

*Upper Callovian to upper Oxfordian Ammonite
Biostratigraphy of the transect Chacay
Melehue-Sierra de Reyes, Argentina*

*Bioestratigrafía de Ammonites del Calloviense
Superior al Oxfordiense Superior en la transversal
Chacay Melehue-Sierra de Reyes, Argentina*

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ABSTRACT

Chronostratigraphic correlation, by means of the biostratigraphy of the ammonite faunas of Rahuecó, Chacay Melehué, Vega de La Veranada (northern Neuquén), and Sierra de Reyes (southern Mendoza), shows that the Oxfordian might be represented in the Neuquén-Mendoza basin more completely than previously suspected. Most of the ammonites are comparable with, or show close affinities to, Tethyan taxa; within the Pacific (endemic?) forms are the species of *Araucanites* WESTERMANN & RICCARDI. *Gregoryceras* has not been recorded whilst *Plicatilis* and *Transversarium* Zones assemblages have been recognized. The available samples of opeliid ammonites are scarce and badly preserved and have not been studied in detail. At Vega de La Veranada and Sierra de Reyes, in a conspicuous lithofacies of reddish marginal sandstones, occurs *Rehmannia* (L.) *patagonensis* associated with *Pseudopeltoceras* sp. constituting the *R. (L.) patagonensis* horizon, here regarded as late Middle- to early Upper Callovian in age (Coronatum-Athleta Zones). The Athleta Zone should be represented at Chacay Melehué as indicated by a specimen of *Peltoceras* (P.) cf. *athleta*. The Cordatum Zone seems to be represented through all the studied localities by the characteristic dimorphic pair *Peltoceras* gr. *constantii* [M]/*arduennense* [m] (d'ORB. spp.); some samples from Rahuecó are strongly similar to those described from Mount Hermon (Syria) for the lowermost Oxfordian, suggesting correlation with the Mariae Zone. From Chacay

Melehué to Sierra de Reyes have been recorded ammonites which strongly suggest Plicatilis Zone age. Ammonites of probable Transversarium Zone age have been found only at Vega de La Veranada, in the form of *?Passendorferia gr. torcalense*. At Aguada de La Mula (Sierra de Reyes) occur *Euaspidoceras gr. hypselum-hominale* [M] and *E. cf. costatum* [m] of probable Bifurcatus-Bimammatum Zones age. The latest Upper Oxfordian (Planula Zone) or earliest Lower Kimmeridgian (Platynota Zone) seems to be represented at Chacay Melehué by *Orthosphinctes (Lithacosphinctes) cf. evolutus* [M].

Key-words: Ammonites, Callovian, Oxfordian, Biostratigraphy, Chronostratigraphy, Andes.

RESUMEN

Un análisis de correlación cronoestratigráfica, por medio de la bioestratigrafía de las faunas de ammonites de Rahuecó, Chacay Melehué, Vega de La Veranada (norte de Neuquén), y Sierra de Reyes (sur de Mendoza), muestra que el Oxfordiano estaría representado en la cuenca Neuquén-Mendoza en forma mucho más completa que lo que se ha supuesto hasta ahora. Prácticamente todos los ammonites son comparables, o son fuertemente afines, con taxa tetisianos; entre las formas Pacíficas (endémicas?) se encuentra el género *Araucanites* WESTERMANN & RICCARDI. *Gregoryceras* no ha sido identificado en las muestras estudiadas, las cuales comprenden conjuntos de las Zonas Plicatilis y Transversarium. Las muestras disponibles de oppéidos son escasas y conformadas por material pobremente preservado por lo que no han sido estudiadas en detalle. En Vega de La Veranada y Sierra de Reyes, en una conspicua litofacies de areniscas marginales gris rojizas, ocurre *Rehmannia (L.) patagonensis* asociada con *Pseudopeltoceras* sp. conformando el horizonte R. (*L. patagonensis*, aquí considerado como Caloviano Medio tardío a Superior temprano (Zonas estándar Coronatum a Athleta). La Zona Athleta del estándar cronoestratigráfico europeo estaría representada en Chacay Melehué como lo indica un individuo de *Peltoceras (P.) cf. athleta*. La Zona Cordatum parece estar representada en todas las localidades estudiadas por el característico par dimórfico *Peltoceras gr. constantii* [M]/*arduennense* [m] (d'ORB. spp.); algunas muestras de Rahuecó son muy similares a algunos elementos de la fauna del Oxfordiano inferior bajo de Mount Hermon (Siria), sugiriendo correlación con la Zona Mariae del estándar cronoestratigráfico europeo. Desde Chacay Melehué hasta la Sierra de Reyes han sido registrados ammonites que sugieren fuertemente la Zona Plicatilis. Ammonites de probable edad Zona Transversarium han sido hallados solamente en Vega de La Veranada bajo la forma de *?Passendorferia gr. torcalense*. En Aguada de La Mula (Sierra de Reyes) se ha recogido *Euaspidoceras gr. hypselum-hominale* [M] y *E. cf. costatum* [m] probablemente del intervalo de las Zonas Bifurcatus-Bimammatum. El inter-

