Cosmopolitan Early Jurassic Marine Gastropods from West-Central Patagonia, Argentina

Author: Ferrari, S. Mariel

Source: Acta Palaeontologica Polonica, 54(3) : 449-461

Published By: Institute of Paleobiology, Polish Academy of Sciences

URL: https://doi.org/10.4202/app.2008.0070

Cosmopolitan Early Jurassic marine gastropods from west-central Patagonia, Argentina

S. MARIEL FERRARI

Ferrari, S.M. 2009. Cosmopolitan Early Jurassic marine gastropods from west-central Patagonia, Argentina. *Acta Palaeontologica Polonica* 54 (3): 449–461. DOI: 10.4202/app.2008.0070.

A new, relatively diverse gastropod fauna is reported from the Chubut province of west-central Patagonia. The gastropod association at the "El Córdoba" fossiliferous locality (Lower Toarcian of Osta Arena Formation) consists of three new species: the eucyclid *Amberleya*? *espinosa* sp. nov. and two procerithiids *Cryptaulax damboreneae* sp. nov. and *Cryptaulax nulloi* sp. nov. Other members of the association are the ataphrid *Striatoconulus* sp., discohelicid *Colpomphalus*? sp., and an undetermined zygopleurid. Knowledge on Early Jurassic gastropods from South America and other southern continents is reviewed to show that the taxonomic composition of the El Cordoba association strongly resembles other gastropod associations of this age (even those from Europe), suggesting a wide distribution of cosmopolitan genera.

Key words: Gastropoda, Osta Arena Formation, Toarcian, Jurassic, Chubut, Patagonia, Argentina.

S. Mariel Ferrari [mferrari@mef.org.ar], Museo Paleontológico "Egidio Feruglio", CONICET, Av. Fontana 140, U9100GYO, Trelew-Chubut, Argentina.

Received 16 September 2008, accepted 6 April 2009, available online 16 July 2009.

Introduction

Early Jurassic gastropods from South America have been studied for a long time (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), but their descriptions were usually appended to papers describing some other invertebrate groups, mostly cephalopods and bivalves. Gründel (2001) recently described some Early Jurassic gastropods from Chile and the Neuquén Basin in Argentina. There are, however, very few reports (Feruglio 1934; Piatnitzky 1936; Wahnish 1942) of Mesozoic gastropods from west-central Patagonia.

The following Early Jurassic gastropods from Chubut province have been reported so far: *Natica catanlilensis* by Weaver (1931), *Amberleya* cf. *americana*, *Natica* sp., and *Natica* cf. *philipi* by Möricke (1894), *Pleurotomaria* sp. and *Cerithium* cf. *quinetteum* by Piette (1856), *Nerinea* sp., *Trochus* sp., and *Lithotrochus humboldtii* by Buch (1839). All these reports need careful revision, including re-investigation of the fossil localities to collect new material with accurate geographical and stratigraphical data. This paper reports a new abundant and fairly diverse fauna from the marine deposits of the Osta Arena Formation that crop out over wide areas of Chubut province. In addition, knowledge of Argentinean and Chilean Early Jurassic gastropod faunas is summarized, and an attempt is made to compare these to coeval faunas known from other southern continents.

Institutional abbreviations.—ALUAR, Aluminio Argentino, Pto. Madryn- Chubut, Argentina; MLP, División Paleontología Invertebrados of Museo de Ciencias Naturales de La Plata, La Plata, Argentina; MPEF-PI, Museo Paleontológico "Egidio Feruglio", Trelew-Chubut, Argentina.

Geological settings

The Early Jurassic sediments in Chubut province are distributed along a NW-SE belt of outcrops between 42°30' and 44°30' S, and 69°30' and 71° W (Riccardi 1983; Giacosa and Márquez 1999). They rest unconformably on Late Paleozoic rocks of the Tepuel Group. In the Pampa de Agnia area, the Jurassic sequence begins with ignimbrites and tuffites of the Puntado Alto Formation (Herbst 1966, 1968) which are of continental origin and have yielded plants of Early Jurassic age (Riccardi 1983). The Puntudo Alto Formation is overlain by the El Córdoba Formation, described by Robbiano (1971) and considered by Riccardi (1983) as part of the Lonco Trapial Group. The Early Jurassic marine deposits of the Osta Arena Formation (Herbst 1966; Nullo 1983) are overlain by the El Córdoba Formation which reaches a thickness of 190–340 m. The most extensive outcrops of this unit are on the western slope of Sierras de Lonco Trapial, Cajón de Ginebra, and Cerro Negro (Fig. 1). The "El Córdoba" fossiliferous locality is located west of the Sierra del Cerro Negro (Fig. 1) at the access to Quebrada El Córdoba where a stratigraphical section was measured by Robbiano (1971) and later also modified by

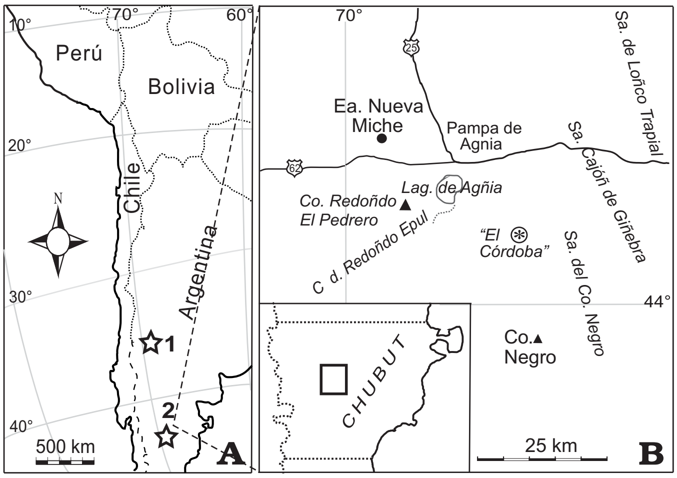

Fig. 1. **A**. Map of the western part of the South American continent showing the localities of new gastropod faunas in Argentina. 1, Cerro Puchenque, Mendoza; 2, Osta Arena Formation area in west-central Patagonia. **B**. Location map of "El Córdoba" fossiliferous locality (*).

Nullo (1983). The Osta Arena Formation consists of marine sandstones, tuffites and conglomerates. The formation is dated as Toarcian (Lower Jurassic) based on dactylioceratid and hildoceratid ammonoids (Musacchio and Riccardi 1971; Blasco et al. 1978). The gastropod-bearing locality yielded a single specimen of *Dactylioceras* (*Orthodactylites*) *hoelderi* Hillebrandt and Schmidt-Effing, 1981 that indicates a Lower Toarcian age for this association.

Material and methods

The material was collected in 2007 during field work and belongs to the MPEF collection. Latex casts of external molds were prepared by technical staff of the MPEF laboratory. The photographs were made by digital camera Nikon (Nikon E8800) at MPEF and by Scanning Electronic Microscopy (SEM) (Jeol JSM-6460LV scanner with retrodifussion detector) at ALUAR.

Systematic paleontology

The systematic classification follows Ponder and Lindberg (1997), Gründel (2000, 2001, 2003, 2007, 2008), and Bouchet and Rocroi (2005). The morphological terminology is based on Knight et al. (1960), Kaim (2004), and Gründel (2000, 2005).

Class Gastropoda Cuvier, 1797

Subclass Orthogastropoda Ponder and Linberg, 1996

Superorder Vetigastropoda Salvini-Plawén, 1980

Order Trochomorpha Naef, 1911

Superfamily Trochoidea Rafinesque, 1815

Family Eucyclidae Koken, 1897

Genus *Amberleya* Morris and Lycett, 1850

Type species: *Amberleya bathonica* Cox and Arkell, 1950 (= *Amberleya nodosa* Morris and Lycett, 1850), Middle Jurassic (Bathonian), England.

Stratigraphic and geographic range.—Middle Triassic–Middle Jurassic (according to Hickman and McLean 1990); Asia, Europe, New Zealand, Antarctica and America.

Amberleya? *espinosa* sp. nov.

Fig. 2A.

Etymology: Referring to the strongly spinose ornament.

Type material: Holotype, MPEF-PI 1882, well preserved teleoconch; paratype, MPEF-PI 1874, poorly preserved teleoconch.

Type horizon: Osta Arena Formation, Lower Toarcian, Jurassic.

Type locality: PA 06 site, "El Córdoba" fossiliferous locality.

Material.—Holotype and one paratype.

Diagnosis.—Anomphalous, conical shell, trochiform to slightly littoriniform, with peripheral carina. Well incised suture bordered by row of small nodes. Ornament strongly spinose, with poorly developed spiral and axial elements. Base with three strong spiral ribs.

Description.—Dextral, medium-sized and trochiform to slightly littoriniform shell, anomphalous and conical. Protoconch is not preserved and teleoconch consists of seven whorls. The adapical portion of each whorl is slightly concave and angular near the periphery of the shell. Sutures are incised, and the depth of the incision increases abapically. On the last three whorls of the teleoconch, a small row of nodes borders the suture.

The ornament is strongly spinose with weakly developed spiral and axial elements. The spiral elements consists of two ribs; the adapical one is weak and borders the suture, and the abapical one, more conspicuous and developed as a carina at the periphery. Over both spiral ribs, rows of regularly spaced and strong spines are developed; there are about 7 spines per whorl on the juvenile portion of the shell and 10 or more on the adult teleoconch whorls. The spines on the adapical rib are much smaller than the ones on the abapical carina. The axial ribs are well developed on the early teleoconch whorls becoming gradually weaker and weaker during ontogeny. Fine prosocline growth lines appear on the last teleoconch whorl. The base is convex and ornamented by three conspicuous, slightly nodose spiral ribs. The aperture is incompletely preserved but a narrow collumelar lip is visible.

