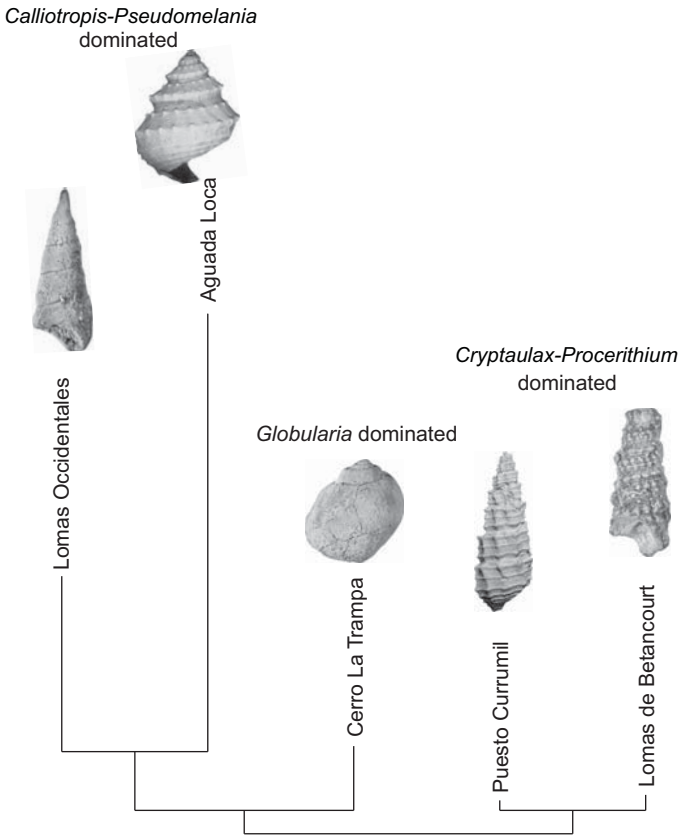


Fig. 6. Neighbor joining clustering, Euclidean similarity measures with root final branch algorithm. Note good clustering of the *Calliotropis–Pseudomelania*-dominated samples next to a cluster containing *Globularia* and *Cryptaulax–Procerithium* dominated samples.

Trampa locality. Even though these new data contribute in some way to the understanding of the Jurassic marine gastropod diversity, it is clear that a more intensive collecting effort in the Jurassic marine sequences of Chubut province should be undertaken in order to progress our knowledge on the actual taxonomic composition of gastropod associations.

The new data present in the current paper, together with the analysis of diversity, show that the Jurassic marine deposits in Chubut province yield considerable number of different gastropod associations, which are still very poorly known. They also show that further research in needed in other regions of Argentina, to facilitate plausible interpretations of the gastropod taxonomic composition following by a paleobiogeographical analysis of these faunas in the entire southern hemisphere.

# Acknowledgements

The present research is part of a Ph.D. thesis prepared at the Museo Paleontológico "Egidio Feruglio" (Trelew, Argentina) supervised by Susana Damborenea (MLP) and Alejandra Pagani (MPEF). I am deeply grateful for their guidance and help during the preparation of this work. I especially thank Susana Damborenea for drawing the stratigraphical sections of Lomas Occidentales, Cerro La Trampa, and Lomas de Betancourt fossiliferous localities. I thank Pablo Puerta, Mariano Caffa and Leandro Canessa (all MPEF) for their help during field work and, especially, Leandro Canessa for his laboratory work. I am grateful to Museo Paleontológico "Egidio Feruglio" for financing the fieldwork. I thank Alexander Nützel (Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany), and Stefano Monari (Università di Padova, Padua, Italy) for their valuable comments.

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http://dx.doi.org/10.4202/app.2011.0090