valo Oxfordiano superior-Kimmeridgiano inferior (zonas Planula-Platynota) parece estar representado en Chacay Melehué por *Orthosphinctes* (*Lithacosphinctes*) *cf. evolutus* [M].

Palabras clave: Ammonites, Caloviano, Oxfordiano, Biostratigrafía, Cronostratigrafía, Andes.

INTRODUCTION

The marine Upper Jurassic sedimentary record of the back-arc Neuquén-Mendoza basin outcrops through Neuquén, Mendoza and San Juan provinces, west central Argentina. The middle Callovian-upper Oxfordian (?lower Kimmeridgian) sediments are made up of the Lotena, La Manga, Auquilco, Fortín Primero de Mayo, and Barda Negra Formations. These lithostratigraphic units have been included in the Lotena-Chacay Subsyntheme by Riccardi & Gulisano (1990), bounded by the Intracallovian Discontinuity (ICD) at the base and the Intramalmic Discontinuity (IMD) at top. The knowledge about ammonite faunas and biostratigraphy of this interval is mainly restricted to papers by Leanza (1947, *Mariae-Cordatum* faunas from Rahuecó and Chacay Melehué), Stipanovic (1951, *Cordatum-Plicatilis* faunas from Arroyo de La Manga), Stipanovic *et al.* (1975, lower-middle Oxfordian biostratigraphy of Mendoza and northern Neuquén with the introduction of the Eurycephalitinae genus *Araucanites*), and Riccardi (1984, first biostratigraphic subdivision of Jurassic-Cretaceous ammonite assemblages and biozones distinguishable throughout the basin); some later papers have reanalyzed these data.

The purpose of this paper is to propose, based on new collections, a preliminary biostratigraphic correlation of the upper Callovian-upper Oxfordian ammonite faunas of the transect Chacay Melehué-Sierra de Reyes with the standard zones of the European chronostratigraphic scale. The transect includes the following main localities (fig. 1): Rahuecó, Chacay Melehué, Vega de La Veranada (northern Neuquén), Aguada de La Mula, and Quebrada Remoredo (Sierra de Reyes, Southern Mendoza). The outcrops at these localities give a good cross-section of the basin: deep areas of the basin represented at Rahuecó and Chacay Melehué, slope at Vega de La Veranada, and platform at Sierra de Reyes (see Digregorio *et al.* 1984, Gulisano *et al.* 1984, Gulisano in Riccardi *et al.* 1992).