Dimensions.—MPEF-PI 1882: maximum height 20.6 mm; spire height 16.8 mm; maximum width 14.4 mm. MPEF-PI 1874: maximum height 19.9 mm; maximum width 8.2 mm.

Remarks.—The littoriniform shell, strongly spinose ornament, weak spiral ribs, and lack of an umbilicus suggest assignment to *Amberleya* (see Knight et al. 1960; Gründel 2003). As the specimen in hand does not display all of the diagnostic characters for the genus, and *Amberleya* itself is of rather disputable identity (see e.g., Kaim et al. 2004), the new species is assigned questionably to *Amberleya*.

Two species of *Amberleya* were previously reported from the Early Jurassic of South America. Möricke (1894) described *Amberleya americana* Möricke, 1894 and Gründel (2001) provided description of *Amberleya*? sp. These species were reported from north-central Chile and Mendoza, Neuquén, and Chubut provinces in Argentina. *A. americana* was subsequently reported by several authors (Weaver 1931; Wahnish 1942; Damborenea and Lanés 2007) from the Early Jurassic of Argentina, and Wahnish (1942) mentioned this species from the Early Jurassic of Chubut province. However, the descriptions and illustrations available in the literature (Möricke 1894: 29, pl. 4: 8a, b) show that *A. americana* differs significantly from *A. bathonica*, which is the type species of the genus. *Amberleya bathonica* has higher-spired littoriniform shell than *A. americana*. Moreover it has an acute apex, six teleoconch whorls, greatest whorl width situated directly above the abapical suture, and three weak and narrow spiral ribs at its base. *A. americana* has only four convex teleoconch whorls, and has no ornament at its base. Hence, it is disputable whether *A. americana* can be classified as *Amberleya*. *Amberleya*? *espinosa* sp. nov. is seemingly the first occurrence of the genus in the Early Jurassic of Argentina.

Amberleya? sp. of Gründel (2001: 50, pl. 3: 1, 2), from Lower Sinemurian of Chile, is comparable with *Amberleya*? *espinosa* sp. nov. Both have a similar gross shell morphology, with weakly developed spiral elements limited to nodose ribs or carinae. However, Gründel's *Amberleya*? sp. has a thinner shell, nodes instead of spines, and better developed axial ornament.

Amberleya? *espinosa* sp. nov. is similar to the type species, *Amberleya bathonica*, named by Cox and Arkell (1950) as a replacement name for *Amberleya nodosa* of Morris and Lycett (1850: 55, pl. 5: 19), from the Bathonian of England. Both share the same shell morphology, with strong nodose or spinose elements and weak spiral ribs; however, *A. bathonica* has slightly convex whorls, and strong, rounded nodes rather than spines. Moreover, the British species has three weak basal spiral ribs.

Amberleya? *espinosa* sp. nov. is closely related to *Amberleya torosa* Marwick, 1953 from the Hettangian (Lower Jurassic) of New Zealand (Marwick 1953: 113, pl. 15: 3). Marwick's species, however, has a more conical shell, nodes instead of spines, three prominent keels, and the base bears four or five smooth spiral cords. *Amberleya* (*Eucyclus*?) sp. (Edwards 1980: 42, fig. 3a) from the Early Jurassic (according to Thompson and Turner 1986) of central Alexander Island (Antarctica) is similar to the Argentinean species; however, *Amberleya* (*E.*?) sp. has a more prominent spiral ornament with three strong and deeply furrowed spiral ribs on each whorl, and five spiral threads on the base.

Amberleya (*Eucyclus*) *capitanea* (Münster, 1844) from the Toarcian of Europe (Szabó 1982: 24, pl. 3: 1, 2) is similar to the Argentinean species. However, *A.* (*Eucyclus*) *capitanea* has more convex whorls, three conspicuous carinae with nodose rows on the last whorl, and fine prosocline growth lines.

Amberleya (*Eucyclus*) *alpina* (Stoliczka, 1861) from the Early Jurassic of Hungary (Szabó 1982: 23, pl. 2: 11–13) is similar to *A.*? *espinosa* sp. nov., but the European species has more convex whorls, smaller nodes, and four spiral carinae on adult teleoconch whorls. *Amberleya* (*Amberleya*) aff. *decorata* Martin, 1859 from the Hettangian of Italy (Gaetani 1970: 391, pl. 31: 18) differs from *A.*? *espinosa* sp. nov. in having weaker spines but better developed spiral elements.

Amberleya elegans (Münster, 1844) and *Amberleya ornata* (Sowerby, 1819) from the Early and Middle Jurassic of England (Hickman and McLean 1990: 76, fig. 38) are similar to *A.*? *espinosa* sp. nov. *A. ornata*, however, is larger and has no spines; and *A. elegans* is smaller, has weaker spines and better developed axial and spiral elements.

Stratigraphic and geographic range.—PA-06 site from "El Córdoba" fossiliferous locality, Chubut province, Argentina. Osta Arena Formation, Lower Toarcian, Lower Jurassic.

Superfamily Turbinoidea Rafinesque, 1815
Family Ataphridae Cossmann, 1915
Subfamily Ataphrinae Cossmann, 1915b
Tribe Homalopomatini Keen, 1960
Genus *Striatoconulus* Gründel, 2000

Type species: *Striatoconulus latus* Gründel, 2000, from the Callovian of Poland.

Stratigraphic and geographic range.—Toarcian (Lower Jurassic)–Callovian (Middle Jurassic); Poland and Argentina.

Striatoconulus sp.

Fig. 2C.

Material.—MPEF-PI 1867a and b (part and counterpart); poorly preserved teleoconch.

Description.—Medium-sized, oval and low-spired shell. Protoconch unknown. Dextral teleoconch with four convex whorls; last whorl is incomplete. The spire represents about 1/3 of teleoconch height and is characterized by the presence of a high expansion rate. Sutures are incised.

On first whorls of the teleoconch ornament is poorly developed. In the later whorls of the teleoconch ornament consists of regularly spaced spiral furrows. No axial ornament is present. Apertural and umbilical features are not preserved.

Dimensions.—MPEF-PI 1867b: maximum height 25.6 mm; spire height 12.7 mm.

Remarks.—The convex teleoconch whorls, low spired shape, incised sutures, and the spiral ornament suggest an assignment to *Striatoconulus* (compare Gründel 2000; Kaim 2004).

Striatoconulus sp. is the first ataphrid recorded in the Early Jurassic of South America. The type species, *Striatoconulus latus* Gründel, 2000 is very similar to the Argentinean species. *S. latus* has a base weakly convex, with rounded edge to the

DOI: 10.4202/app.2008.0070

flanks of the whorls, aperture broadly oval, inner lip with a broad callus and a halfmoon-shaped cavity on the columella (Gründel 2000: 228, pl. 6: 11–15; Kaim 2004: 29, fig. 15). Basal, apertural and umbilical features are regrettably not preserved in *Striatoconulus* sp. and that is why the species is left in open nomenclature.

Superfamily Cirroidea Cossmann, 1916

Family Discohelicidae Schröder, 1995

Genus *Colpomphalus* Cossmann, 1915

Type species: *Straparollus altus* d'Orbigny,1853, from the Bathonian of France.

Stratigraphic and geographic range.—Hettangian (Lower Jurassic)–Bathonian (Middle Jurassic); Europe and South America.

Colpomphalus? sp.

Fig. 2B.

Material.—MPEF-PI 1863, poorly preserved teleoconch.

Description.—Small-sized and almost planispiral shell. Protoconch is not preserved. Teleoconch consists of three rapidly expanding whorls with the last whorl incomplete. The adapical portion of the whorls is almost horizontal and slightly concave near the angular edge of the whorls. Sutures are well incised.

Ornament pattern with nodose, spiral and axial elements. The spiral elements consist of weak ribs and two strongly nodose carinae near the suture. The abapical carina forms the peripherical edge; it has fewer and stronger nodes than the adapical carina. Prosocline collabral ribs intersect the spiral elements. The collabral ribs on the lateral flank of the last whorl are orthocline and intersect a weak spiral furrow. Base is not preserved, and apertural and umbilical features are unknown.

Dimensions.—MPEF-PI 1963: maximum height 3.1 mm; maximum width 6.9 mm.

Remarks.—Although important diagnostic characters of aperture and base are not preserved in the present material, the almost planispiral shape, the angular whorls as well as the ornament strongly suggest that this is a species of *Colpomphalus*.

The South American species, *Colpomphalus toarciensis* Gründel (2001: 46, pl.1: 9–13) from the Lower Toarcian of Chile, is similar to *Colpomphalus*? sp. Both share a low spira, ornament pattern with spiral ribs and two nodose carinae, and spiral ribs on lateral side of the last whorl. However, *C. toarciensis* is larger than *Colpomphalus*? sp. and has no colabral elements. Moreover, Gründel's (2001) species has a third row of nodes surrounding the relatively narrow umbilicus. The basal, apertural and umbilical features are not preserved in *Colpomphalus*? sp.

Colpomphalus angulati (Quenstedt, 1856) from the Hettangian of Germany (Gründel 2003: 6, pl. 1: 9, 10) is similar to *Colpomphalus*? sp., but the latter differs from the European species in having a more rapidly increasing width and fewer nodes.

Superorder Caenogastropoda Cox, 1959

Order Ptenoglossa Gray, 1853

Family Zygopleuridae Wenz, 1938

Zygopleuridae? gen. et sp. indet.

