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Oxfordian perisphinctid ammonites from Chacay Melehué, Argentina

HORACIO PARENT, Rosario; GÜNTER SCHWEIGERT, Stuttgart & GUILLERMO MELÉNDEZ, Zaragoza

with 9 figures and 1 table

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Abstract: A significant assemblage of Oxfordian perisphinctids was collected at Chacay Melehué, Neuquén, Argentina. It is composed of well preserved specimens belonging to the family Perisphinctidae: *Perisphinctes* aff. *promiscuus* BUKOWSKI (Perisphinctinae), *Tenuisphinctes herreroduclouxi* (LEANZA) (Perisphinctinae), and *Subvinalesphinctes pseudokranaus* n. sp. and *S. prophetae* (GYGI & HILLEBRANDT) (Vinalesphinctinae). The family Ataxioceratidae is represented by *Lithacosphinctes* aff. *janus* (CHOFFAT) (Ataxioceratinae). The subfamily Vinalesphinctinae MELÉNDEZ & MYCZYNSKI, 1987 is discussed and organized into three genera: *Subvinalesphinctes* WIERZBOWSKI, *Vinalesphinctes* SPATH and *Cubasphinctes* JUDOLEY & FURRAZOLA, which seems to cover the whole of the subfamily, ranging, at least, from the lower *plicatilis* to the lower *bifurcatus* zones, Middle Oxfordian in Cuba, part of Mexico, Chile and Argentina. The root of the subfamily is most likely *S. pseudokranaus* n. sp. The paleobiogeographic affinites are mainly Tethyan, and Tethyan-Caribbean during the Middle Oxfordian.

Keywords: Oxfordian • Ammonoidea • Vinalesphinctinae • Perisphinctinae • Ataxioceratinae • Argentina

Zusammenfassung: Eine bemerkenswerte Assoziation von Perisphinctiden aus dem Oxfordium wurde bei Chacay Melehué (Neuquén, Argentinien) aufgesammelt. Sie beinhaltet gut erhaltene Stücke der Familie Perisphinctidae mit den Arten *Perisphinctes* aff. *promiscuus* BUKOWSKI (Perisphinctinae), *Tenuisphinctes herreroduclouxi* (LEANZA) (Perisphinctinae) sowie *Subvinalesphinctes pseudokranaus* n. sp. und *S. prophetae* (GYGI & HILLEBRANDT) (Vinalesphinctinae). Die Familie Ataxioceratidae ist mit *Lithacosphinctes* aff. *janus* (CHOFFAT) (Ataxioceratinae) vertreten. Die Unterfamilie Vinalesphinctinae MELÉNDEZ & MYCZYNSKI, 1987 wird diskutiert und in drei Gattungen aufgegliedert: *Subvinalesphinctes* WIERZBOWSKI, *Vinalesphinctes* SPATH und *Cubasphinctes* JUDOLEY & FURRAZOLA, welche die ganze Unterfamilie abzudecken scheinen, die von der *plicatilis* bis *bifurcatus* Zone, Mittel Oxfordium in Kuba, Teilen Mexikos, Chile und Argentinien verbreitet ist. Der Ursprung dieser Unterfamilie liegt höchstwahrscheinlich bei *S. pseudokranaus* n. sp. Die paläobiogeographischen Bezüge sind vorwiegend zur Tethys bzw. tethyal-karibisch während des Mittel-Oxfordiums.

Schlüsselwörter: Oxfordium • Ammonoidea • Vinalesphinctinae • Perisphinctinae • Ataxioceratinae • Argentinien

Introduction

Late Callovian to Early Kimmeridgian ammonites of the Neuquén-Mendoza Basin have received little attention. Descriptions are mainly restricted to papers by BURCKHARDT (1900a, b), LEANZA (1947), STIPANICIC (1951), and STIPANICIC et al. (1976). Ammonite biostratigraphy and time-correlation of those papers were recently re-interpreted (PARENT 1998), whereas the current biostratigraphic classification still follows the subdivision of RICCARDI (1984; see also RICCARDI et al. 2000; RICCARDI & DAMBORENEA 1993).

Chacay Melehué (Fig. 1) is a classical ammonitiferous locality with a Jurassic record of slope and distal sediments of the Neuquén-Mendoza Basin. Known Oxfordian sections have yielded scarce ammonites, never-

Addresses of the authors: Horacio Parent, Laboratorio de Paleontología, IFG, FCEIA, Universidad Nacional de Rosario, Pellegrini 250, 2000 Rosario, Argentina; e-mail <parent@fceia.unr.edu.ar >. – Günter Schweigert, Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart, Germany; e-mail <schweigert.smns@naturkundemuseum-bw.de>. – Guillermo Meléndez, Departamento de Geología (Paleontología), Universidad de Zaragoza, Spain; e-mail <gmelende@posta.unizar.es>.

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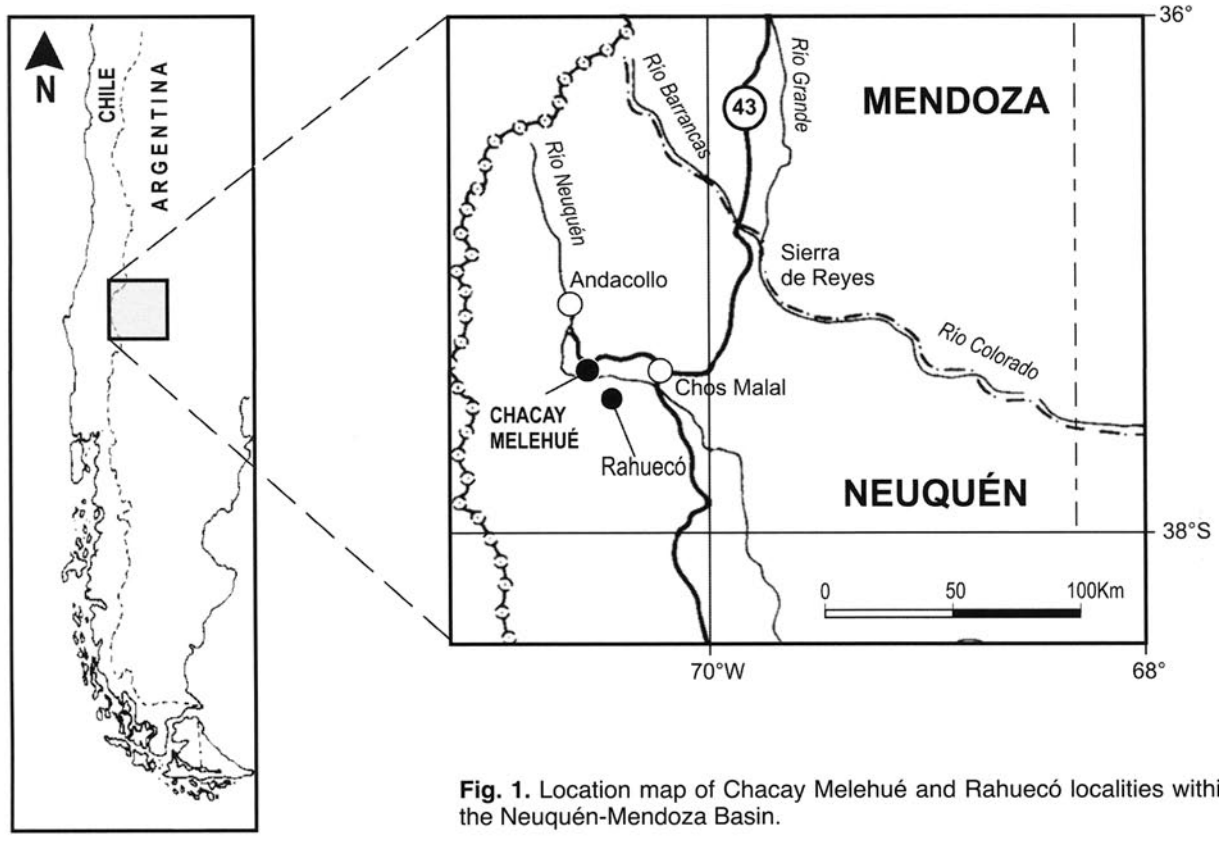


Fig. 1. Location map of Chacay Melehué and Rahuecó localities withi the Neuquén-Mendoza Basin.

theless an interesting assemblage of perisphinctids has been collected during the last years. The purpose of the present paper is to describe this assemblage which is composed of specimens from three closely allied sections, ranging across the Upper Callovian – Lower Kimmeridgian interval. The samples include specimens discussed in a previous paper (PARENT 1998) and additional more recently collected material.