AMMONITE BIOSTRATIGRAPHY FROM SELECTED LOCALITIES

The major part of the ammonites cited below comes from collections of C. Gulisano. Since fossils are not illustrated in the present paper (systematic description in preparation) the repository number of each specimen cited here for

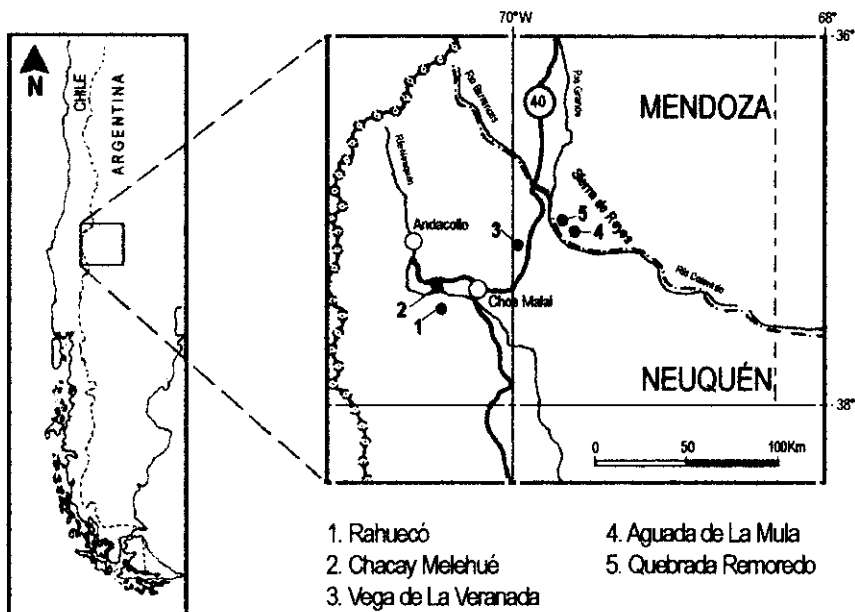


FIGURE 1.—Location map of the transect Chacay Melehué-Sierra de Reyes.

FIGURA 1.—Mapa de localización del transecto Chacay Melehué-Sierra de Reyes.

first time is indicated after the species name; most ammonites are at the Museo de La Plata (MLP), Universidad Nacional de La Plata; the remaining at Laboratorio de Paleontología y Biocronología (LPB), Universidad Nacional de Rosario.

Localities cited below are referred in figure 1, presented from south to north.

1. Rahuec6 (Neuquén).

Stratigraphic log from Dellap6 *et al.* (1979), ammonites collected by Gulisano in 1981.

<INTRAMALMIC DISCONTINUITY>

AUQUILCO Fm.:

50m greenish-grey fine sandstones with intercalated beds of gypsum and limestone banks.

LA MANGA Fm.:

40m grey limestones and siltstones.

• Bed G₁ 295:

Perisphinctes (Prosoisphinctes) gr. mazuricus-claromontanus BUKOWSKI spp. [M] [MLP 16865]

Perisphinctes (Prososphinctes) gr. mairei-matheyi (LORIOLOL spp.) [MLP 16870]

Euaspidoceras cf. douvillei (COLLOT) [MLP 16864]

Neocampylites? sp. [MLP 16871]

• Bed G₁ 292:

Perisphinctes (Prososphinctes?) sp. [MLP 16861]

Perisphinctes cf. picteti LORIOLOL *sensu* Tarkowski (1983: pl. 14: fig. 2) [MLP 16857]

Mirosphinctes gr. syriacus-regularis (NOETLING spp., *sensu* Haas 1955: pl. 24: figs. 36-37, pl. 26: figs. 17-19) [MLP 16863]

Euaspidoceras cf. kobyi (LORIOLOL *sensu* Haas 1955: pl. 26: figs. 23-25, 42-43) [MLP 16863]

Euaspidoceras cf. babe anum (d'ORB. *sensu* Tarkowski 1983: pl. 21: fig. 1) [MLP 16858]

Peltoceras (Parawedekindia) cf. arduennense (d'ORBIGNY) [MLP 16860]

Neocampylites? sp. [MLP 16856]

LOTENA Fm.:

10m grey-yellowish siltstones.

40m grey shales.

100m yellowish fine sandstones with siltstones at base.