Fig. 3A.

Material.—MPEF-PI 1886, poorly preserved teleoconch.

Description.—Dextral, small-sized and high-spired shell, anomphalous and conical. Protoconch is not preserved and teleoconch consists of six convex whorls. The last two teleoconch whorls are considerably more expanded than the early whorls. Sutures are distinct. Shell is either externally smooth or the sculpture is not preserved. Base is convex and the aperture oval.

Dimensions.—MPEF-PI 1886: maximum height 9.8 mm; spire height 6.1 mm; maximum width 4.6 mm.

Remarks.—The Argentinean species may probably be a Zygopleuridae of the *Azyga* group. Mesozoic zygopleurids are generally characterized by a high-spired teleoconch with axial ribs (Nützel and Senowbari-Dayran 1999; Nützel and Erwin 2004) but there are some zygopleurids of the *Azyga* group having a smooth teleoconch and axially pleated protoconch (Nützel 1998; Kaim 2004). Due to lack of protoconch in the specimen under consideration, crucial for a correct taxonomic assignment, this specimen is left in open nomenclature. The other possibilities are Pseudomelaniidae and Ampullinidae or even pyramidelloidean heterobranchs (compare Gründel and Kaim 2006; Hikuroa and Kaim 2007).

Order Sorbeoconcha Ponder and Lindberg, 1997

Suborder Cerithiomorpha Golikov and Starobogatov, 1975

Superfamily Cerithioidea Férussac, 1819

Family Procerithiidae Cossmann, 1906

Subfamily Cryptaulacinae Gründel, 1976

Genus *Cryptaulax* Tate, 1869 (= *Xystrella* Cossman, 1906)

Type species: *Procerithium (Xystrella) protortile* Cox, 1965 (pro *Cerithium tortile* Hébert and Eudes-Deslongchamps, 1860, non Eudes-Deslongchamps, 1842); from the Callovian of Normandy, France.

Stratigraphic and geographic range.—Upper Triassic–Early Cretaceous; Europe, Asia, Africa, New Zealand, and South America.

Cryptaulax damboreneae sp. nov.

Fig. 3B–D.

Etymology: Dedicated to Susana E. Damborenea.

Type material: Holotype, MPEF-PI 1878a and b (part and counterpart); well preserved teleoconch; paratypes, MPEF-PI 1877 and MPEF-PI 1872a and b; poorly preserved teleoconch fragments.

Type horizon: Osta Arena Formation, Lower Toarcian, Jurassic.

Type locality: PA 06 site, "El Córdoba" fossiliferous locality.

Other material.—MPEF-PI 1875, MPEF-PI 1868, MPEF-PI

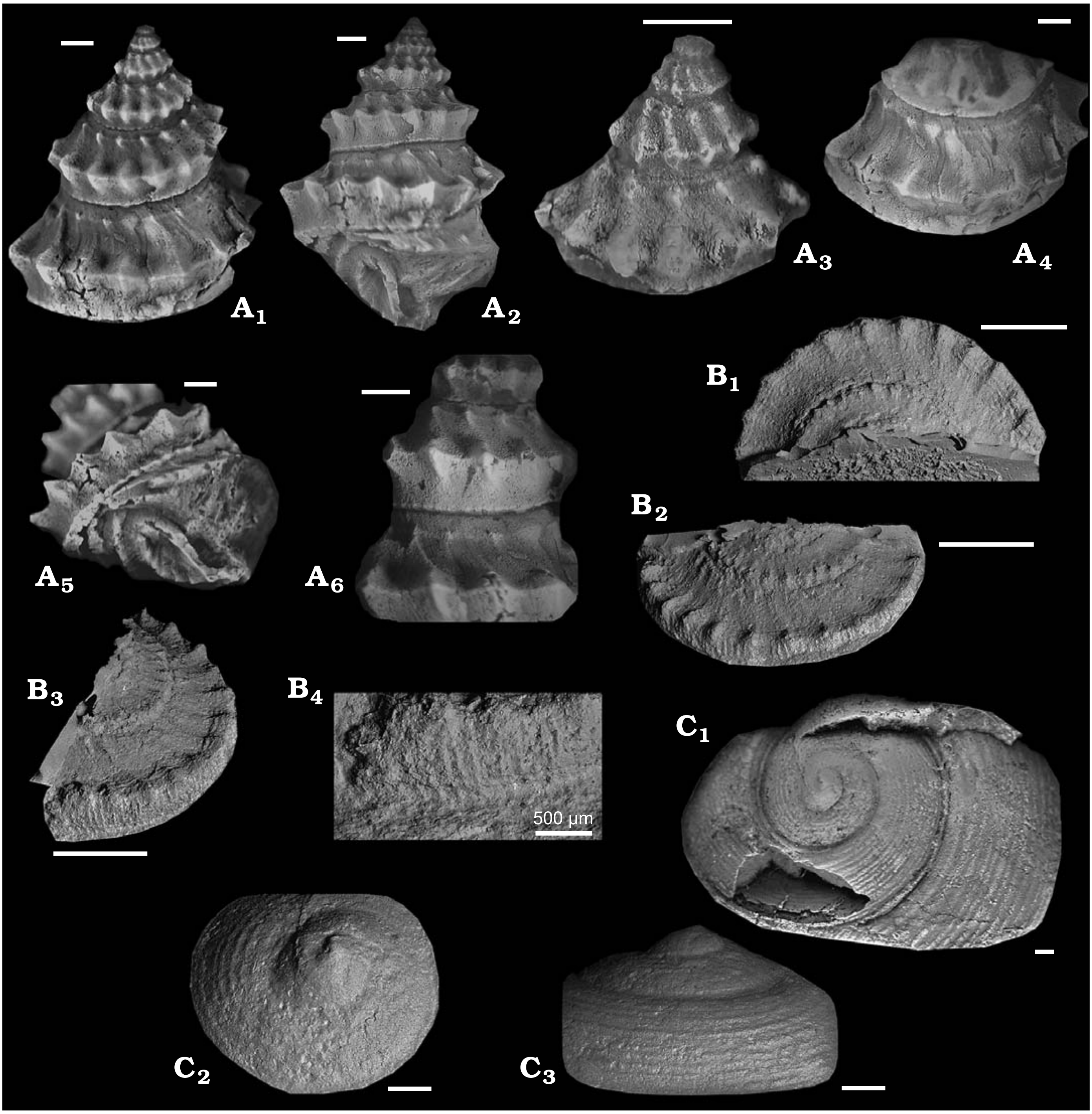

Fig. 2. Early Jurassic gastropods from the "El Córdoba" fossiliferous locality, Chubut Province, Argentina. **A**. *Amberleya*? *espinosa* sp. nov. MPEF-PI 1882, holotype, latex cast of external mold in lateral view (A_1, A_2), juvenile teleoconch in lateral view (A_3), last whorl in lateral view (A_4), basal and apertural view (A_5), ornament pattern and sutural detail (A_6). **B**. *Colpomphalus*? sp. MPEF-PI 1863, latex cast of external mold of incomplete teleoconch in apical and lateral view (B_1–B_3), last whorl ornament detail showing the spiral furrow (B_4). **C**. *Striatoconulus* sp. MPEF-PI 1867b, latex cast of external mold in apical view (C_1), apical detail (C_2), first teleconch whorls lateral view (C_3). Scale bars 2 mm unless otherwise indicated.

1876, MPEF-PI 1880, MPEF-PI 1865, MPEF-PI 1884, and MPEF-PI 1864; poorly preserved teleoconchs.

Diagnosis.—Anomphalous and turriculate shell. Ornament predominantly axial, with spiral and nodose elements. Two weak spiral ribs of second order appear on adult teleoconch between three strong primary spiral ribs. Circular and holostomatous aperture.

Description.—Dextral, small-sized and high-spired shell, anomphalous, slender and turriculate. Protoconch is not preserved. Teleoconch comprises eight whorls with gradate out-

DOI: 10.4202/app.2008.0070

line. Deeply incised sutures. Ornament with nodose, spiral and axial elements. Axial elements are predominant and consist of orthocline and narrow axial ribs that run from suture to suture. Axial ribs regularly spaced, 8–9 per whorl. Axial ornament intercepts spiral elements. The latter comprises three strong spiral ribs; two of which are situated somewhat above and below the suture; the third spiral rib is median. On the sixth teleoconch whorl two weak secondary spiral ribs appear between the primary ribs. At the intersection of axial and spiral elements, strong conspicuous and acute nodes are present; nodes are strongest on primary spiral ribs. Base is strongly convex with five acute spiral ribs. The aperture is holostomatous and oval.

Dimensions.— See Table 1.

Remarks.—The present material shows the characters which are typical of *Cryptaulax* (compare Gründel 1999; Kaim, 2004). Most representatives of the genus are characterized by mode of occurrence of the weak secondary spiral ribs during ontogeny. The presence of two such spiral ribs on sixth teleoconch whorl separates *Cryptaulax damboreneae* sp. nov. from other species of the genus.

Cryptaulax variformatum Bandel, 1994 from the Early Jurassic of Peru (Bandel 1994: 140, pl. 3: 16, 17, 19), is similar to *C. damboreneae* sp. nov. but is more high-spired than the Argentinean species, has a stronger spiral ornament, and its aperture is quadrangular rather than oval. *Cryptaulax*? sp. of Gründel (2001: 54, pl. 3: 10) from the Bathonian of Chile resembles *C. damboreneae* sp. nov. in having a dominant axial ornament with at least one abapical spiral rib.