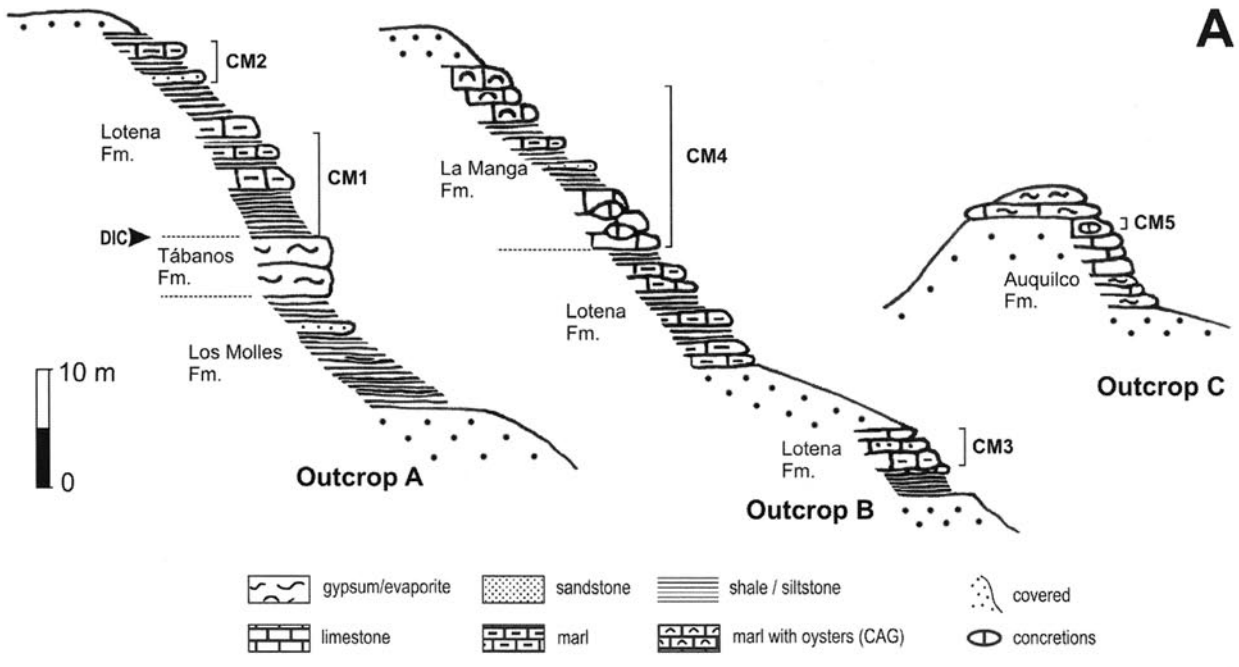
Stratigraphic framework

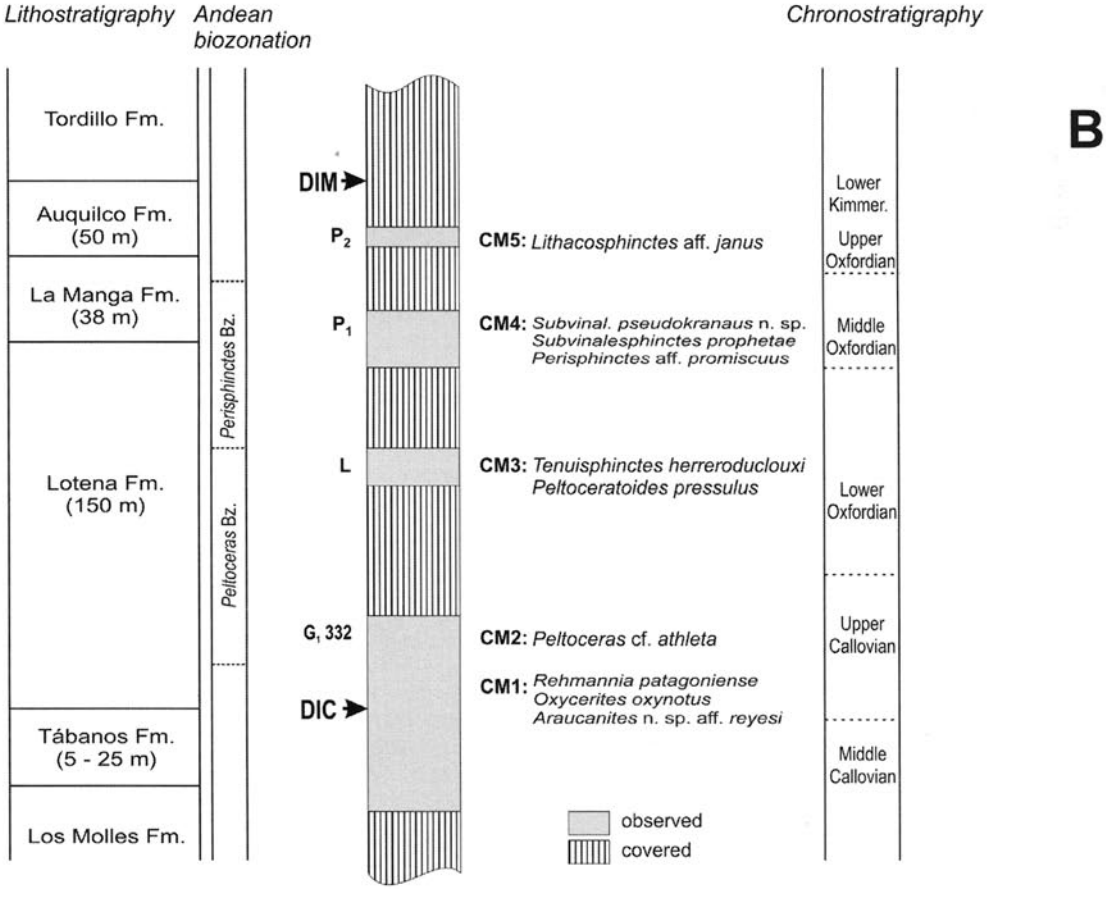
The marine Upper Jurassic sedimentary record of the Neuquén-Mendoza Basin in West-Central Argentina crops out through Neuquén, Mendoza and San Juan provinces. The marine Upper Callovian to Lower Kimmeridgian rocks are commonly included in the Lotena, La Manga (= Barda Negra in the subsurface to the east), and Auquilco formations (GULISANO et al. 1984; RICCARDI & DAMBORENEA 1993; see Fig. 2). The sequence comprises the Lotena-Chacay Subsintheme of RICCARDI & GULISANO (1990), which is bounded, through most of the basin, by the "Intra-Callovian Discontinuity" (DIC) at its base and the "Intra-Malmic Discontinuity" (DIM) at its top (RICCARDI & GULISANO 1990: 359, 361). The Upper Jurassic stratigraphy of the Chacay Melehué area has been described in last decades by HERRERO DUCLOUX (1948), LEANZA & ZÖLLNER (1949), ZÖLLNER & AMOS (1973), and DELLAPÉ et al. (1979). The most significant lithological features of the Oxfordian sequence are summarized in PARENT (1998: 265).

The stratigraphic positions of all samples are indicated in Fig. 2. A bed or set of adjoining beds (i.e. the rocks), with its content of ammonites (i.e. the fauna), in the sections are defined and labelled as *faunal levels* (CM1–CM5); their correspondence with the beds used by PARENT (1998) is indicated in Fig. 2.

In this paper the use of the word *zone* is in the sense of standard chronostratigraphic classification of the Submediterranean scale of Europe as given by CALLOMON (2003) for the Callovian and by ZEISS (2003) for the Oxfordian. Correlations with some of the emergent alternative zonations for the Lower Oxfordian of southern Europe are given by ZEISS (2003: fig. 3) and by

Fig. 2. A: Sections of the outcrops A–C, Chacay Melehué. Covered segments are not to scale; bed numbers (G_1 332, L, P_1, P_2) for the faunal levels CM1–CM5 after PARENT (1998). – **B**: Stratigraphic classification of and ammonite occurrences in outcrops A–C in composite section. Chronostratigraphy derived from the biostratigraphy of the ammonite faunas as discussed in the text. – DIC, Intra-Callovian Discontinuity; DIM, Intra-Malmic Discontinuity. Biozones after RICCARDI (1984).


A
CM2
Lotena Fm.
CM1
DIC
Tábanos Fm.
Los Molles Fm.
10 m
0
Outcrop A
La Manga Fm.
CM4
Lotena Fm.
Lotena Fm.
CM3
Outcrop B
CM5
Auquilco Fm.
Outcrop C
gypsum/evaporite
sandstone
shale / siltstone
covered
limestone
marl
marl with oysters (CAG)
concretions


Lithostratigraphy
Andean biozonation
Chronostratigraphy
B
Tordillo Fm.
Auquilco Fm. (50 m)
La Manga Fm. (38 m)
Lotena Fm. (150 m)
Tábanos Fm. (5 - 25 m)
Los Molles Fm.
Perisphinctes Bz.
Peltoceras Bz.
DIM
P2
P1
L
G, 332
DIC
CM5: Lithacosphinctes aff. janus
CM4: Subvinal. pseudokranaus n. sp.
Subvinalesphinctes prophetae
Perisphinctes aff. promiscuus
CM3: Tenuisphinctes herreroduclouxi
Peltoceratoides pressulus
CM2: Peltoceras cf. athleta
CM1: Rehmannia patagoniense
Oxycerites oxynotus
Araucanites n. sp. aff. reyesi
observed
covered
Lower Kimmer.
Upper Oxfordian
Middle Oxfordian
Lower Oxfordian
Upper Callovian
Middle Callovian

CARIOU et al. (1997). It is well known that the *transversarium* Zone as used by GYGI & HILLEBRANDT (1991) includes part of the Primary Standard Chronostratigraphic *plicatilis* Zone.

Systematic paleontology

The described material is deposited in the Laboratorio de Paleontología y Biocronología, Universidad Nacional de Rosario (LPB) and Museo de Paleontología de la Fundación Casa del Pueblo, Firmat (FCP-I). Measured characters used as biometric variables are the following: diameter (*D*), diameter at the last adult septum (*D*ls), final adult diameter at peristome (*D*p), umbilical width (*U*), whorl width (*W*), whorl height (H_1), and whorl ventral height (H_2), all given in millimetres [mm]; counts of number of primary (*P*) and ventral ribs (*V*) per half whorl; and length of body-chamber at the base of the adult peristome (*LBC*) in degrees [°]. Body-chamber is abbreviated with Bc and phragmocone with Ph. [M]: macroconch female, [m]: microconch male. Open nomenclature is as recommended by BENGTSON (1988).

Superfamily Perisphinctoidea STEINMANN, 1890
Family Perisphinctidae STEINMANN, 1890
Subfamily Perisphinctinae STEINMANN, 1890

Perisphinctes WAAGEN, 1869

Type species: *Ammonites variocostatus* BUCKLAND, 1836; SD by ARKELL proposed in 1951, accepted by ICZN in 1954.

Perisphinctes (*Kranaosphinctes*) BUCKMAN, 1921

Type species: *Kranaosphinctes kranaus* BUCKMAN, 1921.

Perisphinctes (*Kranaosphinctes*) aff. *promiscuus* BUKOWSKI, 1887 [M]

Figs. 3A–C, Tab. 1

aff. *1887 *Perisphinctes promiscuus* n.f. – BUKOWSKI: 137, pl. 29 fig. 1 [lectotype], 2, non pl. 28 fig. 1.
aff. 1980 *Perisphinctes* (*Kranaosphinctes*) *promiscuus* BUKOWSKI. – MALINOWSKA: 464, pl. 143 fig. 3 [lectotype].
aff. 2002 *Perisphinctes* (*Kranaosphinctes*) *promiscuus* BUKOWSKI. – GLOWNIAK: 337, pl. 1 figs. 1–2, pl. 3 fig. 3.

Material: A well preserved, adult macroconch (FCP–I–M 070) extracted from a concretion in faunal level CM4, Chacay Melehué, La Manga Fm.

Description: Adult macroconch with complete phragmocone and almost complete body-chamber, maximum preserved diameter about 100 mm. Inner whorls ($2 < D < 40$ mm) evolute, with wide umbilicus, rounded, wider than high whorl section with broadly convex flanks and venter. At $D = 2$ mm ornamentation consists of wide, rounded lateral ribs which in next whorl become fine, densely spaced and slightly prorsiradiate ribs. At $D = 15$ mm primary ribs bifurcate at the ventro-lateral shoulder: one secondary orthogonally crosses the venter and the other forming an arch convex towards the peristome. The last whorl of the phragmocone ($40 < D < 65$ mm) shows a wide umbilicus with low wall and rounded shoulder; the whorl section is depressed-oval to subcircular, with a widely rounded venter. The primary ribs are strong, slightly prorsiradiate and flexuous bifurcating on the ventro-lateral shoulder; the ventrals and some few intercalatories cross the venter orthogonally but become blunted (in the internal mould they are interrupted by a smooth band of 2–3 mm width). There are six widely-spaced constrictions irregularly intercalated on the phragmocone at diameters of 29, 33, 40, 51, 52, and 65 mm. The body-chamber (estimated *LBC* = 300°) is very evolute, uncoiled through the last third preserved. It has a depressed, rounded whorl section, wider on the lower third of the flanks. Ribbing is very irregular, the primary ribs arise in the umbilical wall, are very strong and sharp, blade-like, trifurcate, less commonly bifurcate, on the upper third of flanks; there are a few intercalatories, and one of the primary ribs is divided in a virgatotome style (Fig. $3A_1$). The peristome is not preserved.

Remarks: There is some resemblance with the Andean *Caracoliceras dunkeri* (STEINMANN, 1881) and related forms (HILLEBRANDT et al. 2000), especially in the inner whorls, but significant differences distinguish them from the described specimen. *C. dunkeri* and comparable forms (in HILLEBRANDT et al. 2000) tend to be more involute and narrowly umbilicate, wider in whorl section with flat flanks. The ornamentation of middle and outer whorls is very different: dense and multi-furcating in sheaves, fading away on the body-chamber in *Caracoliceras*, but bi- or trifurcated, becoming coarser on the body-chamber, in *P.* aff. *promiscuus*. The ribbing curves are both bell-shaped with a max $P = 24$ at $D = 70$–80 mm in *C. dunkeri* but at $D = 30$ mm in the present specimen. Within Tethyan perisphinctids the best resemblance to the present specimen is, in shape and ornamentation, *P. promiscuus* as figured by BUKOWSKI (1887: pl. 29 fig. 1, lectotype refigured by MALINOWSKA 1980: pl. 143 fig. 3) and GLOWNIAK (2002: pl. 1 figs. 1–2, pl. 3 fig. 3). The lectotype (designated by NEUMANN 1907: 37) was originally figured by a hand-drawn picture. *P. promiscuus* is characterized by its very evolute and densely ribbed, rounded whorl section in inner and juvenile whorls, and its more coarsely ribbed adult body-chamber which tends to be more depressed, showing some trifurcate ribs (see GLOWNIAK 2002). Our specimen slightly differs in its irregular ribbing on the preserved portion of body-chamber.