<INTRACALLOVIAN DISCONTINUITY>

2. Chacay Melehué (Neuquén).

Stratigraphic log from Dellapé *et. al* (1979), ammonites from Gulisano, and the author collections.

<INTRAMALMIC DISCONTINUITY>

AUQUILCO Fm.:

50m grey evaporitic limestones and gypsum with beds of marls intercalated at base.

• Bed P2, about 5m above base:

Orthosphinctes (Lithacosphinctes) cf. evolutus (QUENSTEDT) [M] [LPB 426]

LA MANGA Fm.:

38m grey-bluish argillaceous limestones with coquinoid banks and shales.

• Bed P1, about 5m from base:

Perisphinctes (Kranaosphinctes) gr. kranaus-decurrens BUCKMAN spp. [M] [LPB 286, 486, 501].

LOTENA Fm.:

112m black to grey shales with sandy and marly-limestones beds intercalated.

• Bed L, about 80m from base:

Peltoceras gr. constantii [M]/*arduennense* [m] (d'ORB. spp.) [in Leanza 1947: pl. 2: figs. 1-3].

• Bed G₁ 332 at about 10m from base:

Peltoceras (Peltoceras) cf. athleta (PHILLIPS) [M] [MLP 15655]

<INTRACALLOVIAN DISCONTINUITY>

3. Vega de La Veranada (Neuquén).

Stratigraphy based on Riccardi & Westermann (1991), ammonites collected by Gulisano in 1981.

<INTRAMALMIC DISCONTINUITY>

AUQUILCO Fm.:

200m gypsum.

LA MANGA Fm.:

2.5m whitish-grey limestones:

- Bed G₁ 288:

?*Passendorferia* gr. *torcalense* (KILIAN) [MLP 16949-16951]

- Bed G₁ 287:

Perisphinctes (*Otosphinctes*) sp. [MLP 15668]

Euaspidoceras catena (SOWERBY *sensu* Bourseau 1977: pl. 7: figs. 2, 3) [MLP 15661]

Euaspidoceras cf. paucituberculatum ARKELL (*sensu* Br.-Lewinski 1970: pl. 10) [MLP 15664]

?*Cubaspidoceras carribeanum* MYCZYNSKI, 1977 [MLP 15670]

Peltoceras gr. *constantii* [M]/*arduennense* [m] (d'ORBIGNY spp.) [MLP 15661, 15673]

Trimarginites? sp. [MLP 15674]

LOTENA Fm.:

14m brown sandstones with dark-grey shales interbedded in lower and upper third:

- Bed G₁ 286:

Euaspidoceras? sp. [MLP 15662]

Pseudopeltoceras sp. [MLP 15669]

Rehmannia (*Loczyeras*) *patagonensis* (WEAVER).

<INTRACALLOVIAN DISCONTINUITY>

4. Aguada de La Mula (Mendoza, Sierra de Reyes).

Stratigraphy based on Riccardi & Westermann (1991: 14), ammonites collected by Riccardi, Uliana, Damborenea and Manceñido (see Stipanovic *et al.* 1975).

<INTRAMALMIC DISCONTINUITY>

LA MANGA Fm.:

8.5m light-grey limestones

- Bed M227:

Euaspidoceras gr. *hypselum* (OPPEL)-*hominale* (FAVRE) [M] [MLP 11354]

Euaspidoceras cf. costatum (DORN) [m?] [MLP 11356]

- Beds M224-5, Stipanovic *et al.* 1975 and Riccardi & Westermann 1991 have cited:

Perisphinctes (*Arisphinctes*) sp.

Araucanites reyesi WESTERMANN & RICCARDI

Araucanites mulai WESTERMANN & RICCARDI

LOTENA Fm.:

3.5m brown-grey shales:

- Bed M222:

Rehmannia (Loczyceras) patagonensis (WEAVER)

<INTRACALLOVIAN DISCONTINUITY>

5. Quebrada Remoredo (Mendoza, Sierra de Reyes).

Stratigraphy based on Riccardi & Westermann (1991: 14), ammonites collected by Gulisano in 1982.