Cryptaulax sp. cf. *protortile* Cox, 1969 from the Early and Middle Jurassic of New Zealand (Bandel et al. 2000: 89, pl. 6: 9, 11–13), is very similar to *C. damboreneae* sp. nov. However, this species (a juvenile teleoconch) has stronger spiral ribs. *Cryptaulax* sp. 1 and *Cryptaulax* sp. 2, both described by Gründel (2003: 26, 27, pl. 6: 8–12, pl. 7: 1) from the Sinemurian of Germany, share some features with *C. damboreneae* sp. nov. However, *Cryptaulax* sp. 1 has weakly prosocline axial ribs and two basal spiral ribs, and *Cryptaulax* sp. 2 has ten opistocline axial ribs on the last whorl. Kaim (2004) described several species from the Middle Jurassic of Poland which resemble *C. damboreneae* sp. nov. *Cryptaulax quenstedti* (Walther, 1951) (see: Kaim 2004: 36, fig. 21; Gründel 1974: 842, pl. 2: 9–15; Gründel 1999: 18; pl. 4: 8–12 identified as *Cryptaulax* ex. gr. *bellayensis* sp. 3) differs from the Argentinean species only in having a weak median spiral rib or, a second order of one additional spiral rib between the strong median and adapical spiral ribs. *Cryptaulax* sp. 1 of Kaim (2004: 34, fig. 19) differs from *C. damboreneae* sp. nov. in having a weak fourth spiral rib on the sixth teleoconch whorl, and an additional fifth, weak spiral rib on the tenth teleoconch whorl. *Cryptaulax* sp. 2 of Kaim (2004: 34, fig. 19) is larger than the Argentinean species and has a second order of two weak spiral ribs on ninth teleoconch whorl. *Cryptaulax shiptonensis* (Cox and Arkell, 1950) is similar to *C. damboreneae* sp. nov. in shell morphology. However, this European species has a second order of two median spiral ribs on the fourth or fifth teleoconch whorls (Kaim 2004: 34, fig. 20). *Cryptaulax armata* (Goldfuss, 1844) differs from *C. damboreneae* sp. nov. in having a weaker median spiral rib on the mature teleoconch (Kaim 2004: 37, fig. 22). *Cryptaulax muricata* (Sowerby, 1825) is larger than *C. damboreneae* sp. nov., has four strong spiral ribs on the last teleoconch whorl, lacks secondary weak spiral ribs, and the nodes result from the intersection with weakly prosocline axial ribs (Kaim 2004: 32, fig. 17). *Cryptaulax undulata* (Eudes-Deslongchamps, 1842) is more elongated than the Argentinean species, has five strong spiral ribs intersecting the axial ribs, and the peristome has an anteriorly directed siphonal channel (Kaim 2004: 33, fig. 18). *C. echinata* (von Buch, 1831) differs from *C. damboreneae* nov. sp. in having two conspicuous and nodose ribs on all teleoconch whorls (Kaim 2004: 38, fig. 23). *Cryptaulax* sp. 3 of Kaim (2004: 43, fig. 27) and *Cryptaulax*? *mutabilis* (Gerasimov, 1955) are similar to the species here described, but the whorls of *C*. sp. 3 have a straighter outline and fewer axial ribs while *C.*? *mutabilis* has a more *Bittium*-like teleoconch (Kaim 2004: fig. 28).

Stratigraphic and geographic range.—PA-06 site, from "El Córdoba" fossiliferous locality, Chubut province, Argentina. Osta Arena Formation, Lower Toarcian, Lower Jurassic.

Table 1. Dimensions (in mm) of *Cryptaulax damboreneae* sp. nov and *Cryptaulax nulloi* sp. nov. Abbreviations: H, maximum height; h, spire height; W, maximum width.

	H	h	W
Cryptaulax damboreneae sp. nov.			
MPEF-PI 1878 b	6.1	4.1	2.5
MPEF-PI 1872	4.7	–	2.8
MPEF-PI 1877	6.7	4.1	2.3
MPEF-PI 1875	5.2	–	2.1
MPEF-PI 1868	3	–	1.7
MPEF-PI 1884	4	–	1.5
MPEF-PI 1864	4.5	–	1.8
Cryptaulax nulloi sp. nov.			
MPEF-PI 1870	8.7	–	3.2
MPEF-PI 1861	9.8	6.9	3.7
MPEF-PI 1862	6	5.1	3.2
MPEF-PI 1866	4	–	2.1
MPEF-PI 1873	5	–	2.4
MPEF-PI 1881	7.5	–	2.9
MPEF-PI 1869	2.7	–	2.1
MPEF-PI 1871	5.3	–	2.6
MPEF-PI 1885	9.5	7.7	3.1

Cryptaulax cf. *damboreneae* sp. nov.

Fig. 3E.

Material.—MLP 18742, MLP 18743, MLP 18744; poorly preserved teleoconch fragments from Cerro Puchenque lo-

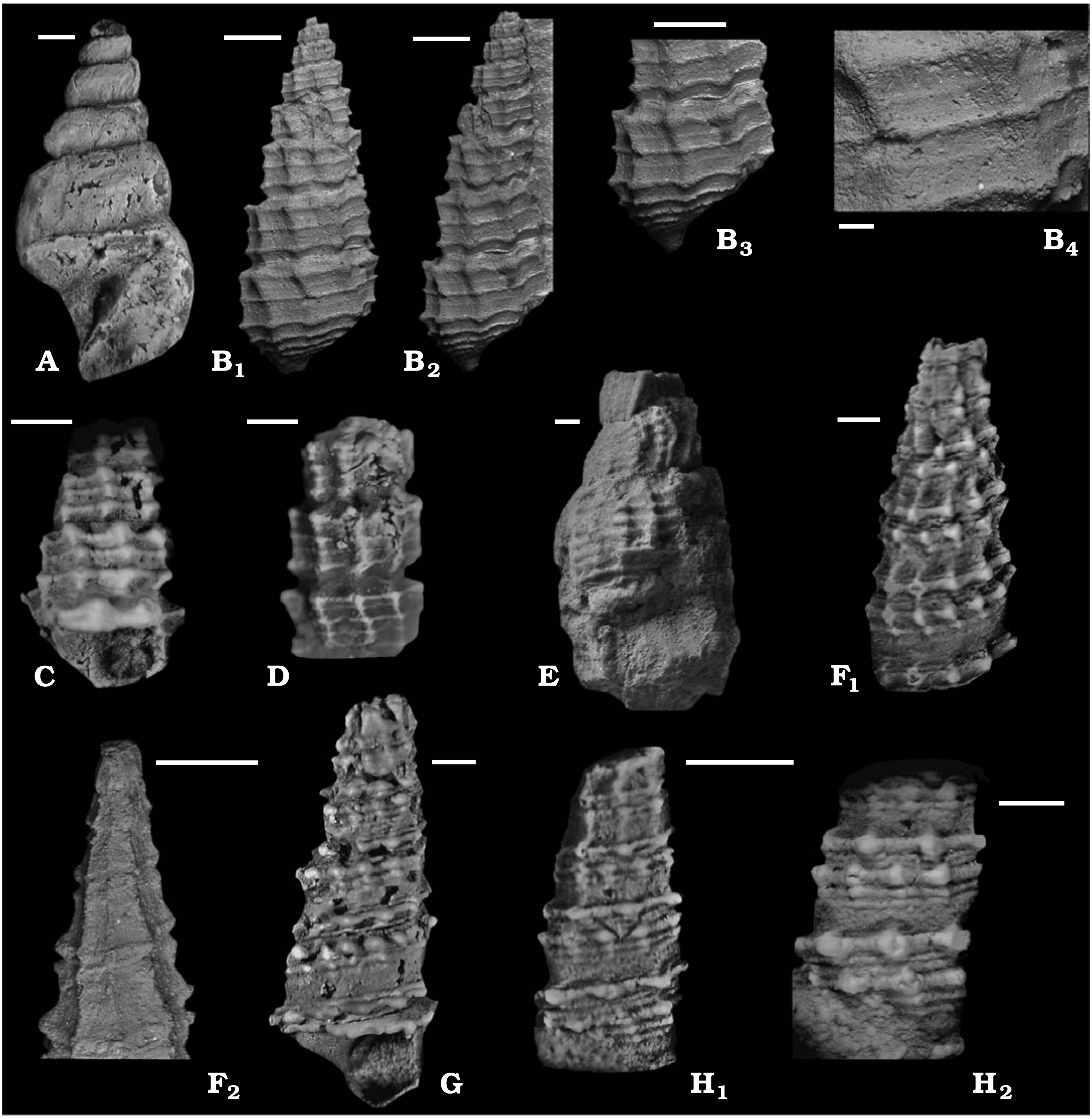

Fig. 3. Early Jurassic gastropods from Argentina **A**. Zygopleuridae? gen. et sp. indet., "El Córdoba" fossiliferous locality, Chubut Province. MPEF-PI 1886, latex cast of external mold in lateral view. **B–D**. *Cryptaulax damborenae* sp. nov., "El Córdoba" fossiliferous locality, Chubut Province. **B**. MPEF-PI 1878b, holotype, latex cast of external mold in lateral (B_1, B_2) and basal (B_3) views, ornament detail (B_4). **C**. MPEF-PI 1877, paratype, latex cast of external mold of incomplete teleoconch in apertural view. **D**. MPEF-PI 1872b, paratype, latex cast of external mold of incomplete teleoconch in lateral view. **E**. *Cryptaulax* cf. *damboreneae* sp. nov., Cerro Puchenque locality, Mendoza Province. MLP 18742, latex cast of external mold of incomplete teleoconch; adult teleoconch in lateral view. **F–H**. *Cryptaulax nulloi* sp. nov., "El Córdoba" fossiliferous locality, Chubut Province. **F**. MPEF-PI 1870, holotype, latex cast of external mold. Adult teleoconch in lateral view (F_1), juvenile teleoconch in lateral view (F_2). **G**. MPEF-PI 1861, paratype, latex cast of external mold in lateral and apertural view. **H**. MPEF-PI 1871, latex cast of external mold of incomplete teleoconch in lateral view (H_1), and its ornament detail (H_2). Scale bars 1 mm.

cality (Mendoza) (Fig. 1), Neuquén Basin, Argentina. *Dactylioceras hoelderi* Zone, Lower Toarcian, Lower Jurassic.