P. promiscuus occurs in the early *plicatilis* Zone (CALLOMON 1988).

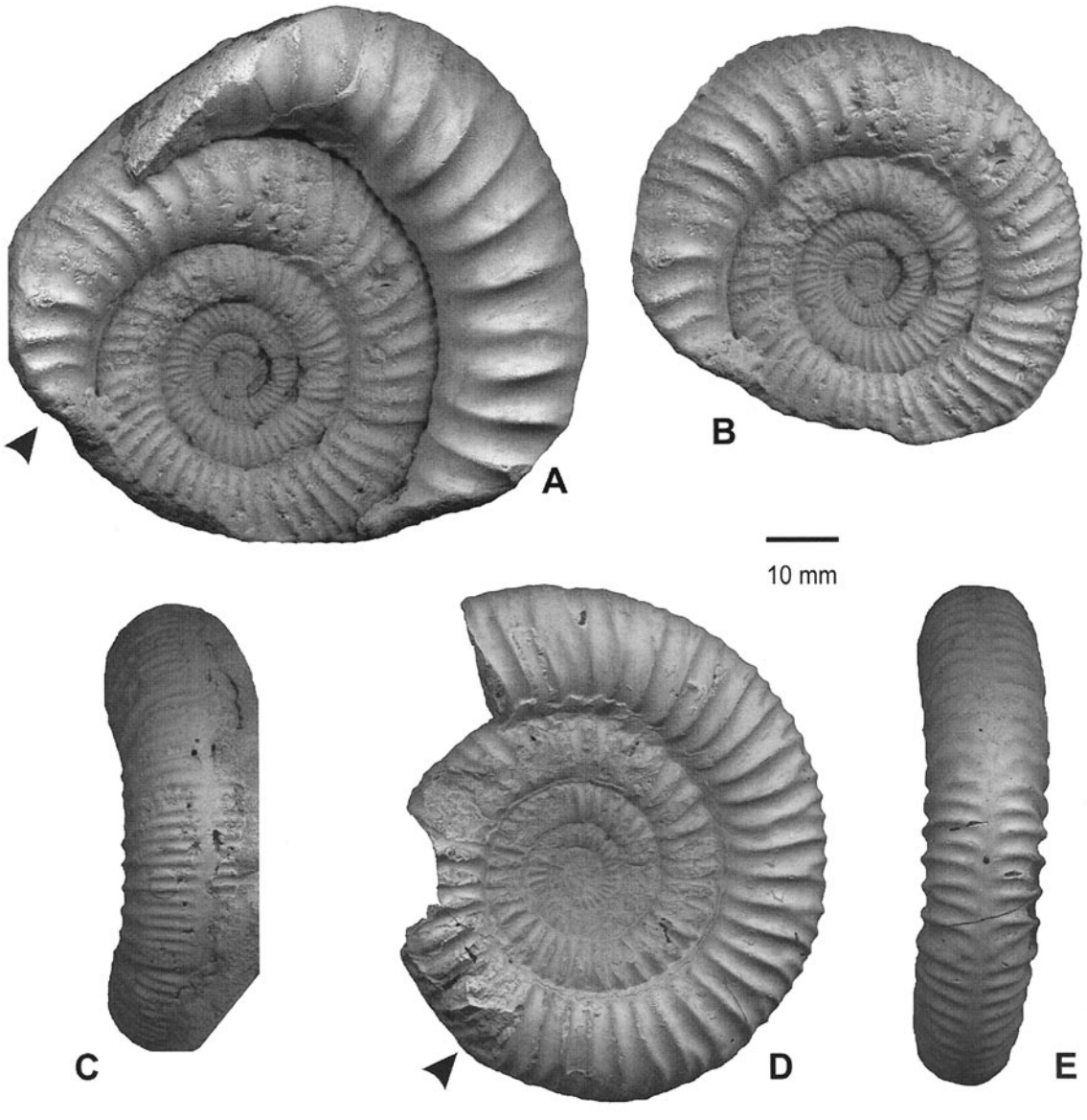


Fig. 3. A–C: *Perisphinctes* (*Kranaosphinctes*) aff. *promiscuus* BUKOWSKI, 1887, adult macroconch (FCP-I-M 070) with incomplete body-chamber; **A**. lateral view of the complete specimen; **B–C**. lateral and ventral views of the specimen with detached body-chamber showing ventral ribbing of the phragmocone. – **D–E**: *Subvinalesphinctes prophetae* (GYGI & HILLEBRANDT, 1991); lateral (**D**) and ventral (**E**) views of the almost complete microconch (FCP-I-M 073). – Both specimens from Chacay Melehué, faunal level CM4, La Manga Fm. Natural size (x1), arrow at last septum.

Tenuisphinctes GYGI, 1998

Type species: *Tenuisphinctes* (*Tenuisphinctes*) *kruegeri* GYGI, 1998 [M], by OD.

Tenuisphinctes herreroduclouxi (LEANZA, 1947) [M & m?]

Figs. 4A–F, 5A–C, Tab. 1

* 1947 *Idoceras herrero-duclouxi* n. sp. LEANZA: 7, pl. 1 figs. 1, 6–7, 8–9 [lectotype].
1966 *Idoceras herrero-duclouxi* LEANZA. – STIPANICIC: 460.
1979 *Idoceras*. – DELLAPÉ et al.: 83, 91 *pars*.
1998 *Perisphinctes* (*Prososphinctes*?) sp. – PARENT: 265.

Lectotype: LEANZA (1947) did not designate a type specimen. We therefore here designate the specimen figured in his Plate 1, figures 8–9 as lectotype, an adult macroconch which is herein refigured in Fig. 4A–B. There are five paralectotypes, three of which were figured by LEANZA (1947: pl. 1 figs. 1, 6–7), herein refigured in Fig. 4C–E.

Material: A complete adult macroconch (LPB 326) from faunal level CM3 of the Lotena Fm. at Chacay Melehué; three

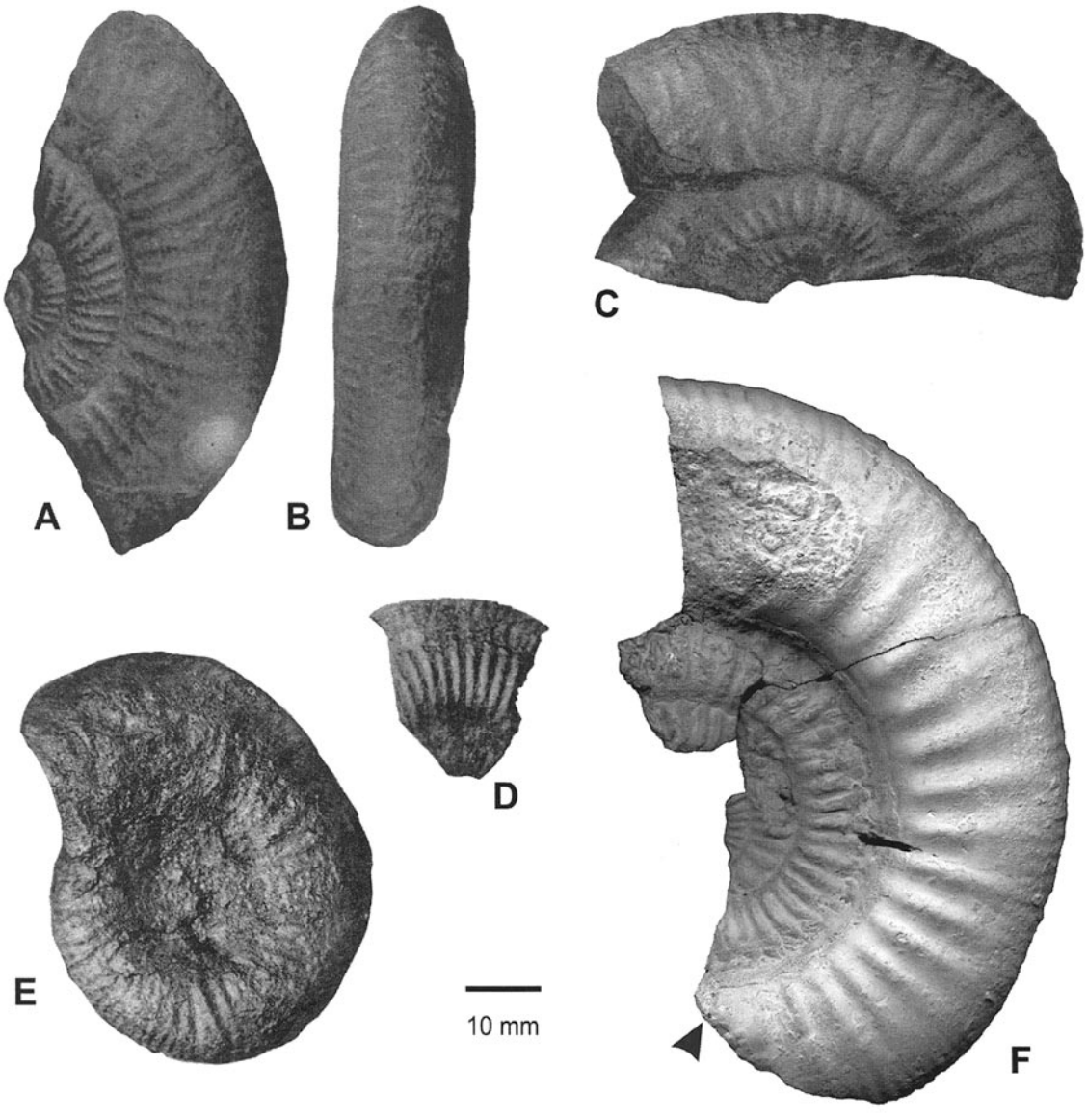


Fig. 4. *Tenuisphinctes herreroduclouxi* (LEANZA, 1947). Lectotype (**A–B**) and paralectotypes (**C–E**) refigured from LEANZA (1947: pl. 1); **A–D**: macroconchs; **E**: probable microconch; **F**: adult macroconch (LPB 326) from Chacay Melehué, faunal level CM3, Lotena Fm. All natural size (x1), arrow at last septum.

fragmentary, probable conspecific specimens loose from beds equivalent to faunal level CM3.

Type horizon and type locality: Lotena Fm., Lower Oxfordian beds at Rahuecó, Neuquén (Fig. 1). LEANZA (1947: 8) stated: "Arroyo Rahuecó, Cerro Caicayén, Neuquén. Arcillas y calizas azuladas. Horizonte con *Idoceras herrero-duclouxi* n. sp. Kimmeridgiano". The type horizon remains to be established by new bed-by-bed sampling.

Diagnosis: Medium to small adult size, evolute. Inner whorls depressed subrectangular with subradial primary ribs; middle and outer whorls subcircular to compressed with slightly prosocline to radial primary ribs; body-chamber compressed with wide, strong primaries divided in two or three finer secondaries on the upper third of flanks which cross the venter unchanged.

Description: Inner whorls at D = 10–15 mm depressed and evolute, with sharp, slightly prorsiradiate primary ribs. At D > 20 mm, rounded subcircular whorl section, with low umbilical wall where sharp, prorsiradiate primary ribs arise with furcation point hidden by the subsequent whorl. Body-chamber (D > 60–80 mm) very compressed, suboval in whorl section, flanks converging in a narrow and rounded venter. Primary ribs are strong, wide, prorsiradiate; they arise on the umbilical

Tab. 1. Dimensions of the specimens described. Symbols and abbreviations as in text.

	D [mm]	*U* [mm]	*W* [mm]	H_1 [mm]	H_2 [mm]	H_2/H_1	W/H_1	P
***Perisphinctes (Kranaosphinctes)* aff. *promiscuus* BUKOWSKI, 1887 [M]**								
FCP-I-M 070, *LBC* > 300°	100.00							19
	66.00	35.30	22.00	17.50			1.26	20
	39.00							23
	30.50							24
	17.00							20
	12.50							17
***Tenuisphinctes herreroduclouxi* (LEANZA, 1947) [M & ?m]**								
Lectotype [M]	80.00			22.00				24
	35.00							20
Paralectot. (LEANZA 1947: pl. 1: 1)	73.00			22.00				22
	115.00		25.00	31.00			0.81	21
	75.00	29.00	20.00	24.70			0.81	
	53.00							22
	43.00		13.00	14.00			0.93	
LPB 326 [M]	30.00							19
***Subvinalesphinctes pseudokranaus* n. sp.**								
Holotype, LPB 707 [M]	83.00	47.00	23.60	18.60				15
	65.40	39.20	21.00	16.80				14
	10.70							16
LPB 286	78.00							17
	50.00							18
	30.30		9.50					19
	23.00	10.30	7.60		5.20			18
	12.70	6.20	4.10	3.60	3.10			20
	10.40	4.70	3.50	3.10	2.70			17
LPB 501/1	28.00							13
	15.00							14
LPB 486	55.00							14
***Subvinalesphinctes prophetae* (GYGI & HILLEBRANDT, 1991) [m]**								
FCP-I-M 073, *LBC* > 240°	72.00	40.10	18.00	18.50	18.00	0.97	0.97	22
	56.50	31.00	15.50	16.00			0.97	21
	40.00							17
	33.00	17.20						18
	17.00							13
***Lithacosphinctes* aff. *janus* (CHOFFAT, 1893) [M]**								
LPB 426, LBC ≈ 360°	180.00							30
	110.62	48.90	31.00	33.30	28.00	0.84	0.93	61
	81.25	30.40	28.00	25.00			1.12	55
	63.26	22.40	21.50	21.60	14.30	0.66	1.00	47
	39.58	16.60	17.00	16.00			1.06	40
	26.74	12.50	11.60	11.10	9.10	0.82	1.05	38
	17.78	8.90	8.90	8.10	7.10	0.88	1.10	36
	10.75	4.80	4.90	4.20	3.20	0.76	1.17	31

shoulder and bifurcate on the upper third of flanks, then divide in sheaves of three finer secondaries; there abundant intercalatories occur which cross the venter together with the secondaries without change. The body-chamber is partially preserved in specimen LPB 326, peristome lacking.