<INTRAMALMIC DISCONTINUITY>

LA MANGA Fm.:

5m light-grey limestones

- Bed G₂ 1140:

Euaspidoceras cf. paucituberculatum ARKELL (*sensu* Br.-Lewinski 1970: pl. 10) [MLP 17016]*Perisphinctes (Otosphinctes)* sp. [MLP 17017]*Perisphinctes (Arisphinctes)* sp. [MLP 17018].

Riccardi & Westermann (1991: 14) cited:

Araucanites stipanicici WEST. & RICCARDI*Araucanites cf. reyesi* WEST. & RICCARDI

LOTENA Fm.:

10m dark-grey shales and limestones

- Bed G₂ 1139:

Rehmannia (Loczyceras) patagonensis (WEAVER)

<INTRACALLOVIAN DISCONTINUITY>

BIOSTRATIGRAPHIC CORRELATION WITH THE EUROPEAN STANDARD CHRONOSTRATIGRAPHIC SCALE (fig. 2)

The methodology adopted to obtain the results that follow was to compare the Andean ammonites and/or assemblages with those of the Tethys and, from the age of the most similar of these, to estimate an approximate age for Andean ones. This seems valid since the Andean faunas for the studied time-interval show strong affinities with (sometimes are morphologically indistinguishable from) the Tethyan ones (cf. Callomon, in Hillebrandt *et al.* 1993, Chong *et al.* 1984, Gygi & Hillebrandt 1991, and Hillebrandt & Gröschke 1995 among others).

Correlations here proposed are in terms of standard chronostratigraphic zones of the Submediterranean Tethys. The attainable precision seems to be not greater than the standard zone. The identified Andean morphotypes sometimes correspond to badly defined tethyan species, or differ in details which cer-

tainly could be concerned with geographic subspeciation and/or age-difference (see Callomon 1995). Perhaps narrower correlations could be proposed in terms of sub-biozones, but the results could be more unstable, thus hardly reproducible from new samplings (which are in course), in part because the definition of many species depend on personal interpretations. In order to prevent from this fact, the identifications are made with reference to illustrated specimens of the species morphotypes in Europe, waiting for better data that allow the definition of ranges of intraspecific variability.

Rahuec6:

The assemblage of *Miosphinctes* gr. *syriacus-regularis* (NOETLING spp.) and *Euaspidoceras* cf. *kobyi* (LORIOLO) closely match the Mariae Zone fauna from Syria described by Haas (1955), strongly suggesting this age for the fauna of bed G1 292. A similar Mariae Zone fauna was described by Fantini-Sestini (1968) from northern Iran.

The dimorphic pair *Perisphinctes* (*Prososphinctes*) gr. *mazuricus-claromontanus* BUKOWSKI spp. [M] / *mairei-matheyi* LORIOLO spp. [m] is typical of the Cordatum Zone through vast regions of the Tethys (Atrops & Meléndez 1993, Meléndez 1989, Enay 1966, Bourseau 1977, Brochwicz-Lewinski 1981, Matyja 1977), and *Euaspidoceras douvillei* (COLLOT) occurs in beds with typical Cordatum Zone faunas in Poland (Matyja 1977) and France (Bonnot et al. 1992). This fauna is typical of the Bukowskii Subbiozone in Europe, and, although *Perisphinctes* (*Prososphinctes*) *matheyi* LORIOLO also occurs in the Mariae Zone in Switzerland (Gygi 1990), correlation with the Cordatum Zone for bed G1 295 seems acceptable.

Chacay Melehué:

In bed G1 332 was collected by C. Gulisano a specimen of *Peltoceras* (*Peltoceras*) cf. *athleta* (PHILLIPS) [M] which closely matches *Peltoceras* (*Peltoceras*) *athleta* morph *baylei* PRIESER [M] as described by Bonnot (1993: pl. 3: fig. 3), but small differences and insufficient preservation prevents a closer identification with the index-species of the Athleta Zone. Nevertheless the incompletely preserved body chamber seems sufficient to distinguish it from the morphotypes of the Lamberti Zone; thus bed G1 332 may be correlated with the Athleta Zone.