Description.—Small-sized and high-spired shell, slender and turriculate. Protoconch is not preserved. Teleoconch comprises five whorls with a straight outline. Sutures are deeply

DOI: 10.4202/app.2008.0070

Table 2. Early Jurassic gastropods described form Argentina and Chile. Original identifications and references are given. Note that in many cases the taxonomic relationships are outdated and the known age is just Early Jurassic. Indigenous taxa are indicated by asterisks.

Taxa	References	Localities	Age	Comments
Actaeonina ovata (*)	Behrendsen 1891; 1922	Portezuelo Ancho, Argentina	Early Jurassic	Probably Cylindrobullinidae, according to Bandel (1994) and Bandel et al. (2000)
Amberleya americana (*)	Möricke 1894	Mina Amolanas, Chile	Early Jurassic	Certainly not a species *Amberleya*, relationships yet unknown
Amberleya cf. *americana*	Weaver 1931; Wahnish 1942	N of Catán Lil and Nueva Lubecka, Argentina	Early Jurassic	Not figured, relationships unknown
Amberleya? *espinosa* sp. nov. (*)	this paper	El Córdoba, Argentina	Early Toarcian	Eucyclidae
Amberleya? sp.	Gründel 2001	Cerro de Cuevitas, Chile	Early Sinemurian	Eucyclidae
Archaeogastropoda? gen. et sp. indet..	Gründel 2001	Cerrito Bayos, Chile	Late Pliensbachian	Taxonomic classification not resolved
Bathrotomaria paipotensis (*)	Gründel 2001	Qda. Paipote, Sa. Limón Verde and Qda. Yerbas Buenas, Chile	Late Sinemurian	Pleurotomaridae
Bourguetia zinkeni	Gründel 2001	Cerro de Cuevitas and Qda. Cachina, Chile	Hettangian	Pseudomelaniidae
Caenogastropoda gen. et sp. indet.	Gründel 2001	Qda. La Plata, Chile	Pliensbachain to Toarcian	Family indet.
Cerithinella (*Laevibaculus*) sp.	Jaworski 1926	Arroyo Serrucho, Argentina	Early Jurassic	Not figured. Relationships unknown
Cerithium bodenbenderi (*)	Behrendsen 1891; 1922	Portezuelo Ancho, Argentina	Early Jurassic	Taxonomic classification not updated
Cerithium cf. *quinetteum*	Jaworski 1925; Feruglio 1934	Piedra Pintada and Río Genoa, Argentina	Early Jurassic	Taxonomic classification not updated. Judying from Feruglio's (1934) figure, not a *Cerithium*
Chenopus sp.	Behrendsen 1891; 1922	Río Salado, Argentina	Early Jurassic	Not figured, relationships unknown
Coelodiscus sp.	Gründel 2001	Río Atuel, Argentina	Early Pliensbachian	Carinariidae
Colpomphalus toarciensis (*)	Gründel 2001	Qda. Chanchoquín-Paitepen, Chile	Early Toarcian	Discohelicidae
Colpomphalus? sp.	this paper	El Córdoba, Argentina	Early Toarcian	Discohelicidae
Cryptaulax damboreneae sp. nov. (*)	this paper	El Córdoba, Argentina	Early Toarcian	Procerithiidae
Cryptaulax cf. *damboreneae* sp. nov.	this paper	El Córdoba, Argentina	Early Toarcian	Procerithiidae
Cryptaulax nulloi sp. nov. (*)	this paper	El Córdoba, Argentina	Early Toarcian	Procerithiidae
Cylindrobullina arduennensis	Jaworski 1926	Portezuelo Ancho, Argentina	Early Jurassic	Not figured, taxonomic classification not updated
Cylindrobullina fragilis	Weaver 1931; Jaworski 1926	Cañada Colorada, Argentina	Early Jurassic	Not figured, taxonomic classification not updated
Cylindrobullina sp. indet. cf. *fragilis*	Weaver 1931	N of Catán Lil, Argentina	Early Jurassic	Not figured, taxonomic classification not updated
Eucyclus sp.	Gründel 2001	Quillagua, Chile	Early Sinemurian	Eucyclidae
Eucyclus sibtiliscostatus (*)	Gründel 2001	Cerro de Cuevitas, Chile	Late Hettangian	Eucyclidae
Gastropoda gen et sp. indet.	Gründel 2001	Near Qda. Chug Chug, Chile	Early Sinemurian	Subclass uncertain
Lithotrochus humboldtii (*)	see synonymy list in Damborenea and Ferrari 2008	see list of localities in Argentina and Chile in Damborenea and Ferrari 2008	Early Sinemurian to Late Pliensbachian	Trochidae
Lithotrochus rothi (*)	Damborenea and Ferrari 2008	Piedra Pintada, Argentina	Late Pliensbachian	Trochidae
Microschiza sp.	Gründel 2001	Cerro de Cuevitas, Chile	Sinemurian	Purpurinidae
Natica catanlilensis (*)	Weaver 1931; Wahnish 1942	N of Catán Lil and Nueva Lubecka, Argentina	Early Jurassic	Not a naticid, relationships yet unknown
Natica aff. *catanlilensis*	Feruglio 1934	Río Genoa, Argentina	Early Jurassic	Not a naticid, relationships yet unknown
Natica philippi	Möricke 1894	Qda. Las Trancas, Chile	Early Jurassic	Not a naticid, relationships yet unknown
Natica cf. *philippi*	Jaworski 1926; Weaver 1931	Cañada Colorada and Arroyo Chachayco, Argentina	Early Jurassic	Not a naticid, relationships yet unknown
Natica sp.	Behrendsen 1891, 1922; Weaver 1931	Portezuelo Ancho, Argentina	Early Jurassic	Not figured, probably more than one taxon. Not a naticid, relationships yet unknown
Natica sp.	Feruglio 1934	Río Genoa, Argentina	Early Jurassic	Not a naticid, relationships yet unknown
"*Natica*" sp.	Pérez 1982	Qda. Asientos, Chile	Pliensbachian	Not a naticid, relationships yet unknown
Nerinea sp.	Wahnish 1942	Nueva Lubecka, Argentina	Early Jurassic	Taxonomic classification not updated

Taxa	References	Localities	Age	Comments
Oonia euspiroides	Jaworski 1926; Weaver 1931	Portezuelo Ancho, Argentina	Early Jurassic	Not figured, Pseudomelaniidae?
cf. *Oonia* sp.	Gründel 2001	Pzo. Pedernales, Co. Difial and Qda. Cachina, Chile	Hettangian to Pliensbachian	Probably more than one species, Pseudomelaniidae
Pleurotomaria anglica	Gründel 2001	Cuevitas, Chile	Sinemurian	Pleurotomariidae
Pleurotomaria cf. *multicincta*	Jaworski 1926	Arroyo Blanco, Argentina	Early Jurassic	Not figured, relationships yet unknown
Pleurotomaria sp.	Möricke 1894	Las Amolanas, Chile	Early Jurassic	Not figured, probably Pleurotomariidae
Pleurotomaria sp. indet.	Weaver 1931	N of Catán Lil, Argentina	Early Jurassic	Not figured, probably Pleurotomariidae
Pleurotomaria sp.	Gründel 2001	Qda. Yerbas Buenas, Chile	Late Pliensbachian	Pleurotomariidae
Pseudomelania aff. *repeliana*	Jaworski 1926	Arroyo Serrucho, Argentina	Early Jurassic	Not figured, probably Pseudomelaniidae
Pseudomelania sp. 3	Gründel 2001	Qda. Plaza and Juntas del Toro, Chile	Middle Toarcian	Pseudomelaniidae
Pseudomelania? sp. indet. cf. *bicarinata*	Jaworski 1926	Portezuelo Ancho, Argentina	Early Jurassic	Not figured, probably Pseudomelaniidae
Pseudonerinea? sp.	Gründel 2001	Qda. San Pedrito, Chile	Sinemurian-Pliensb achian	Ceritillidae
Striactaeonina atuelensis (*)	Gründel 2001	Río Atuel, Argentina	Early Pliensbachain	Bullinidae
Striactaeonina transatlantica (*)	Behrendsen 1891, 1922; Möricke, 1894; Jaworski 1926; Weaver 1931; Pérez 1982; Gründel 2001	Portezuelo Ancho and N of Catán Lil, Argentina; Qda. Asientos and Jorquera/La Guardia, Chile	Pliensbachain	Bullinidae
Striactaeonina? sp.	Pérez 1982	Qda. Asientos, Chile	Pliensbachian	Bullinidae
Striatoconulus sp.	this paper	El Córdoba, Argentina	Early Toarcian	Proconulidae
Tatediscus aratus (Tate)	Gründel 2001	Río Atuel, Argentina	Early Pliensbachian	Carinariidae
Trochus aff. *perinianus*	Burckhardt 1900; Jaworski 1915	Cerro Puchenque and Milla Michicó, Argentina	Early Jurassic	Taxonomic classification not updated
Trochus sp.	Behrendsen 1891, 1922	Portezuelo Ancho, Argentina	Early Jurassic	Not figured, taxonomic classification not updated
Trochus sp.	Wahnish 1942	Nueva Lubecka, Argentina	Early Jurassic	Not figured, taxonomic classification not updated
Zygopleura sp.	Gründel 2001	Qda. Yerbas Buenas, Chile	Late Sinemurian	Zygopleuridae
Zygopleuridae? gen. et sp. indet.	this paper	El Córdoba, Argentina	Early Toarcian	?Zygopleuridae

incised. Ornament consists of spiral and axial ribs with conspicuous nodes at intersections. Axial ribs are predominant and consists of orthocline to slightly prosocline axial ribs running from suture to suture. Axial ribs are regularly spaced and show no marked change during ontogeny. Seven distinct regularly spaced spiral ribs appear on mature teleoconch whorls (fewer in juvenile growth stages). A second order of spiral ribs is not developed. Basal and apertural features are not preserved.