Remarks: Variocostate ribbing seen in larger specimens (Figs. 4A–C, F) indicates that they are macroconchs. The smallest paralectotype (Fig. 4E), equicostate with uncoiled body-chamber, seems to be an adult microconch. The general aspect of this specimen matches well that of *Perisphinctes* (*Otosphinctes*), e.g., *P.* (*O.*) *montfalconensis* DE LORIOL (in MELÉNDEZ et al. 1983: pl. 2 fig. 3, pl. 5 fig. 2). Intraspecific variability of the known material seems to be not very high and is mainly expressed in the primary ribbing with some specimens showing rather coarse and sparse ribbing and others with denser and finer ribbing on flanks. A generic attribution for the species is not easy to decide. There is good agreement with the diagnostic features of *Tenuisphinctes* with respect to the compressed body-chamber, moderate adult size, rounded whorls in phragmocone, rather densely ribbed inner whorls with furcation point hidden by the subsequent whorl, and coarse primaries with finer ventral ribs. On the other hand, the adult macroconch from Chacay Melehué (Fig. 4F) recalls the Polish specimens of the lower part of the *plicatilis* Zone, described as *Liosphinctes cumnorensis* and *L.* sp. A by GLOWNIAK (2002: figs. 27 and 25 respectively), especially by their compressed and evolute shell with prorsiradiate primaries and abundant ventrals on the body-chamber. These features are also typical of *Tenuisphinctes* GYGI, and a separation of all these forms is weak. Other closely comparable forms are: *Alligaticeras* aff. *rotifer* as figured by COX (1988: pl. 23 fig. 1) from the *athleta* Zone of Woodham, and, especially *?Alligaticeras* sp. figured by VIDIER et al. (1993: pl. 1 fig. 1) from the *lamberti* Zone of the Boulonnais area in northern France.

Distribution: Rahuecó (type locality) and Chacay Melehué. Recently collected material (still unpublished) from Sierra Vaca Muerta, Neuquén, seems to belong to this, or a closely related species, although its position is stratigraphically somewhat deeper.

Subfamily Vinalesphinctinae MELÉNDEZ & MYCZYNSKI, 1987

Type genus: *Vinalesphinctes* SPATH, 1931.

Remarks: This taxon is based on morpho-spatial criteria and seems useful in this analytical phase of taxonomy for including species described below, and most of those described by O'CONNELL (1920), JAWORSKI (1940), SANCHEZ-ROIG (1951), JUDOLEY & FURRAZOLA (1968), WIERZBOWSKI (1976), and GYGI & HILLEBRANDT (1991). The subfamily was erected by MELÉNDEZ & MYCZYNSKI (1987) based on the following characters: (1) small adult size of both macro- and microconchs; (2) low variocostation of adult macroconchs; (3) a distinctive ribbing style, unknown in European perisphinctids, characterized by convex primaries on the flank and regular alternation of simple and bifurcate primaries [from the inner whorls, see diagnoses of WIERZBOWSKI (1976)]; and (4) suture line with simplified suspensive-lobe, "vinalesphinctoid"-type [sic]. There are other features occurring in almost all the species studied by WIERZBOWSKI (1976) and JUDOLEY & FURRAZOLA (1968): (a) microconchs have short and wide lappets; (b) body-chamber is relatively long; ranges of *LBC* based on plates of WIERZBOWSKI (1976) are as follows (lower macroconch values correspond to almost complete specimens; considered microconchs are only those with lappets assumed fully grown): *Vinalesphinctes* [M] (>300°–410°), [m] (280°–330°); *Cubasphinctes* [M] (>315°–390°), [m] (300°–360°). Especially significant is *LBC* of microconchs which normally, in Perisphinctidae, have shorter body-chambers than macroconchs, around 270°–290° long; and (c) ribbing typically irregular, including polyschizotome and/or polygyrate ribs with abundant intercalatories, especially in discoidal forms (*Cubasphinctes*); and well marked constrictions preceded by a prominent pseudo-polyschizotomic rib, frequently polyfurcate or with intercalatories, and followed by one or two prominent simple, sometimes flared ribs.

After the studies of WIERZBOWSKI (1976) and MYCZYNSKI & PSZCZOLKOWSKI (1976) it seems evident that there are two lineages with sustained morphology and patterns of intraspecific variation: *Subvinalesphinctes-Vinalesphinctes* and *Cubasphinctes*, as defined below.

Genus *Subvinalesphinctes* WIERZBOWSKI, 1976 [M & m] (Type species: *Perisphinctes corrali* JUDOLEY & FURRAZOLA, 1968). Perisphinctids evolute throughout juvenile and adult ontogeny, rounded to subrectangular whorl section, moderately strong ribbing becoming even stronger on flanks of body-chamber but fading on the venter. The separation from *Vinalesphinctes* is justified, not only on morphological grounds but also by its lower stratigraphic position in Cuba and the lowermost known occurrence of the subfamily in the Andes with *Subvinalesphinctes pseudokranaus* n. sp. (described below). The microconchs are described by WIERZBOWSKI (1976) under *Vinalesphinctes* (*Roigites*). The macroconchs show a tendency toward smoothing of the body-chamber, it typically starts with a smooth venter in earlier forms (genus *Subvinalesphinctes*) progressing to smoothing of venter and flanks in later forms (genus *Vinalesphinctes*).

Genus *Vinalesphinctes* SPATH, 1931 (Type species: *Vinalesphinctes roigi* SPATH, 1931). Subgenera for sexual dimorphs are available: *Vinalesphinctes* SPATH, 1931 [M]; *Roigites* WIERZBOWSKI, 1976 [m] (Type species: *Prososphinctes subconsociatus* SPATH, 1931). Macroconchs differ from those of *Subvinalesphinctes* in their

smooth body-chamber, where only large and well spaced primaries are developed, but microconchs are indistinguishable, evidencing the close genetic relationship.

Genus *Cubasphinctes* JUDOLEY & FURRAZOLA, 1968 (Type species: *Perisphinctes jaworskii* JUDOLEY & FURRAZOLA, 1968). Subgenera for sexual dimorphs are available: *Cubasphinctes* JUDOLEY & FURRAZOLA, 1968 [M]; *Antilloceras* WIERZBOWSKI, 1976 [m] (Type species: *Perisphinctes antillarum* JAWORSKI, 1940). As used by MELÉNDEZ et al. (1988: 429) but including also the macroconchs described by WIERZBOWSKI (1976) as *Discosphinctes*, which are co-occurring ammonites differing only in their more densely and finely ribbed whorls.

The limits between these genera are well evident when the body-chamber is considered; nevertheless, within *Vinalesphinctes* and *Cubasphinctes* coexisted species with densely ribbed, evolute inner whorls beside others that are less densely ribbed and have more involute inner whorls. The specimen from San Carlos Valley, figured by WIERZBOWSKI (1976: pl. 1 fig. 1) as *Vinalesphinctes roigi,* has densely ribbed and involute inner whorls (*Cubasphinctes*-like) and a rather smooth body-chamber (*Vinalesphinctes*-like). On the other hand, the holotype of *Perisphinctes poeyi* JUDOLEY & FURRAZOLA (1968: pls. 15–17) shows strongly ribbed inner whorls, a rounded whorl section (*Subvinalesphinctes*-like) and a compressed, densely ribbed body-chamber (*Cubasphinctes*-like).

The known record of morphospecies included in Vinalesphinctinae suggests a spatio-temporal distribution comprising, at least, the lower *plicatilis* to the lower *bifurcatus* zones (Middle Oxfordian) in the Caribbean region (Cuba and part of México) and the Andean Neuquén-Mendoza and Tarapacá basins. *Subvinalesphinctes pseudokranaus* n. sp. seems to be the earliest Vinalesphinctinae known (lower *plicatilis* Zone), which could have given rise to the perisphinctid fauna of the Caribbean region. The *Vinalesphinctes*, *Roigites* and *Discosphinctes* described by BEZNOSOV & MITTA (1995) show a trend toward the development of a smooth body-chamber in the adult stage as the only vinalesphinctinid feature. Moreover, two alternative possibilities are evident: they are true Vinalesphinctinae and the subfamily is much more widely extended than supposed; or they simply represent homoeomorphs which is not unusual in almost all perisphinctids around the world.

Subvinalesphinctes WIERZBOWSKI, 1976

Type species: *Perisphinctes corrali* JUDOLEY & FURRAZOLA, 1968

Subvinalesphinctes pseudokranaus n. sp. [M]

Figs. 5D–G, 6A–I, Tab. 1

? 1988 *Perisphinctes* (*Kranaoshinctes*) sp. – ATROPS & MARQUES: pl. 1 fig. 1.

1998 *Perisphinctes* (*Kranaosphinctes*) gr. *kranaus-decurrens* BUCKMAN spp. [M]. – PARENT: 265, 269.

2003 *Perisphinctes* (*Kranaosphinctes*) gr. *kranaus-decurrens* BUCKMAN. – PARENT: 152.

Derivatio nominis: An allusion to its resemblance to *Perisphinctes kranaus* (BUCKMAN, 1921).

Material: The holotype, four almost complete adult specimens (LPB 286, 501/1–3) and a fragment of body-chamber (LPB 486); all from Chacay Melehué, faunal level CM4, bluish marls with oysters ("Calizas azules con *Gryphaea*"), La Manga Fm.

Holotype: The specimen LPB 707 in Figs. 6A–C, a well preserved, adult macroconch with complete phragmocone and half whorl of its body-chamber.

Type locality: Chacay Melehué, Neuquén (Fig. 1).

Type horizon: Bed P_1, faunal level CM4 (Fig. 2), La Manga Fm., Middle Oxfordian.

Diagnosis: Small macroconch, evolute and depressed with smooth venter; inner whorls with simple, prorsiradiate primary ribs; body-chamber with strong, prorsiradiate primaries and widely rounded, smooth to weakly ribbed venter.

Description: At D = 5–7 mm shell depressed and evolute, venter smooth, flanks with fine prorsiradiate, undivided primaries. At 7 < D < 10 mm shell serpenticone ($H_2/H_1 = 0.26$) with wide umbilicus ($U/D = 0.45$); whorl section subrectangular, wider than high (W/H_1 = 1.35), with broadly rounded venter and flat flanks. Primary ribs arise in umbilical seam, prorsiradiate, wide and rounded (P = 17–20), and reach the ventro-lateral shoulder with a slight enlargement and fade away at this point without any furcation. At D = 20 mm the whorl section becomes subcircular to rounded depressed with inflated flanks. The lateral ribbing remains unchanged but some primaries divide on the ventro-lateral shoulder and all the ribs cross the venter orthogonally but vanished (P = 18). At D > 30 mm whorl section is rounded to suboval depressed; the primary ribs (P = 19–20) arise on the umbilical shoulder and are stronger and blade-like. On the ventro-lateral shoulder the ribs tend to fade out without furcating, only in the larger specimens the venter of the body-chamber is undulated by very low, rounded orthogonal ventral ribs. Some scattered parabolic structures appear on the ventro-lateral shoulder around the last septum at D = 40–50 mm. The length of the body-chamber is 250–270°. The peristome is partially preserved in one specimen (LPB 286). It is simple, slightly projected ventrally with a dorsal sinus at each side. Estimated adult size D = 70–90 mm. The fragment of a body-chamber preserving the test, is not ribbed, showing only growth lines; the whorl section is subcircular.

Discussion: The type series encompasses a moderate range of variability, mainly in the adult size and in the whorl section. This conspicuous morphology has no counterpart in any other described Andean form. The most similar species are *Subvinalesphinctes corrali* (JUDOLEY & FURRAZOLA, 1968: pls. 41–42) and "*Decipia*

aff. *lintonensis*" (in JUDOLEY & FURRAZOLA 1968: pl. 49) from the Oxfordian of Cuba, differing in their always ribbed venter and less subrectangular whorl section of the innermost whorls. The densely ribbed and depressed inner whorls, ventrally smooth middle and outer depressed whorls, and very strong and wide, prosocline primaries of the body-chamber, suggest the inclusion of the new species in *Perisphinctes* (*Kranaosphinctes*) (in the sense of ARKELL 1957 and MELÉNDEZ 1989). Nevertheless, the much smaller adult size, the geographic separation, and the similarity of *S. pseudokranaus* with *S. corrali* and allied forms, indicate inclusion in *Subvinalesphinctes*, as its earliest currently known member, probably closely related to *P. kranaus*. The specimen from Arroyo de la Manga, Mendoza, described as *Perisphinctes* (*Kranaosphinctes*) cf. *decurrens* BUCKMAN by STIPANICIC (1951: pl. 1 fig. 1) differs in its larger adult size, the presence of constrictions and denser and more rectiradiate lateral ribbing of the inner whorls.