From a bed, here named L, Leanza (1947) figured undoubted *Peltoceras* gr. *constantii* [M]/*arduennense* [m] (d'ORBIGNY spp.), erroneously described by him as «*Nebrodités pressulus* nov. sp». These ammonites suggest correlation with the Cordatum Zone of the Lower Oxfordian.

Bed P1 has yielded a little sample of perisphinctids here assigned to *Perisphinctes* (*Kranaosphinctes*) gr. *kranasus-decurrrens* BUCKMAN spp. [M], that could be a convenient shorthand way to describe them although it does not imply the same age (Callomon pers. com. 18-07-97). *Perisphinctes* (*K.*) gr. *kranasus-decurrrens* BUCKMAN spp. [M] are forms of the Vertebratale Subzone, Pli-

catilis Zone (Callomon 1988), thus correlation with this zone is here tentatively proposed. This is supported by the fauna described by Stipanovic (1951); at Arroyo de La Manga (southern Mendoza) in blue-grey marly limestones, the same lithofacies («calizas azules con *Gryphaea*») of bed P1, occur *Perisphinctes* (*Kranaosphinctes*) *gr. kranaus-decurrrens* BUCKMAN spp. [M] (*op. cit.*: pl. 1: fig. 1), *Perisphinctes* (*Arisphinctes*) *cf. plicatilis* (SOWERBY) (*op. cit.*: pl. 1: fig. 3, pl. 3: fig. 2), and *Perisphinctes* (*Arisphinctes*) *cf. helenae* (RIAZ) (*op. cit.*: pl. 1: fig. 2, pl. 2: fig. 2), which, associated, indicate Plicatilis Zone with a narrow margin of error. Moreover, Atrops & Marques (1988: pl. 1: fig. 1) have figured a fragmentary perisphinctid as *Perisphinctes* (*Kranaosphinctes*) sp. from the Plicatilis Zone at Montejunto (Portugal) which strongly resembles the specimen coming from bed P1 at Chacay Melehué.

Bed P2 has yielded a specimen of *Orthosphinctes* (*Lithacosphinctes*) *cf. evolutus* (QUENSTEDT) [M]. Atrops (1982), that has recently fully reviewed the genus *Orthosphinctes* SCHINDEWOLF, described the dimorphic pair *Orthosphinctes* (*Lithacosphinctes*) *evolutus* (QUENSTEDT) [M] / *Orthosphinctes* (*Orthosphinctes*) *polygyratus* (REINECKE) [m] for the Planula (upper Oxfordian) and Platynota (lower Kimmeridgian) Zones. The present specimen closely matches the morphs described by Atrops (1982: pl. 25: figs. 1-2, pl. 28: fig. 1) for the Planula Zone of Ardèche and Drôme (France), and especially the holotype (refigured by Atrops *op. cit.*: pl. 27: fig. 1), i.e., the most primitive representatives of *Orthosphinctes* (*Lithacosphinctes*) *evolutus* (QUENSTEDT) [M]. The presence of beds of this age, late Oxfordian, in Argentine was suspected by Riccardi (1984) by comparison with Chilean faunas.