Remarks.—The present material strongly resembles *Cryptaulax damboreneae* sp. nov. However, *Cryptaulax* cf. *damboreneae* sp. nov. has larger shells, orthocline to slightly opistocline axial ribs, seven stronger spiral ribs intersecting the axial elements, and a weakly developed second order of spiral ribs. The present material probably represents a new *Cryptaulax* species but the specimens are too poorly preserved for such proposal.

Cryptaulax nulloi sp. nov.

Fig. 3F–H.

Etymology: Dedicated to Francisco E. Nullo.

Type material: Holotype, MPEF-PI 1870, well preserved teleoconch; paratype, MPEF-PI 1861, poorly preserved teleoconch.

Type horizon: Osta Arena Formation, Lower Toarcian, Jurassic.

Type locality: PA 06 site, "El Córdoba" fossiliferous locality.

Other material.—MPEF-PI 1862, MPEF-PI 1866, MPEF-PI 1873, MPEF-PI 1881, MPEF-PI 1869, MPEF-PI 1871, and MPEF-PI 1885, poorly preserved teleoconch fragments.

Diagnosis.—Anomphalous and turriculate shell. Juvenile teleoconch characterized by predominance of axial ornament and presence of weak nodes. Adult teleoconch with spiral ornament predominant, consisting of two strong ribs near the suture both in adapical and abapical parts of the flank, and weaker ribs between. On adult teleoconch whorls conspicuous nodes are present. Subcircular holostomatous aperture.

Description.—Dextral, small-sized, and high-spired shell, anomphalous, slender and turriculate. Protoconch is not preserved. Teleoconch comprises eight whorls which are straight in outline. Sutures are well delimited and bordered by two spiral ribs. Teleoconch ornament consists of spiral and axial ribs with nodose intersections. The early teleoconch whorls (juvenile stage) differ from the adult stage in having a strongly axial ornament pattern, with orthocline ribs intersecting two weak spiral ribs near the sutures. At the intersections of axial and spiral ribs, eight weak nodes are developed. The mature ornament of the teleoconch stabilizes on the fifth whorl; a strong spiral ornament appears and the axial ribs become weaker.

DOI: 10.4202/app.2008.0070

Table 3. Records of Early Jurassic marine gastropods from the southern hemisphere (exclusive of South America, see Table 2). Original identifications and references are given. Note that in most cases the taxonomic classification is updated.

Taxa	References	Localities	Age	Updated classification
Actaeonina (*Striactaeonina*) *supraliasica*	Cox 1965	Kenya, Africa	Toarcian	Acteonidae
Actaeonina novozealandica	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic	Cylindrobullinidae
Africoconulus kenyanus	Cox 1965	Kenya, Africa	Toarcian	Trochidae
Amberleya (*Eucylus*) (?) sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Eucyclidae
Amberleya torosa	Marwick 1953	Taylors Creek, New Zealand	Hettangian	Eucyclidae
Amphitrochus sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antartida	Sinemurian (according to Thompson and Turner 1986)	Nododelphinulidae
Austriacopsis ovalis	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic	Emarginulidae
Brevizygia spiralusulcata	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic	Pommerozygiidae
Bullina (*Sulcoactaeon*) *zealata*	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Bullinidae
Camponaxis zardiniensis	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Tofanellidae
Canterburyella pacifica	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Canterburyllidae
Coelocentrus pacificus	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Turbinidae
Conusella? *pacifica*	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Tofanellidae
Cristalloella parva	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Tofanellidae
Crossotoma globulifera	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Crossostomatidae
Crossotoma spirata	Bandel et al. 2000	Kaiwara Valley, New Zealand	upper Early Jurassic/Early Middle Jurassic)	Crossostomatidae
Cryptaulax sp. cf. *protortile*	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Procerithiidae
Discohelix didimtuensis	Cox 1965	Kenya, Africa	Toarcian	Discohelicidae
Dictyotomaria gondwaniensis	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Pleurotomariidae
Emarginula kaiwarensis	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Emarginulidae
Emarginula sp.	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Emarginulidae
Eucochlis costata	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Microdomatidae
Eucycloscala torulosa	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Eucyclidae
Guidonia riedeli	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Trochidae
Hamusina maxwelli	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Cirridae
Kaiwarella beui	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Orbitestellidae
Katosira (?) sp.	Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Zygopleuridae
Loxotoma jurassica	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Emarginulidae
Maoraxis kieli	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Maoraxidae
Maxwellella novozeelandica	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Scissurellidae
Omphaloptycha (?) sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Coelostylinidae
Paracerithium pacificum	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Procerithiidae
Paracerithium spinosum	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Procerithiidae
Pietteia christchurchi	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Aporrhaiidae
Pileolus convexus	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Pileolidae
Pleurotomaria (*Talantodiscus*) *trechmanni*	Marwick 1953	Taylors Creek, New Zealand	Hettangian	Pleurotomariidae
Potrofus sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Procerithiidae
Prisciophora schroederi	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Prisciophoridae
Procerithiidae? gen. et. sp. indet.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (acording to Thompson and Turner 1986)	Uncertain
Procerithium (*Apicaria*) sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Procerithiidae
Promathilda aff. *opalini*	Cox 1965	Kenya, Africa	Toarcian	Mathildidae
Purpuroidea supraliasica	Cox 1965	Kenya, Africa	Toarcian	Purpurinidae
Rhabdocolpus sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (acording to Thompson and Turner 1986)	Procerithiidae
Rhabdocolpus? *kowalkei*	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Procerithiidae

Taxa	References	Localities	Age	Updated Classification
Sallya calyptraeensis	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Pseudophoridae
Scurriopsis (?) *arahetexta*	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Acmaeidae
Tricarilda cancellata	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Mathildidae
Trochopsidea africana	Cox 1965	Kenya, Africa	Toarcian	Ataphridae
Turritellidae gen. et sp. indet.	Edwards, 1980; Thompson and Turner, 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Turritellidae
Tylotrochus keuppi	Bandel et al. 2000	Kaiwara Valley, New Zealand	(upper Early Jurassic/Early Middle Jurassic)	Trochidae
Zygopleura (*Katosira*) sp.	Edwards 1980; Thompson and Turner 1986	Lully Foothills, Antarctica	Sinemurian (according to Thompson and Turner 1986)	Zygopleuridae