A closely comparable specimen from Portugal was described as *P.* (*Kranaosphinctes*) sp. by ATROPS & MARQUES (1988: pl. 1 fig. 1) and dated as coming from the *plicatilis* Zone. The specimen of *P. kranaus* from the *plicatilis* Zone of Ariño, Spain (MELÉNDEZ et al. 1983: pl. 6) is larger but closely comparable. *S. pseudokranaus* n. sp. differs from the holotype of *P. kranaus* (ARKELL 1939: pl. 39 fig. 5) in the more persistently flat and smooth venter of the innermost whorls (about at least *D* = 10 mm), undivided primaries which fade away on the ventro-lateral shoulder, absence of intercalatories and constrictions, and the much smaller adult size. *Perisphinctes* (*Arisphinctes*) *maximus* (YOUNG & BIRD, 1822) described from Germany (SIEGFRIED 1952: pl. E fig. 1), Poland (MALINOWSKA 1972: pl. 3), and England, with evolute, finely and densely ribbed inner whorls changing to coarsely and prorsiradiate ribbed, and a rounded whorl section towards the body-chamber, is very similar in shape but five or six times as large in size.

S. pseudokranaus n. sp. resembles *T. herreroduclouxi* in the inner whorls, but strongly differs in the last whorls of the phragmocone and the body-chamber, which, in the new species, are rounded depressed and strongly ribbed on the flanks with a smooth venter whereas *T. herreroduclouxi* is compressed suboval in whorl section with a densely ribbed venter.

Distribution: At present only known from the type locality. The closely comparable specimen from Portugal (ATROPS & MARQUES 1988: pl. 1 fig. 1) could indicate a wider paleobiogeographic distribution.

Subvinalesphinctes prophetae (GYGI & HILLEBRANDT, 1991) [m]

Figs. 3D–E, Tab. 1

? 1968 *Perisphinctes* (*Dichotomosphinctes*) *plicatiloides* O'CONNELL. – JUDOLEY & FURRAZOLA: 92, pl. 23 fig. 4, pl. 39 fig. 2, pl. 40 figs. 1–3.

* 1991 *Perisphinctes* (*Antilloceras*) *prophetae* n. sp. GYGI & HILLEBRANDT: 151, pl. 2 figs. 1 [holotype], 3–4, cf. fig. 2.

1998 *Perisphinctes* (*Antilloceras*) *prophetae* GYGI & HILLEBRANDT. – MYCZYNSKI et al.: 188.

Material: A well preserved specimen (FCP-I-M 073) from a concretion of faunal level CM4, Chacay Melehué, La Manga Fm.

Description: Adult microconch with almost complete body-chamber, maximum preserved diameter 72 mm, phragmocone preserved from D = 10 mm. Evolute (H_2/H_1 = 0.97 at D = 72 mm), widely and shallowly umbilicate with subrectangular rounded whorl section, slightly higher than wide on the phragmocone and body-chamber. There are no constrictions discernible. The ornamentation of the phragmocone is composed of strong, widely spaced primary ribs, prorsiradiate or slightly rursiradiate, with furcation point hidden by the following whorl. On the body-chamber the ribbing is rather irregular; primaries strong, sharp, and widely spaced, with a twist at the umbilical shoulder; prorsiradiate and slightly flexuous on the flanks. They each divide into two secondaries on the upper third of the flank. Simple, undivided ribs occur each three or five of the bifurcated ones. The ventral ribs are as strong as the primaries and form a shallow sinus backwards; they are all interrupted by a siphonal groove or band (weaker on the test). The body-chamber is well preserved (*LBC* > 240°) and almost complete, but lacks the peristome. The diameter at the last septum is *D*ls = 52 mm.

Remarks and comparison: The specimen is almost identical to the holotype (GYGI & HILLEBRANDT 1991: pl. 2 fig. 1), only differing in details of the ornamentation: the holotype exhibits few constrictions on the body-chamber and the primary ribs are somewhat straighter. However, the ventral ribbing of the holotype is strong and interrupted by a siphonal groove (seen in a cast provided by R. PANCHAUD) resembling the specimen under study. GYGI & HILLEBRANDT (1991) and MYCZYNSKI et al. (1998) have already pointed out the close resemblance between *S. prophetae* and *Perisphinctes arkelli* GLOWNIAK, 2000 [m] [= *Perisphinctes rotoides* RONCHADZÉ, 1917 sensu ARKELL] both in shape and ornamentation [e.g., GLOWNIAK 2000: pl. 5 figs. 1 (holotype) , 2]. *S. prophetae* was originally assigned to the subgenus *Antilloceras* WIERZBOWSKI, 1976. The latter includes microconchs of *Cubasphinctes* as pointed out above and is characterized by a dense ribbing of the inner whorls and a rather involute coiling with a whorl section higher than wide, so that *S. prophetae* should not be included in this subgenus. It is here included in *Subvinalesphinctes* because of its strong ornamentation of the inner and outer whorls on a depressed to rounded whorl section. *S. prophetae* is indistinguishable from most of the specimens of *Subvinalesphinctes plicatiloides* figured by JUDOLEY & FURRAZOLA (1968, see synonymy) and is very similar to *Subvinalesphinctes*

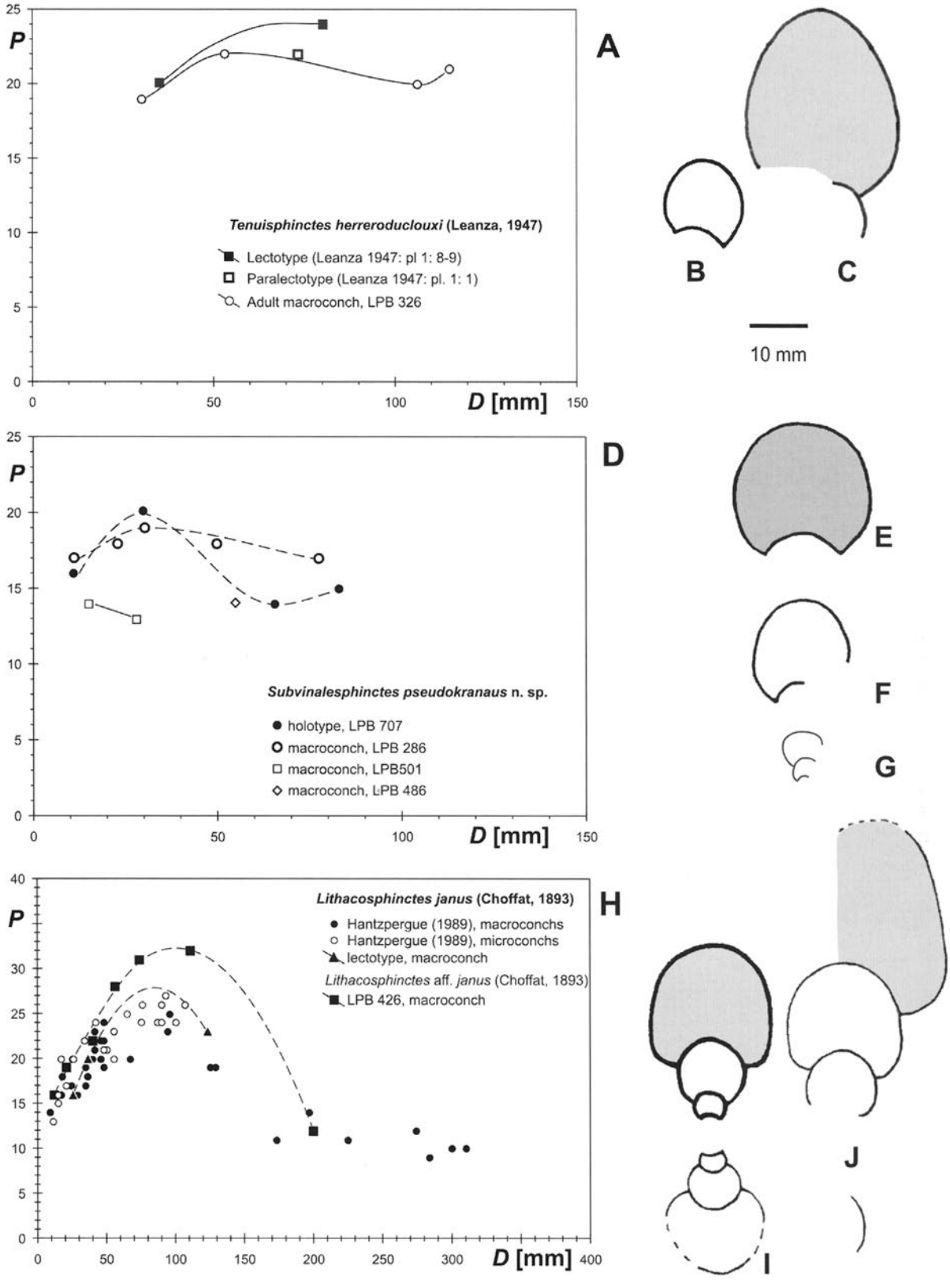


Fig. 5. **A–C**: *Tenuisphinctes herreroduclouxi* (LEANZA); **A**. ribbing curve (primaries per half whorl); **B**. whorl section of specimen LPB 326 (last whorl of phragmocone at $D = 56$ mm); **C**. same specimen, whorl section of the body-chamber (shaded at about $D = 105$ mm). – **D–G**: *Subvinalesphinctes pseudokranaus* n. sp.; **D**. ribbing curve (primaries per half whorl); **E**. body-chamber (shaded) whorl section of the holotype (LPB 707) at $D = 85$ mm; **F**. whorl section of the ?macroconch LPB 501 at $D = 49$ mm (last septum); **G**. whorl section of inner whorls of ?macroconch LPB 286 at D = 22.3 mm. – **H–J**: *Lithacosphinctes* aff. *janus* (CHOFFAT); **H**. ribbing curve (primaries per half whorl) including the type specimen (in CHOFFAT 1893) and comparative material from HANTZPERGUE (1989); **I–J**. whorl sections of the adult macroconch LPB 426 taken at different diameters, body-chamber shaded. All natural size (x1).

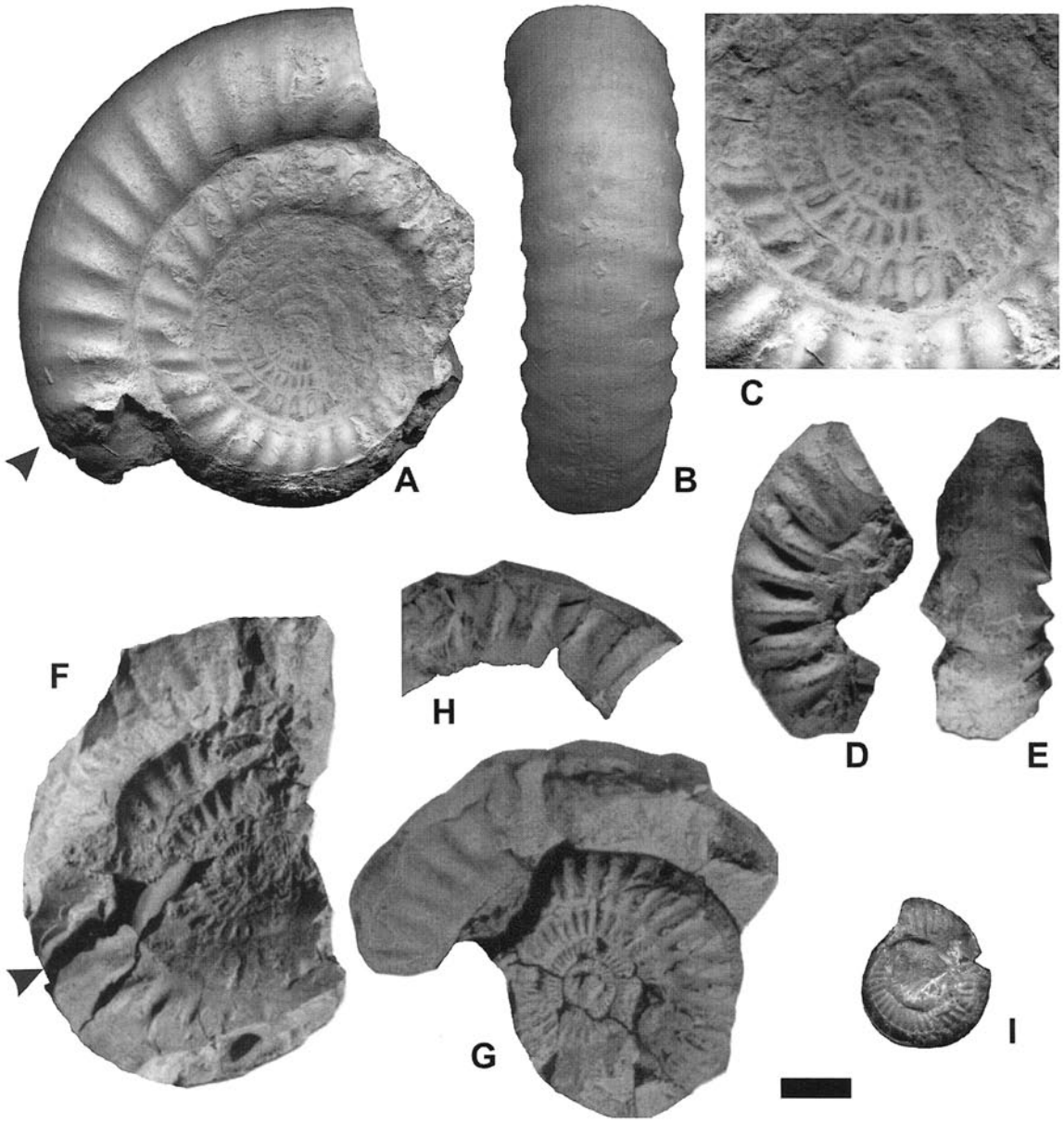


Fig. 6. *Subvinalesphinctes pseudokranaus* n. sp., Chacay Melehué, faunal level CM4, La Manga Fm. **A–C**: holotype (LPB 707), adult macroconch with incomplete body-chamber; lateral (**A**) and ventral (**B**) views; **C**: inner whorls enlarged (x2); **D–E**: lateral (**D**) and ventral (**E**) views of a fragment of adult ?macroconch body-chamber (LPB 486) of a strongly and sharply ribbed individual; **F**: adult ?macroconch (LPB 501/1) with part of body-chamber; **G–I**: adult ?macroconch (LPB 286) with terminal part of body-chamber, lateral view of the complete specimen (**G**), lateral view of the other face of the body-chamber (**H**), and inner whorls detached (x2), the venter is completely smooth (**I**). All natural size (x1) unless indicated. Scale bar: 10 mm for A–B and D–H; 5 mm for C and I. Arrow at last septum.