Vega de La Veranada:

Bed G₁ 286 has yielded *Rehmannia* (*Loczyceras*) *patagonensis* (WEAVER), *Pseudopeltoceras* sp., and a very distinct Aspidoceratinae, here listed as *Euaspidoceras*? sp. This assemblage conforms to the *patagonensis* Horizon of Riccardi & Westermann (1991) as in many other localities through the Neuquén-Mendoza basin. Riccardi & Westermann (1991) considered this widely extended biostratigraphic horizon as Middle Callovian in age, but the co-occurrence of *Rehmannia* (*L.*) *patagonensis* with the newly discovered aspidoceratids and *Pseudopeltoceras* suggests latest middle to early late Callovian, Coronatum to Athleta Zone. This is because: 1) in Europe, *Pseudopeltoceras* ranges from the upper Coronatum Zone to the upper Athleta Zone (Cox 1988, Mangold 1970; Marchand personal communication 25-02-98), and 2) in Europe the first *Euaspidoceras* is in the highest Athleta Zone, but in Kutch is in the middle Athleta Zone (Cariou 1984; Callomon personal communication 23-10-97). Cariou (1984) has cited *Pseudopeltoceras* *aff. chauvinianum* (d'ORB.) for the Rota Horizon, Phaeinum Subzone, Coronatum Zone at Poitou (France) associated with *Rehmannia* (*L.*) *rota* (BOURQUIN) and *R. (L.) jeanneti* (ZEISS) which do not differ strongly from *R. (L.) patagonensis*. Through the Neuquén-Mendoza basin the association *Pseudopeltoceras*-*R. (L.) patagonensis* is very

consistent and occurs from Pic'n Leuf' (southern Neuquén), Vega de La Veranada, Arroyo de La Vaina (central Mendoza) to the High Andes of San Juan, Espinacito Pass (Riccardi & Westermann 1991, Riccardi *et al.* 1991, Álvarez 1994, 1996); predominantly, in a very particular lithofacies, narrow beds of marginal reddish-grey mudstones and fine sandstones, easily distinguishable in the field.

Bed G1 287 has yielded a fauna comprising Cordatum Zone peltoceratinae, *Peltoceras gr. constantii* [M]/*arduennense* [m] (d'ORB. spp.), and a little sample of *Euaspidoceras catena* (SOW.) as figured by Bourseau (1977: pl. 7: figs. 2-3) for the early Plicatilis Zone, Vertebrale Subzone at Beauvoisin (France). The specimen of *Euaspidoceras cf. paucituberculatum* ARKELL is hard to distinguish from the specimen illustrated by Brochwicz-Lewinski (1970: pl. 10) as *E. paucituberculatum* ARKELL from the transitional beds of the Plicatilis/Transversarium Zones at Zawodzie, Czestochowa (Poland). *?Cubaspidoceras caribbeanum* MYCZYNSKI, 1977 is a form very hard to interpret from the scarce material available. *Cubaspidoceras caribbeanum* MYCZYNSKI is a species described originally from Bifurcatus-Bimammatum Zones beds at Cuba, and later by Förster & Hillebrandt (1984) from upper Oxfordian beds at northern Chile. The specimen of *Trimarginites?* sp. does not contribute to narrowing the Early-Middle Oxfordian, Cordatum-Plicatilis age interval strongly suggested by the assemblage. A very similar succession of ammonite assemblages was given by Stipanovic (1965: 417), where he cited *Euaspidoceras* of post-Plicatilis Zone aspect associated with Cordatum Zone peltoceratinae and Plicatilis Zone perisphinctinae. Probably we have here one (or more?) new species of Cordatum Zone *Euaspidoceras* whose adult morphology is not commonly seen below Transversarium Zone through Europe, furthermore a gap between the lower and the upper parts of this bed could exist, although discontinuities have not been observed so far.

Bed G1 288 has yielded a little assemblage of perisphinctids that may be accommodated within the Transversarium-early Bifurcatus *Passendorferia gr. torcalense* (KILIAN) [M] (including *zieglerei* BR.-LEWINSKI, *teresiformis* BR.-LEWINSKI, and *brochwiczi* SEQUEIROS) which best matches with some of the morphotypes figured by Sequeiros (1977) from the Transversarium Zone at Málaga, Spain (Meléndez 1989, Cariou & Meléndez 1990: 141).

Aguada de La Mula:

Bed M222: the occurrence of *Rehmannia (L.) patagonensis* (WEAVER) suggests the homonymous horizon, as above.