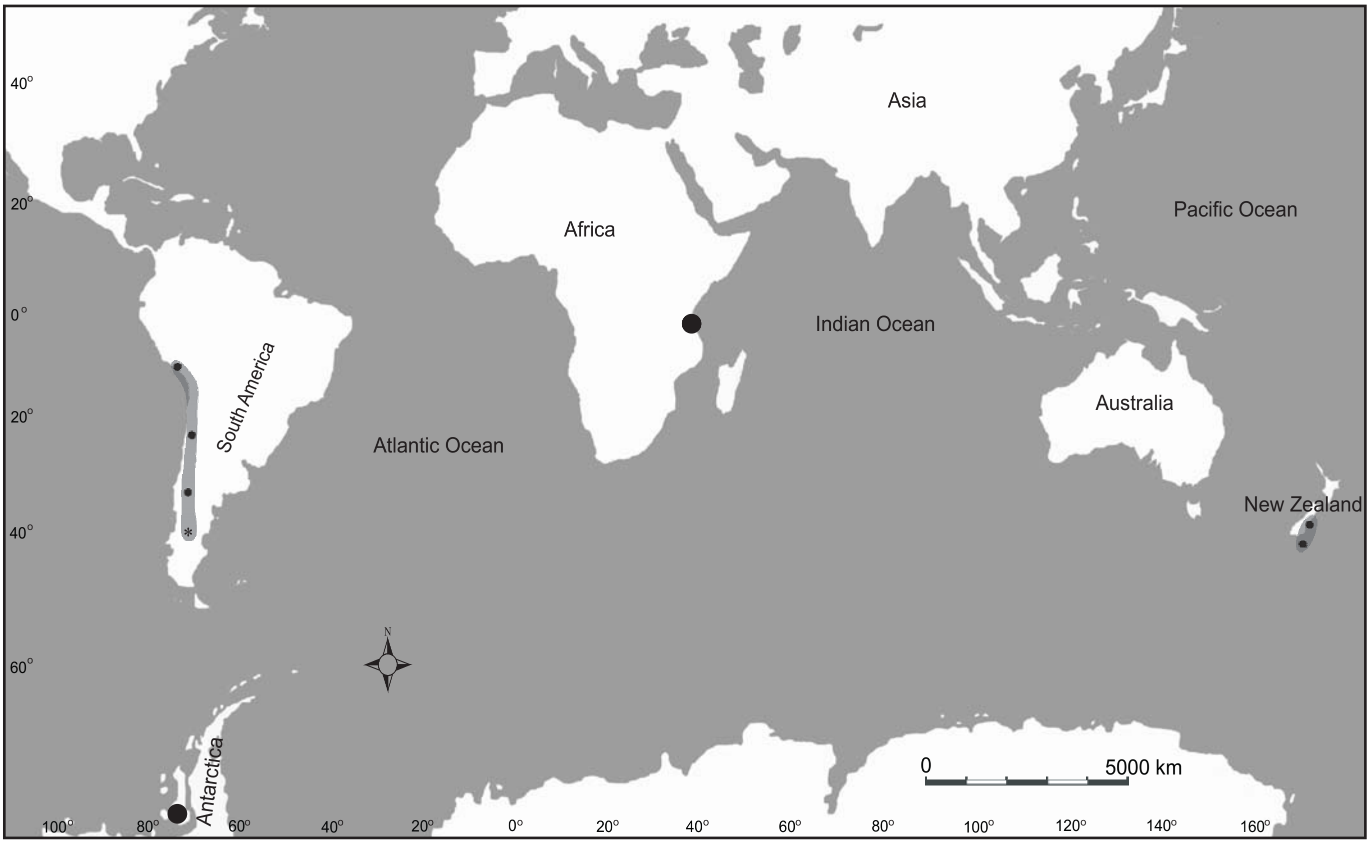

Fig. 4. Southern hemisphere map showing the paleobiogeographical distribution of the cosmopolitan Jurassic gastropod genere reported herein. Note that the occurrence of the new Lower Toarcian gastropod association in "El Córdoba" fossiliferous locality (*) (Chubut province, Argentina) extends the paleobiogeographical distribution of the group in South America.

The spiral elements comprise two strong ribs near the sutures; additionally, a number of much weaker ribs appears. The presence of strong spiral ribs near the suture gives the whorl face a concave appearance. Base is convex and ornamented with four spiral ribs. The aperture is holostomatous and subcircular.

Dimensions.—See Table 1.

Discussion.—The presence of strong axial and weak spiral ribs on juvenile teleoconch whorls allow this material to be identified as *Cryptaulax*. The adult teleoconch whorl with strong spiral ribs and conspicuous nodes separate *C. nulloi* sp. nov. from other species of the genus. *Cryptaulax nulloi* sp. nov., *C. damboreneae* sp. nov., and *C.* cf. *damboreneae* are the first cryptaulacins recorded from the Early Jurassic of Argentina. *C. nulloi* sp. nov. and *C. damboreneae* sp. nov. are similar in having a small-sized high-spired shell and axial and spiral ribs with nodose intersections. *C. nulloi* nov. sp., however, has weakly developed axial ribs and much better developed spiral ribs during ontogeny. *C. damboreneae* sp. nov. is slightly smaller than *C. nulloi* sp. nov., has fewer nodes and strong axial ornament pattern on all growth stages. *C.* cf. *damboreneae* differs from *C. nulloi* sp. nov. in having better developed axial ribs and more spiral ribs.

Stratigraphic and geographic range.—PA-06 site, from "El Córdoba" fossiliferous locality, Chubut province, Argentina. Osta Arena Formation, Lower Toarcian, Lower Jurassic.

DOI: 10.4202/app.2008.0070

Concluding remarks

The taxonomic classifications of most gastropod taxa described so far from the Early Jurassic of Argentina are outdated in comparison to those of gastropods from Antarctica (Edwards 1980; Thompson and Turner 1986), Africa (Cox 1965), and New Zealand (Bandel et al. 2000). There are only few illustrations of the species available in the published literature, and in many cases their taxonomic position is uncertain. More complete and recently reviewed data (Table 2) on Early Jurassic gastropods are available from Chile (Gründel 2001). A survey of other records of Early Jurassic gastropods from the southern hemisphere (Table 3) shows rather limited systematic knowledge of particular gastropod taxa in Argentina. A more detailed research (including the investigation of new fossiliferous localities in Argentina, the collection of new gastropod material with accurate geographical and stratigraphical data, and the revision of all described gastropod groups of Early Jurassic age) is currently in progress. Nevertheless, the new gastropod association of the "El Cordoba" fossiliferous locality provides new data on its taxonomic composition in the Jurassic of Argentina and South America. It clearly shows that some taxa (especially at generic level) were of cosmopolitan distribution in the southern hemisphere (Fig. 4) and other regions of the world (e.g., Europe). Nevertheless, these genera are usually represented by indigenous species known so far only from Chubut province and other localities in Argentina and Chile (Table 2).

Several taxa are recorded for the first time from the Early Jurassic of South America (*Striatoconulus*) or Argentina (*Cryptaulax*, and possibly *Amberleya*). The new findings reported here from just one locality, show that new localities of South American Jurassic gastropods may greatly extend our knowledge and stimulate further research in the future, facilitating appropriate interpretation of the palaeobiogeographical distribution of gastropods in the southern hemisphere in the Jurassic.

Acknowledgements

I want to thank Alejangra Pagani, Mariano Caffa, and Leandro Canessa (all at Museo Paleontológico "Egidio Feruglio", Trelew, Argentina) for their help during fieldwork and, especially, Leandro Canessa for his laboratory work. I thank Jaime Groizard (ALUAR, Pto. Madryn, Argentina) for allowing the access to the SEM. I am grateful to Alberto Riccardi (División Paleontología Invertebrados of Museo de Ciencias Naturales de La Plata, Argentina) for identifying the Patagonian cephalopod, to Susana Damborenea (División Paleontología Invertebrados of Museo de Ciencias Naturales de La Plata, Argentina), Andrzej Kaim (Institute of Paleobiology PAS, Warsaw, Poland), Joachim Gründel (Freie Universität, Berlin, Germany), János Szabó (Hungarian Natural History Museum, Budapest, Hungary), Alexander Nützel (Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany), and Stefano Monari (Università Degli Studi di Padova, Padua, Italy) for supplying important literature. I thank Susana Damborenea, Andrzej Kaim, and the referees Alexander Nützel, Joachim Gründel, and Alan Beu (GNS Science, Lower Hutt, New Zealand) for their valuable comments. I am grateful to Museo Paleontológico "Egidio Feruglio" and Ministerio de Educación de la Provincia del Chubut for financing the fieldwork. Special thanks are given to Paul D. Taylor (Natural History Museum, London, UK) for linguistic corrections.

References

Bandel, K. 1994. Comparison of Upper Triassic and Lower Jurassic Gastropods from the Peruvian Andes (Pucará Group) and the Alps (Cassian Formation). *Palaeontographica* 233: 127–160.

Bandel, K., Gründel, J., and Maxwell, P. 2000. Gastropods from the upper Early Jurassic/early Middle Jurassic of Kaiwara Valley, North Canterbury, New Zeland. *Freiberger Forschungshefte* C 490: 67–132.

Bayle, E. and Coquand, H. 1851. Mémoire sur les Fossiles recueillis dans le Chili par M. Ignace Domeyko et sur les terrains auxquels ils appartiennent. *Mémoires de la Société Géologique de France, Série 2* 4: 1–47.

Behrendsen, O. 1891. Zur Geologie des Ostabhanges der argentinischen Cordillere. Teil I. *Zeitschrift der Deutschen Geologischen Gesellschaft* 43: 369–420.

Behrendsen, O. 1922. Contribución a la geología de la pendiente oriental de la Cordillera Argentina. *Actas de la Academia Nacional de Ciencias (Córdoba)* 7: 161–227.

Blasco, G., Levy, R. and Nullo, F. 1978. Los amonites de la Formación Osta Arena (Liásico) y su posición estratigráfica, Pampa de Agia (Provincia del Chubut). *Actas del 7° Congreso Geológico Argentino* 2: 407–429.

Bouchet, P. and Rocroi, J.P. 2005. Classification and nomenclator of gastropod families. *Malacologia* 47: 1–397.

Buch, L. de 1839. *Pétrifications recueillies en Amérique par Mr. Alexandre de Humboldt et par Mr. Charles Degenhardt*. 22 pp. Imprimerie Académie Royale des Sciences, Berlin.

Burckhardt, C. 1900. Profils géologiques transversaux de la Cordillère Argentino-Chilienne. Stratigraphie et tectonique. *Anales del Museo de La Plata, Sección Geología y Mineralogía* 2: 1–136.

Burckhardt, C. 1902. Le Lias de la Piedra Pintada (Neuquén). III. Sur les fossiles marines du Lias de la Piedra Pintada, avec quelques considérations sur l'âge et l'importance du gisement. *Revista del Museo de La Plata* 10: 243–249.

Cox, L.R. 1965. Jurassic Bivalvia and Gastropoda from Tanganyika and Kenya. *Bulletin of the British Museum (Natural History) Geology, London* 1: 137–209.

Cox, L.R. and Arkell, W.J. 1950. *A Survey of the Mollusca of the British Great Oolite Series. Part II*, 49–105. Palaeontographical Society, London.

Damborenea, S.E. and Lanés, S. 2007. Early Jurassic shell beds from marginal marine environments in southern Mendoza, Argentina. *Palaeogeography, Palaeoclimatology, Palaeoecology* 250: 68–88.

Damborenea, S.E. and Ferrari, S.M. 2008. El género *Lithotrochus* Conrad (Gastropoda, Vetigastropoda) en el Jurásico temprano de Argentina. *Ameghiniana* 45: 197–209.