catalinensis [m] (WIERZBOWSKI 1976: pl. 3 fig. 1) and *Vinalesphinctes rosariensis* (WIERZBOWSKI 1976: pl. 3 fig. 5). Nevertheless, it is expected that all microconchs of the *Subvinalesphinctes-Vinalesphinctes* lineage tend to be very similar or indistinguishable, and the diagnostic features are mainly those of the adult macroconch body-chamber, at sizes not reached by the microconchs. Despite the almost complete similarity between *S. prophetae* and *S. plicatiloides*, it seems more convenient to retain the local name because of the imprecisely known biostratigraphy of the ammonites described by JUDOLEY & FURRAZOLA (1968).

T. herreroduclouxi [M] differs, not only in its lower stratigraphic position, but morphologically in having a

more compressed body-chamber, which is densely and finely ribbed, ventrally lacking an interruption. *S. pseudokranaus* [M] is similar in the inner whorls, but strongly differs by its (early) variocostation passing to a stronger and wider-spaced subadult and adult ribbing, with a smooth venter.

The stratigraphic position of *S. prophetae* in Chile has been correlated with the upper *plicatilis* Zone (= *antecedens* Subzone of the *transversarium* Zone of GYGI & HILLEBRANDT 1991; cf. MYCZYNSKI et al. 1998). This correlation is supported by independent evidence, namely the association of *S. prophetae* with *Gregoryceras chongi* in Quebrada del Profeta, an early species of that genus (GYGI & HILLEBRANDT 1991: 158). The occurrence of *P. arkelli* in Europe lies in the *plicatilis* Zone (ENAY 1966; CALLOMON 1988; CARIOU & MELÉNDEZ 1990; ATROPS & MELÉNDEZ 1993; GLOWNIAK 2000, 2002).

Family Ataxioceratidae BUCKMAN, 1921
Subfamily Ataxioceratinae BUCKMAN, 1921

Lithacosphinctes OLÓRIZ, 1978

Type species: *Ammonites lictor evolutus* QUENSTEDT, 1888 (re-named *Lithacosphinctes siemiradzkii* ZEISS; see KIESSLING & ZEISS 1992) by OD.

Remarks: *Lithacosphinctes* OLÓRIZ, 1978 [M] / *Ardescia* ATROPS, 1982 [m] is said to originate from *Pseudorthosphinctes* ENAY, 1966 [M] / *Orthosphinctes* SCHINDEWOLF, 1925 [m] in the late *bimammatum* Zone (SCHAIRER 1974; OLÓRIZ 1978; ATROPS 1982; HANTZPERGUE 1989). *Orthosphinctes* is well documented in the *bimammatum* Zone and represents the microconch dimorph of *Pseudorthosphinctes*. In the *bauhini* Horizon (*hauffianum* Subzone) of southern Germany the first still unpublished *Ardescia* sp. appears, characterized by inner whorls which are much denser, prorsiradiately ribbed than in co-occurring *Orthosphinctes*.

In the Upper Oxfordian of Quebrada del Medio, Tarapacá Basin, northern Chile, *Lithacosphinctes* aff. *desertorum* (STEHN, 1923) occurs as described by GYGI & HILLEBRANDT (1991: pl. 4 figs. 1–2), a form very close to the coarsely ribbed morphotype of *L. evolutus* from the *planula* to *platynota* zones figured by SCHAIRER (1985: pl. 3 fig. 3) with radiate ribbing and a rounded, massive whorl section (see Fig. 7). *L. desertorum* occurs in the Neuquén-Mendoza Basin, in northwestern Mendoza at Quebrada Vargas, near Puente del Inca (La Manga Fm.) as indicated by AGUIRRE-URRETA (in SANGUINETTI 1987, 1989). Other references of *Orthosphinctes* for the Neuquén-Mendoza Basin were discussed by STIPANICIC (1966). Another possible occurrence of *Lithacosphinctes* in the Neuquén-Mendoza Basin is the poorly preserved specimen from Paso del Montañés, Mendoza, figured as "*Perisphinctes polyplocus* REIN." by BURCKHARDT (1900a: pl. 26 fig. 2), here refigured (Fig. 8). It is almost identical with *Lithacosphinctes pseudoachilles* WEGELE (in ATROPS 1982: pl. 33 fig. 2) of the middle *platynota* Zone, and very similar to *Ataxioceras striatellum* (in ATROPS 1982: pl. 45 fig. 4) of the late *platynota* Zone.

Lithacosphinctes aff. *janus* (CHOFFAT, 1893) [M]

Figs. 5H–J, 9A–B, Tab. 1

aff. *1893 *Perisphinctes janus* n. sp. CHOFFAT: 35: pl. 8 figs. 1 (holotype, M), 2–3.
aff. 1989 *Lithacosphinctes janus* (CHOFFAT, 1893). – HANTZPERGUE: 138, pl. 7 figs. a–e.
1998 *Orthosphinctes* (*Lithacosphinctes*) cf. *evolutus* (QUENSTEDT). – PARENT: 265, 269.
2003 *Orthosphinctes* (*Lithacosphinctes*) cf. *evolutus* (QUENSTEDT). – PARENT: 152.

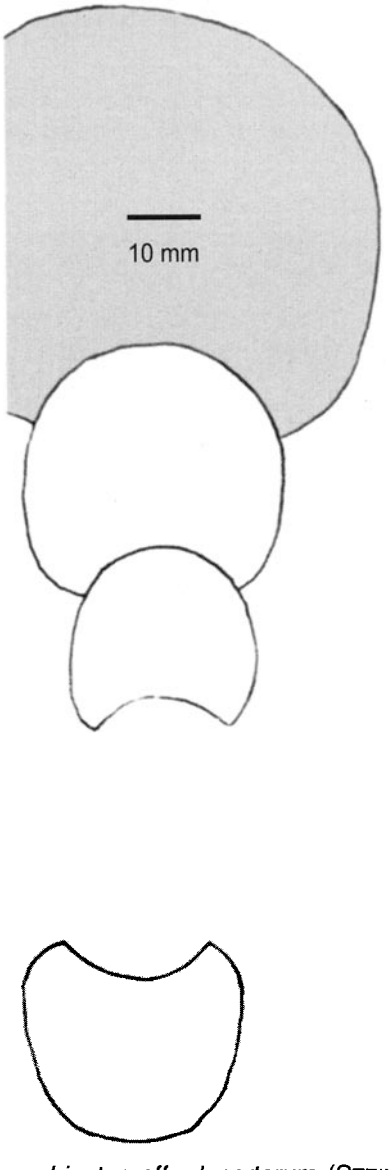


Fig. 7. *Lithacosphinctes* aff. *desertorum* (STEINMANN). Whorl section (body-chamber stippled) of the specimen figured by GYGI & HILLEBRANDT (1991: pl. 4 fig. 1).

Fig. 8. "*Perisphinctes polyplocus* FONTANNES" from Molinos Colgados, Mendoza, loose in the field, figured by BURCKHARDT (1900: pl. 26 fig. 2).

Material: A well preserved specimen (LPB 426) from faunal level CM5; fragments and impressions seen in the field.

Description: Adult macroconch with incomplete body-chamber beginning at $D = 81$ mm, maximum preserved diameter 110 mm. At $D \approx 5$ mm the shell is inflated and ventrally smooth. At $10 < D < 20$ mm the shell becomes evolute, widely umbilicate, whorl section subrectangular to depressed-oval, with convex flanks and broadly rounded venter. Primary ribs are acute, prorsiradiate and start from the umbilical shoulder; each divided into three secondaries on the ventro-lateral shoulder and crossing the venter without change of strength, describing a convex-adapertural arch. There are three shallow constrictions per whorl. At $20 < D < 40$ mm coiling remains evolute ($H_2/H_1 = 0.82$); whorl section becomes rounded, nearly as wide as high ($W/H_1 = 1.05$), the umbilicus is slightly narrower. Ribs are strong and acute, prorsiradiate, starting on the umbilical seam; they bifurcate regularly on the upper third of flanks, and the secondaries remain hidden by the following whorl. An increase of ribbing density is very notable throughout all the phragmocone. At $40 < D < 80$ mm the whorl section changes slightly, the flanks flatten, the venter becomes broad and rounded, and the umbilical wall is high and subvertical. At about 60 mm in diameter the umbilicus is narrowest ($U/D = 0.35$) and the whorl section of the phragmocone is most compressed ($W/H_1 = 0.99$) and involute ($H_2/H_1 = 0.66$). Primary ribs are strong and prorsiradiate; they bifurcate on the upper third of flanks, and all secondaries are hidden by the next whorl. Secondaries and intercalatories are not modified when crossing the venter. At $D > 81$ mm (body-chamber) the whorl section is subtrapezoidal with flattened flanks which converge to a moderately narrow and rounded venter. The ribbing changes remarkably: The primary ribs are progressively enlarged describing a prorsiradiate concavity on the flanks, and bifurcate or trifurcate in the upper half where some intercalaries occur (rib index *V/P* increases from 2 to 3); in the first half of the body-chamber the ribbing is composed of strong prorsiradiate primaries which divide in sheaves of three to four secondaries on the upper third of flanks; secondaries and occasional intercalatories are regularly spaced and finer than the primaries, crossing the venter orthogonally and without change. The final portion of the body-chamber is not completely preserved, only a part of the umbilical shoulder with portions of primary ribs which are strong and wide, about 13 per half-whorl, denoting the macroconch sexual dimorphic status of the specimen. Adult *LBC* is probably close to 360°.

Remarks and comparison: The characteristic features of the present specimen (and the same for impressions seen in the field) are the perisphinctid-like, or "conventional", innermost whorls, the rather densely and finely ribbed body-chamber with fine, dense secondaries arranged in sheaves dividing on the upper third of flanks. However, the ribbing lacks any polyploke or virgatotome polyfurcations typical of the Kimmeridgian Ataxioceratinae. The whorl section is subrounded depressed in the inner whorls, then becoming gradually subrounded (as high as wide) to subtrapezoidal on the body-chamber. All these features of shell shape and ornamentation are seen in post-*bimammatum* Zone Ataxioceratinae, commonly grouped in *Lithacosphinctes* [M] / *Ardescia* [m] (see above). Within figured *Lithacosphinctes*, our material is closest to *L. janus* (CHOFFAT, 1893) and late *L. evolutus* (QUENSTEDT) (ATROPS 1982), *platynota* and *planula* zones respectively. The resemblance of the present specimen to the lectotype and the material of *L. janus* described by HANTZPERGUE (1989: pl. 7 figs. a–c) is almost complete, exactly matching the ornamental stages, but mainly differing in the smaller adult size. The prorsiradiate ribbing from innermost whorls in the present material is the most significant difference with *L. evolutus* of the *planula* Zone which shows a persistent radiate ribbing (e.g., SCHAIRER 1985: pl. 2 fig. 4; ATROPS 1982: pl. 25 figs. 1–2, pl. 28 fig. 1). Significantly, a typical feature of *L. janus* is the prorsiradiate ribbing from innermost whorls (HANPTZPERGUE 1989). *Lithacosphinctes* from the *platynota* Zone of Algeria closely matches the present material (ATROPS & BENEST 1982: pl. 1 figs. 1–3).