Beds M224-5: the age of the assemblage *Perisphinctes (Arisphinctes)* sp., *Araucanites reyesi* and *A. mulai* has been regarded as time-equivalent to late Cordatum-Plicatilis Zones by Stipanovic *et al.* (1975).

Bed M227: the specimen of *Euaspidoceras cf. costatum* (DORN) closely matches, if not identically, the specimen of *E. costatum* (DORN) figured by Dorn (1931: pl. 6: fig. 7) that comes from the Bimammatum Zone of Germany

		← South					
		basin		slope	platform		
Standard chronostratigraphic zonation (1)		1 Rahuecó	2 Chacay Melehué	3 Vega de la Veranada	4 Aguada de La Mula	5 Quebrada Remoredo	Regional biostratigraphic subdivision (2)
LOWER KIMMERIDGIAN	Hypselocyclum						
	Platynota		P2				
UPPER OXFORDIAN	Planula						
	Bimammatum				M227		<i>Euaspidoceras</i> assemblage
MIDDLE OXFORDIAN	Bifurcatus						
	Transversarium			G ₁ 288			<i>Perisphinctes-Areucanites</i> assemblage
	Plicatilis		P1	G ₁ 287	M224-5	G ₂ 1140	
LOWER OXFORDIAN	Cordatum	G ₁ 295	L				<i>Peltoceratoides-Parawedelotridia</i> assemblage
	Mariae	G ₁ 282					
UPPER CALLOVIAN	Lamberti						
	Athleta		G ₁ 332	G ₁ 298	M222	G ₂ 1139	<i>R. (L.) patagonensis</i> horizon
MIDDLE CALLOVIAN	Coronatum						
	Jason						

FIGURE 2.—Correlation chart for the transect of selected localities here studied. Boxes shaded indicate the inferred chronostratigraphic range as indicated by biostratigraphic correlation for beds cited in the text. Numbering of localities as in figure 1. (1): Cariou *et al.* (1971), (2): Riccardi (1984), and Riccardi & Westermann (1991).

FIGURA 2.—Carta de correlación para el transecto de localidades estudiadas. Las cajas sombreadas indican el rango cronostratigráfico inferido a partir de la correlación bioestratigráfica para los niveles citados en el texto. Numeración de localidades como en figura 1. (1): Cariou *et al.* (1971), (2): Riccardi (1984), and Riccardi & Westermann (1991).

(Schweigert personal communication 08-07-97). *Euaspidoceras* *gr. hypselum-hornnale* and *E. costatum* are characteristic species of the Bimammatum Zone, and Rozak & Br.-Lewinski (1978) have discounted this evidence in the sense that forms of the *E. gr. hypselum* are common in the late Bifurcatus Zone. Correlation from ammonites of bed M227 indicates a probable late Bifurcatus-early Bimammatum Zone age.

Quebrada Remoredo:

Bed G2 1139: equivalent to bed M222 of Aguada de La Mula.

Bed G2 1140: the assemblage from this bed seems equivalent to that of beds M224-5 of Aguada de La Mula. The specimen of *Euaspidoceras cf. paucituberculatum* seems conspecific with that of late Cordatum-Plicatilis age of Vega de La Veranada.

CONCLUSIONS

The main conclusions are contained in the correlation chart of figure 2.

This preliminary analysis of the ammonite faunas of the Neuquén-Mendoza basin suggests that the Oxfordian seems to be more completely represented than previously suspected. Almost all the ammonites are comparable or show close affinities, with Tethyan taxa; exceptions are the species of the Eurycephalitinae genus *Araucanites* WESTERMANN & RICCARDI, 1975.

Gregoryceras, which is abundant in Chile (Gygi & Hillebrandt 1991), was not found in the Neuquén-Mendoza basin whilst Plicatilis and Transversarium Zones seem to be represented in the basin; thus the explanation for this absence might be searched in relation to paleobiogeographic patterns. Representatives of oppeliid ammonites are, so far, very scarce and badly preserved for contributing to correlation.

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