Edwards, C.W. 1980. Early Mesozoic marine fossils from central Alexander Island. *British Antarctic Survey Bulletin* 49: 33–58.

Feruglio, E. 1934. Fossili Liassici della Valle del Rio Genua (Patagonia). *Giornale di Geologia, Annali del R. Museo Geologico di Bologna* 9: 1–64.

Gaetani, M. 1970. Faune hettangiane della parte orientale della provincia di Bergamo. *Rivista Italiana di Palaeontologia* 76: 355–442.

Giacosa, R.E. and Márquez, M.J. 1999. Jurásico y Cretácico de la Cordillera Patagónica septentrional y Precordillera Patagónica. *In*: R. Caminos (ed.), Geología Argentina. *Anales del Servicio Geológico Minero Argentino* 29: 444–459.

Gottsche, C. 1878. Ueber jurassische Versteinerungen aus der argentinischen Cordillere. *Palaeontographica* (Supplement 3): 1–50.

Gottsche, C. 1925. Contribuciones a la Paleontología de la República Argentina. Sobre fósiles jurásicos de la Cordillera Argentina (Paso del

Espinacito, prov. de San Juan). *Actas Academia Nacional de Ciencias* 8: 229–283.

Gründel, J. 1974. Gastropoden aus dem Dogger. II. Procerithiidae. *Zeitschrift für Geologische Wissenschaften* 2: 831–851.

Gründel, J. 1999. Procerithiidae (Gastropoda) aus dem Lias und Dogger Deutschlands und Polens. *Freiberger Forschungshefte C* 481: 1–37.

Gründel, J. 2000. Archaeogastropoda aus dem Dogger Norddeutschlands und des nordwestlichen Polens. *Berliner Geowissenschaftliche Abhandlungen Reihe E* 34: 205–253.

Gründel, J. 2001. Gastropoden aus dem Jura der südamerikanischen Anden. *Freiberger Forschungshefte C* 492: 43–84.

Gründel, J. 2003. Gastropoden aus dem Unteren Lias (Ober-Hettangium bis Unter-Sinemurium) Südwestdeutschlands. *Stuttgarter Breiträge zur Naturkunde B* 340: 1–55.

Gründel, J. 2005. Die Gattung *Discohelix* Dunker, 1847 (Gastropoda) und zur Fassung der Discohelicidae Schröder, 1995. *Neues Jahrbuch für Geologie und Paläonologie, Monathshefte* 2005: 729–748.

Gründel, J. 2007. Gastropoden aus dem oberen Toarcium/unteren Aalenium (Jura) von Norddeutschland. *Paläontologische Zeitschrift* 81: 238–253.

Gründel, J. 2008. Remarks to the classification and phylogeny of the Ataphridae Cossmann, 1915 (Gastropoda, Archaeogastropoda) in the Jurassic. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 250:177–197.

Gründel, J. and Kaim, A. 2006. Shallow-water gastropods from the Late Oxfordian sands in Kłęby (Pomerania, Poland). *Acta Geologica Polonica* 56: 121–157.

Herbst, R. 1966. La Flora Liásica del Grupo Pampa de Agnia, Chubut, Patagonia. *Ameghiniana* 4: 337–349.

Herbst, R. 1968. Las Floras Liásicas argentinas con consideraciobes estratigráficas. *Actas Terceras Jornadas Geológicas Argentinas* 1: 145–162.

Hickman, C.S. and McLean, J.H. 1990. Systematic revision and suprageneric classification of trochacean gastropods. *Natural History Museum of Los Angeles Country, Science Series* 35: 1–169.

Hikuroa, D.C.H. and Kaim, A. 2007. New gastropods from the Jurassic of Orville Coast, eastern Ellsworth Land, Antarctica. *Antarctic Science* 19: 115–124.

Jaworski, E. 1915. Beiträge zur Kenntnis des Jura in Süd-Amerika. Teil II. Spezieller, paläontologischer Teil. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie Beilage-Band* 40: 364–456.

Jaworski, E. 1925. Contribución a la paleontología del Jurásico Sudamericano. *Publicación de la Dirección General de Minería, Geología e Hidrología, sección Geología* 4: 1–160.

Jaworski, E. 1926a. La fauna del Lias y Dogger de la Cordillera Argentina en la parte meridional de la provincia de Mendoza. *Actas de la Academia Nacional de Ciencias (Córdoba)* 9: 137–316.

Jaworski, E. 1926b. Beiträge zur Paläontologie und Stratigraphie des Lias, Doggers, Tithons und der Unterkreide in der Kordilleren im Süden der Provinz Mendoza (Argentinien). Teil I. Lias und Dogger. *Geologische Rundschau* 17a: 373–427.

Kaim, A. 2004. The evolution of conch ontogeny in Mesozoic open sea gastropods. *Palaeontologia Polonica* 62: 3–183.

Kaim, A., Beisel, A.L., and Kurushin, N.I. 2004. Mesozoic gastropods from Siberia and Timan (Russia). Part 1: Vetigastropoda and Caenogastropoda (exclusive of Neogastropoda). *Polish Polar Research* 25: 241–266.

Knight, J.B., Cox, L.R., Keen, A.M., Batten, R.L., Yochelson, E.L., and Robertson, R. 1960. Systematic descriptions. *In*: J.B. Knight, L.R. Cox, A.M. Keen, A.G. Smith, R.L. Batten, E.L. Yochelson, N.H. Ludbrook, R. Robertson, C.M. Yonge, and R.C. Moore (eds.), *Treatise on Invertebrate Paleontology. Part I. Mollusca 1*. 351 pp. Geological Society of America and University of Kansas Press, Lawrence.

Marwick, J. 1953. Divisions and faunas of the Hokonui System (Triassic and Jurassic). *New Zealand Geological Survey, Paleontological Bulletin* 21: 1–141.

Möricke, W. 1894. Versteinerungen des Lias und Unteroolith von Chile. *Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilage-Band* 9: 1–100.

Morris, E.G.S. and Lycett, J. 1850. A monograph of the Mollusca from the Great Oolite, Chiefly from Minchinhampton and the Coast of Yorkshire. Part I, Univalves. *Monograph of the Palaeontographical Society of London* 1850: 1–130.

Musacchio, E.A. and Riccardi, A.C. 1971. Estratigrafía, principalmente del Jurásico en la Sierra de Agnia, Chubut, República Argentina. *Revista de la Asociación Geológica Argentina* 29: 272–273.

Nullo, F. 1983. Descripción de la hoja 45c, Pampa de Agnia, Provincia del Chubut. *Boletín del Servicio Geológico Nacional* 199: 1–97.

Nützel, A. 1998. Über die Stammesgeschichte der Ptenoglossa (Gastropoda). *Berliner Geowissenschaftliche Abhandlungen, Reihe E* 26: 1–229.

Nützel, A. and Erwin, D. 2004. Late Triassic (Late Norian) gastropods from the Wallowa Terrane (Idaho, USA). *Paläontologische Zeitschrift* 78: 361–416.

Nützel, A. and Senowbari-Daryan, B. 1999. Gastropods from the Late Triassic (Norian–Rhaetian) Nayband Formation of Central Iran. *Beringeria* 23: 93–132.

Pérez, A.E. d' 1982. Bioestratigrafía del Jurásico de Quebrada Asientos, Norte de Potrerillos, Región de Atacama. *Boletín del Servicio Nacional de Geología y Minería de Chile* 37: 1–149.

Piatnitzky, A. 1936. Estudio geológico de la región de los Ríos Chubut y Genua. *Boletín de Informaciones Petroleras* 13: 83–118.

Piatnitzky, A. 1946. Relaciones estratigráficas de la región del Río Chubut. *Boletín deInformaciones Petroleras* 23: 173–178.

Piette, E. 1856. Notice sur les grès d'Aiglemout et de Rimogne. *Bulletin de la Societé Geologiqué de France* 13: 188–207.

Ponder, W.F. and Lindberg, D.R. 1997. Towards a phylogeny of gastropod molluscs: an analysis using morphological characters. *Zoological Journal of the Linnean Society* 119: 83–265.

Riccardi, A.C. 1983. The Jurassic of Argentina and Chile. *In*: M. Moullade and A.E.M. Nairn (eds.), *The Phanerozoic Geology of the World II. The Mesozoic, B*, 201–263. Elsevier, Amsterdam.

Robbiano, J.A. 1971. Contribución al conocimiento estratigráfico de la sierra del Cerro Negro, Pampa de Agnia, Provincia de Chubut, República Argentina. *Revista de la Asociación Geológica Argentina* 26: 41–56.

Szabó, J. 1982. Lower and Middle Jurassic Gastropods from the Bakony Mountains (Hungary). Part IV: Neritacea, Craspedostomacea, Amberleyacea (Archaeogastropoda). *Annales Historico-Naturales musei Nationalis Hungarici* 74: 17–33.

Thompson, M.R.A. and Turner, T.H. 1986. Early Jurassic fossils from Central Alexander Island and their geological setting. *British Antarctic Survey, Bulletin* 70: 23–39.

Wahnish, E. 1942. Observaciones geológicas en el Oeste del Chubut. Estratigrafía y fauna del Liásico en los alrededores del rio Genua. *Boletín del Servicio Geológica Nacional (Buenos Aires)* 51: 1–73.

Weaver, C. 1931. Paleontology of the Jurassic and Cretaceous of West Central Argentina. *Memoirs of the University of Washington* 1: 1–469.

DOI: 10.4202/app.2008.0070