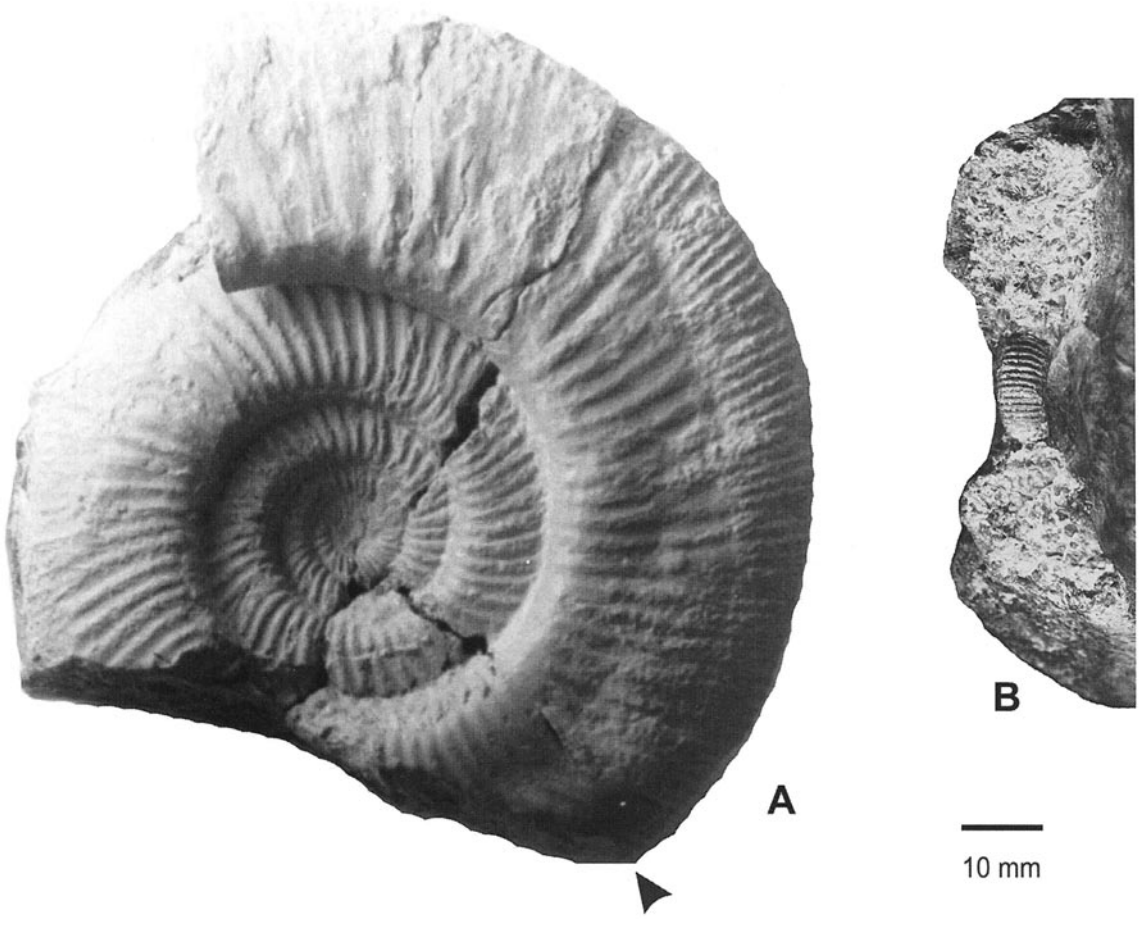


Fig. 9. *Lithacosphinctes* aff. *janus* (CHOFFAT), adult macroconch with incomplete body-chamber (LPB 426) from Chacay Melehué, faunal level CM5, lower Auquilco Fm. Lateral view of the complete specimen (**A**) and cross-cut view showing the venter of an inner whorl (**B**). All natural size (x1), arrow at last septum.

Biostratigraphy

The biostratigraphy and time-correlation of the Chacay Melehué – Sierra de Reyes transect have been previously discussed in detail by PARENT (1998), and a new formal biostratigraphic classification will be published elsewhere. The additional samples included in the descriptions above are consistent with previous correlations, but provide a greater resolution for the investigated species associations (see Fig. 2B).

Faunal level CM2 (bed G_1 332, Lotena Fm.): Late *athleta* to early *lamberti* zones, but only based on a single specimen which was compared with *P. athleta* (PHILLIPS, 1829) by PARENT (1998).

Faunal level CM3 (bed L, Lotena Fm.): Early to mid *cordatum* Zone, which is a narrower interval than previously assumed (PARENT 1998). This becomes evident by the association of *Peltoceratoides pressulus* (LEANZA, 1947) [M & m], a form very close or conspecific with *P. constantii* [M] / *arduennense* [m] (according to ALAIN BONNOT, pers. comm. 27/12/2002), and *Tenuisphinctes herreroduclouxi*, a form very close to perisphinctids of the early Oxfordian of Europe. In Europe and most of the Tethyan realm *Peltoceratoides* does not reach the latest *cordatum* Zone (CALLOMON & COPE 1971; MATYJA 1977) and the same seems to be true for northern Chile (HILLEBRANDT & GRÖSCHKE 1995; HILLEBRANDT et al. 2000) by which the faunal level CM3 indicates the maximum age for the CM4.

Faunal level CM4 (bed P_1, La Manga Fm.): The new occurrences in beds of this level again suggest *plicatilis* Zone, after discussions of all the three species of this assemblage.

Faunal level CM5 (bed P_2, lower Auquilco Fm.): Latest *planula* to early *platynota* zones as discussed under *Lithacosphinctes* aff. *janus*.

Faunal levels CM2 and CM3 should belong to the *Peltoceras* Biozone and CM4 to the *Perisphinctes* Biozone of RICCARDI (1984).

Resúmen

Un significativo conjunto de perisfínctidos oxfordianos fue colectado en Chacay Melehué, Neuquén, Argentina. Este conjunto está compuesto por ejemplares bien preservados correspondientes a la familia Perisphinctidae: *Perisphinctes* aff. *promiscuus* BUKOWSKI (Perisphinctinae), *Tenuisphinctes herreroduclouxi* (LEANZA) (Perisphinctinae), y *Subvinalesphinctes pseudokranaus* n. sp. y *S. prophetae* (GYGI & HILLEBRANDT) (Vinalesphinctinae). La familia Ataxioceratidae está representada por *Lithacosphinctes* aff. *janus* (CHOFFAT) (Ataxioceratinae). La Subfamilia Vinalesphinctinae MELÉNDEZ & MYCZYNSKI, 1987 es discutida y organizada en tres géneros: *Subvinalesphinctes* WIERZBOWSKI, *Vinalesphinctes* SPATH y *Cubasphinctes* JUDOLEY & FURRAZOLA, los cuales parecen incluir la totalidad de la subfamilia extendiéndose en el intervalo de las zonas *plicatilis* a *bifurcatus*, Oxfordiano Medio en Cuba, parte de Mexico, Chile y Argentina. La raíz de la subfamilia es muy probablemente *S. pseudokranaus* n. sp. Las afinidades biogeográficas son principalmente tethysianas, y tethysiano-caribeñas durante el Oxfordiano medio.

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References

ARKELL, W.J. 1935–1948. The ammonites of the English Corallian Beds. Pts 1–14. –Palaeontographical Society Monograph **88** (398), **89** (402), **90** (406), **91** (410), **93** (417), **94** (418), **95** (423), **96** (426), **97** (429), **98** (431), **99** (435), **100** (438), **101** (442), **102** (445): 1–420.

ARKELL, W.J. 1957. Jurassic ammonites. – In: MOORE, R.C., ed., Treatise on Invertebrate Paleontology, (L) Mollusca 4: 22 + 490 p., Lawrence (University of Kansas Press and Geological Society of America).

ATROPS, F. 1982. La sous-famille des Ataxioceratinae dans le Kimmeridgien Inferieur du Sud-Est de la France. – Documents des Laboratoires de Géologie Lyon **83**: 1–371.

ATROPS, F. & BENEST, M. 1982. Découverte de faunes d'ammonites de la zone à Platynota (Kimméridgien Inférieur) dans les Monts de Chellala (avant-pays Tellien, Algérie); consequences stratigraphiques et paléogéographiques. – Géobios **15**: 951–957.

ATROPS, F. & MARQUES, B. 1988. Précisions stratigraphiques sur les formations a ammonites du Jurassique Supérieur dans le massif du Montejunto (Nord du Tage, Portugal). – Proceedings of the Second International Symposium on Jurassic Stratigraphy **2**: 505–516.

ATROPS, F. & MELÉNDEZ, G. 1993. Current trends in systematics of Jurassic Ammonoidea: the case of Oxfordian-Kimmeridgian perisphinctids from southern Europe. – Géobios, Mémoir spéciale **15**: 19–31.

BENGTSON, P. 1988. Open nomenclature. – Journal of Paleontology **31** (1): 223–227.

BEZNOSOV, H.B. & MITTA, V.V. 1995. Perisphinctid ammonites from the Caucasian Republic and Central Asia. – 123 p., Moscow (edition of the authors) [in Russian].

BUCKLAND, W. 1836. Geology and Mineralogy Considered with Reference to Natural Theology. Vol. 1. – 599 p., London (Pickering).

BUCKMAN, S.S. 1909–1930. Yorkshire Type Ammonites. Vols. 1–2. Type Ammonites. Vols. 3–7, London (Weldon & Wesley).

BUKOWSKI, G. 1887. Über die Jurabildungen von Czenstochau in Polen. – Beitrage zur Paläontologie von Oesterreich-Ungarn und des Orients **5**: 75–171.

BURCKHARDT, C. 1900a. Profils géologiques transversaux de la Cordillere Argentino-Chilenne. – Anales del Museo de La Plata, Sección Geología y Minería **2**: 1–136.

BURCKHARDT, C. 1900b. Coupe géologique de la Cordillere entre Las Lajas et Curacautín. – Anales del Museo de La Plata, Sección Geología y Minería **3**: 1–102.

CALLOMON, J.H. 1988. The ammonite successions and Subzones of the Transversarium Zone in the Submediterranean Middle Oxfordian. – Proceedings of the Second International Symposium on Jurassic Stratigraphy **2**: 433–444.

CALLOMON, J.H. 2003. The Middle Jurassic of western and northern Europe: its subdivisions, geochronology and correlations. – Geological Survey of Denmark and Greenland Bulletin **1**: 61– 76.

CALLOMON, J.H. & COPE, J.C.W. 1971. The stratigraphy and ammonite succession of the Oxford and Kimmeridge Clays in the Warlingham Borehole. – Bulletin of the Geological Survey of Great Britain **36**: 147–176.

CARIOU, E. & MELÉNDEZ, G. 1990. A modified perisphinctid zonation for the Middle Oxfordian of Southern Europe, Submediterranean Province. First Oxfordian Meeting, Zaragoza. – Publicación SEPAZ **2**: 129–151.

CARIOU, E.; ENAY, R.; ATROPS, F.; HANTZPERGUE, P.; MARCHAND, D. & RIOULT, M. 1997. Oxfordien. – In: CARIOU, E. & HANTZPERGUE, P., coord., Biostratigraphie du Jurassique ouest-européen et méditerranéen: zonations parallèles et distribution des invertébres et microfossiles. – Bulletin du Centre de Recherche Elf Exploration et Production **17**: 79–86.

CHOFFAT, P. 1893. Description de la faune jurassique du Portugal, Classe des Céphalopodes. Premiere Serie, Ammonites du Lusitanien de la contrée de Torres-Vedras. – Memoire Direction Travalhos Géologiques de Portugal **26**: 1–82.

CHONG, G.; BROCHWICZ-LEWINSKI, W.; MYCZYNSKI, R.; MELÉNDEZ, G. & SEQUEIROS, L. 1984. Stratigraphic value paleobeographic implications of Oxfordian ammonite fauna of Chile. – Proceedings of the International Symposium on Jurassic Stratigraphy **2**: 416–427.

COX, B.M. 1988. English Callovian (Middle Jurassic) Perisphinctid Ammonites. Part 1. – Palaeontographical Society Monograph **140** (575): 1–54.

DELLAPÉ, D.A.; MOMBRÚ, C.; PANDO, G.A.; RICCARDI, A.C.; ULIANA, M.A. & WESTERMANN, G.E.G. 1979. Edad y correlación de la Formación Tábanos en Chacay Melehué y otras localidades de Neuquén y Mendoza. – Obra del Centenario del Museo de La Plata **5**: 81–105.

ENAY, R. 1966. L'Oxfordien dans la moitié sud du Jura français. – Nouvelles Archives Museum d'Histoire Naturelle de Lyon **8**: 1–624.

GLOWNIAK, E. 2000. The *Platysphinctes* immigration event in the Middle Oxfordian of the Polish Jura Chain (Central Poland). – Acta Geologica Polonica **50** (1): 143–160.

GLOWNIAK, E. 2002. The ammonites of the family Perisphinctidae from the Plicatilis Zone (lower Middle Oxfordian) of the Polish Jura Chain (Central Poland); their taxonomy, phylogeny and biostratigraphy. – Acta Geologica Polonica **52** (3): 307–364.

GULISANO, C.A.; GUTIERREZ PLEIMLING, A.R. & DIGREGORIO, R.E. 1984. Esquema estratigráfico de la secuencia Jurásica del oeste de la provincia de Neuquén. – Actas Noveno Congreso Geológico Argentino **1**: 236–259.

GYGI, R.A. 1998. Taxonomy of perisphinctid ammonites of the Early Oxfordian (Late Jurassic) from near Herznach, Canton Aargau, Switzerland. – Palaeontographica (A) **251**: 1–37.

GYGI, R.A. & HILLEBRANDT, A. von 1991. Ammonites (mainly *Gregoryceras*) of the Oxfordian (Late Jurassic) in northern Chile and time-correlation with Europe. – Mémoires Suisses de Paléontologie **113**: 135–185.

HANTZPERGUE, P. 1989. Les ammonites Kimmeridgiennes du Haut-Fond d'Europe Occidentale: Biochronologie, systematique, Evolution, Paléobiogeographie. – Cahiers de Paléontologie.– 428 p. (Centre National de la Recherche Scientifique).

HERRERO DUCLOUX, A. 1948. Sobre el "Yeso Principal" del Neuquén y Sur de Mendoza. – Revista de la Asociación Geológica Argentina **3**: 201–218.

HILLEBRANDT, A. von & GRÖSCHKE, M. 1995. Ammoniten aus dem Callovium/Oxfordium Grenzbereich von Nordchile. – Berliner Geowissenschaftliche Abhandlungen (A) **169**: 1–40.

HILLEBRANDT, A. von; KOSSLER, A. & GRÖSCHKE, M. 2000. *Caracoliceras*, a new Oxfordian (Upper Jurassic) ammonite genus from northern Chile. – Revue de Paléobiologie, volume spéciale **8**: 65–81.

JAWORSKI, E. 1940. Oxford-Ammoniten von Cuba. – Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilagen-Band (B) **1940**: 87–137.

JUDOLEY, C.M. & FURRAZOLA-BERMÚDEZ, G. 1968. Estratigrafía y fauna del Jurásico de Cuba. – Publicación Especial del Instituto Cubano de Recursos Minerales, Departamento científico, Academia de Ciencias de Cuba: 1–126.

KIESSLING, W. & ZEISS, A. 1992. New palaeontological data from the Hochstegen Marble (Tauern Window, Eastern Alps). – Geologisch-Paläontologische Mitteilungen Innsbruck **18**: 187–202

LEANZA, A.F. 1946. Las Oppelias de Chacay-Melehué, en el Neuquén. *"Streblites (Pseudoppelia) oxynotus"* subgen. et sp. nov. – Revista de la Asociación Geológica Argentina **1**: 63–72.

LEANZA, A.F. 1947. Descripción de la fáunula Kimmeridgiana de Neuquén. – Dirección de Minas y Geología, Informes preliminares y comunicaciones **1**: 3–15.

LEANZA, A.F. & ZÖLLNER, W. 1949. Acerca de la edad del Yeso Principal. – Revista de la Asociación Geológica Argentina **4**: 25–35.

MALINOWSKA, L. 1972. The middle Oxfordian Perisphinctidae of Zawodzie near Czestochowa. – Acta Palaeontologica Polonica **17**: 167–242.

MALINOWSKA, L. 1980. Geology of Poland, vol. 3. Atlas of guide and characteristic fossils, Part 2b, Mesozoic, Jurassic. – 476 pp., Warszawa (Instytut Geologiczniy. Wydawnictwa Geologiczne).

MATYJA, B.A. 1977. The Oxfordian in the South-Western margin of the Holy Cross Mts. – Acta Geologica Polonica **27**: 41–64.

MELÉNDEZ, G. 1989. El Oxfordiense en el sector central de la Cordillera Ibérica (Provincias de Zaragoza y Teruel). – Instituto de Estudios Turolenses. Zaragoza-Teruel, p. 1–8 + 1–418.

MELÉNDEZ, G.; SEQUEIROS, L. & BROCHWICZ-LEWINSKI, W. 1983. Lower Oxfordian in the Iberian Chain. Part II. Ammonite Fauna. – Bulletin de l'Academie Polonaise des Sciences, Série des Sciences de la terre **30**: 173–180.

MELÉNDEZ, G. & MYCZYNSKI, R. 1987. Sobre la posición sistemática de los ammonites del Oxfordiense de los Andes Chilenos (cordiller Domeyko, Chile, Provincia Andina). – Geogaceta **2**: 12–14.

MELÉNDEZ, G.; SEQUEIROS, L.; BROCHWICZ-LEWINSKI, W.; MYCZYNSKI, R. & CHONG, G. 1988. Palebiogeographic relationships between Oxfordian ammonite faunas from the Mediterranean, Caribbean, and Andean provinces. – In: WIEDMANN, J. & KULLMANN, J., eds., Cephalopods – Present and Past: 425–436, Stuttgart (Schweizerbart).

MYCZYNSKI, R. & PSZCZOLKOWSKI, A. 1976. The ammonites and age of the San Cayetano Formation from Sierra del Rosario, Western Cuba. – Acta Geologica Polonica **26** (2): 321–330.

MYCZYNSKI, R.; OLÓRIZ, F. & VILLASEÑOR, A.B. 1998. Revised biostratigraphy and correlations or the Middle-Upper Oxfordian in the Americas (southern USA, Mexico, Cuba, northern Chile). – Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen **207**: 185–206.

NEUMANN, J. 1907. Die Oxfordfauna von Cetechowitz. – Beiträge zur Paläontologie Österreich-Ungarns und des Orients **20**: 1–67.

O'CONNELL, M. 1920. The Jurassic ammonite fauna of Cuba. – Bulletin of the American Museum of Natural History **42**: 643–692.

OLÓRIZ, F. 1978. Kimmeridgiense-Tithónico inferior en el sector central de las Cordilleras Béticas (Zona Subbética). Paleontología. Bioestratigrafía. – Tesis doctoral Universidad de Granada **184**: 1–758.

PARENT, H. 1998. Upper Callovian to upper Oxfordian ammonite biostratigraphy of the transect Chacay Melehué-Sierra de Reyes, Argentina. – Cuadernos de Geología Ibérica **24**: 261–275.

PARENT, H. 2003. The Ataxioceratid ammonite fauna of the Tithonian (Upper Jurassic) of Casa Pincheira, Mendoza (Argentina). – Journal of South American Earth Sciences **16**: 143–165.

PHILLIPS, J. 1829. Illustrations of the geology of Yorkshire; or, a description of the strata and organic remains of the Yourshire coast. – 192 pp., York & London (Wilson).

QUENSTEDT, F.A. 1887–1888. Die Ammoniten des Schwäbischen Jura. Teil 3. Der Weiße Jura: 817–1140, Stuttgart (Schweizerbart).

RICCARDI, A.C. 1984. Las asociaciones de amonitas del Jurásico y Cretácico de la Argentina. – Actas Noveno Congreso Geológico Argentino **4**: 559–595.

RICCARDI, A.C. & GULISANO, C.A. 1990. Unidades limitadas por discontinuidades. Su aplicación al Jurásico andino. – Revista Asociación Geológica Argentina **45**: 346–364.

RICCARDI, A.C. & DAMBORENEA, S.E. 1993. Léxico Estratigráfico de la Argentina. – Asociación Geológica Argentina **B 21**: 477.

RICCARDI, A.C.; LEANZA, H.A.; DAMBORENEA, S.E.; MANCEÑIDO, M.O.; BALLENT, S.C. & ZEISS, A. 2000. Marine Mesozoic biostratigraphy of the Neuquén Basin. – Zeitschrift für Angewandte Geologie **SH1**: 103–108.

RONCHADZÉ, J. 1917. Perisphinctes de l'Argovien de Chézery et de la Faucille. – Mémoires de la Societé Paléontologique Suisse **42**: 1–69.

SÁNCHEZ-ROIG, M. 1951. La fauna jurásica de Vinales. – Anales de la Academia de Ciencias Médicas, Físicas y Naturales de La Habana **89**: 47–94.

SANGUINETTI, A.S. 1987. El "Tordillolitense" y la extensión del volcanismo neojurásico en la cuenca Neuquino-Aconcaguina. – Actas Décimo Congreso Geológico Argentino **4**: 279–282.

SANGUINETTI, A.S. 1989. Volcanismo neojurásico-Neocomiano de la Quebrada de Vargas, Alta Cordillera de Mendoza. – Revista de la Asociación Geológica Argentina **44**: 381–393.

SCHAIRER, G. 1974. Quantitative Untersuchungen an Perisphinctidae (Ammonoidea) des untersten Unterkimmeridge der Fränkischen Alb (Bayern). – Zitteliana **3**: 37–124.

SCHAIRER, G. 1985. Die Cephalopodenfauna der Schwammkalke von Biburg (Oberoxford, südl. Frankenalb): *Pseudaganides*, *Amoe-*

boceras, *Paraspidoceras*, *Rasenia*, *Orthosphinctes*. – Münchner Geowissenschaftliche Abhandlungen **A6**: 1–28.

SCHINDEWOLF, O.H. 1925. Entwurf einer Systematik der Perisphincten. – Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilagen-Band (B) **52**: 309–343.

SIEGFRIED, P. 1952. Die Heersumer Schichten im Hildesheimer Jura-Zug. – Geologisches Jahrbuch **67**: 273–360.

SPATH, L.F. 1931. Revision of the Jurassic cephalopod fauna of Kachh (Cutch). – Palaeontologica Indica (New Series) **9**, Memoir **2** (5): 551–658.

STEHN, E. 1923. Beiträge zur Kenntnis des Bathonien und Callovien in Südamerika. – Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilagen-Band **49**: 52–158.

STEINMANN, G. 1881. Zur Kenntnis der Jura- und Kreideformation von Caracoles (Bolivia). – Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Beilagen-Band **1**: 239–301.

STEINMANN, G. 1890. Cephalopoda. – In: STEINMANN, G. & DÖDERLEIN, L., eds., Elemente der Paläontologie: 344–475, Leipzig (Engelmann).

STIPANICIC, P.N. 1951. Sobre la presencia del Oxfordense superior en el arroyo de la Manga (provincia de Mendoza). – Revista de la Asociación Geológica Argentina **6** (4): 213–240.

STIPANICIC, P.N. 1966. El Jurásico en Vega de La Veranada. El Oxfordense y el Diastrofismo Divesiano (Agassiz-Yaila) en Argentina. – Revista de la Asociación Geológica Argentina **20**(4): 403–478.

STIPANICIC, P.N.; WESTERMANN, G.E.G. & RICCARDI, A.C. 1976. The Indo-Pacific ammonite *Mayaites* in the Oxfordian of the Southern Andes. – Ameghiniana **12** (4): 281–305.

VIDIER, J.P.; MARCHAND, D.; BONNOT, A. & FORTWENGLER, D. 1993. The Callovian and Oxfordian of the Boulonnais area in northern France: new biostratigraphic data. – Acta Geologica Polonica **43** (3/4): 169–182.

WAAGEN, W. 1869. Die Formenreihe des *Ammonites subradiatus*. – Geognostisch-Paläontologische Beiträge **2**: 181–256.

WIERZBOWSKI, A. 1976. Oxfordian ammonites of the Pinar del Rio province (western Cuba); their revision and stratigraphical significance. – Acta Geologica Polonica **26** (2): 137–260.

YOUNG, G.M. & BIRD, J. 1822. A geological survey of the Yorkshire coast; describing the strata and fossils occurring between the Humber and the Tees, from the Germany Ocean to the plain of York. – 332 p., Whitby.

ZEISS, A. 2003. The Upper Jurassic of Europe: its subdivision and correlation. – Geological Survey of Denmark and Greenland Bulletin **1**: 75–114.

ZÖLLNER, W. & AMOS, A.J. 1973. Descripción geológica de la Hoja 32b Chosmalal, Provincia del Neuquén. – Boletín del Servicio Nacional Minero y Geológico Argentino **143**: 1–91.

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