Marine Mesozoic Biostratigraphy of the Neuquén Basin

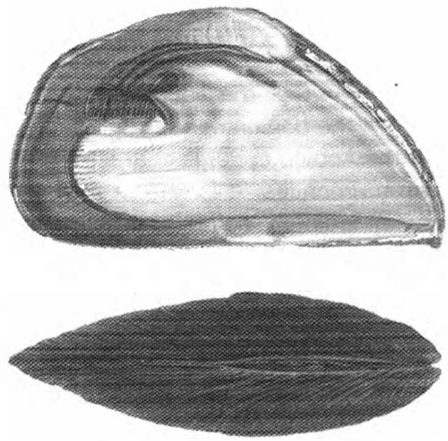
Alberto C. Riccardi, Héctor A. Leanza, Susana E. Damborenea, Miguel O. Manceñido, Sara C. Ballent & Arnold Zeiss

ABSTRACT

The marine Mesozoic of the Neuquén Basin in central west Argentina is characterized by ammonites and other invertebrates, especially bivalves, brachiopodes and calcareous microfossils. On that basis, Upper Triassic to Oxfordian, and Tithonian to Barremian have been divided in 39 and 18 ammonite assemblage / zones respectively, corresponding to 15 and 4 for bivalves, 15 and 2 for brachiopods and 11 and 9 for microfossils.

RESUMEN

El Mesozoico marino de la Cuenca de Neuquén, en el centro oeste argentino, se caracteriza por ammonites y otros invertebrados, tales como bivalvos, braquiópodos y microfósiles calcáreos. Sobre esta base, las unidades del Triásico Superior – Oxfordiano y la del Tithoniano – Barremiano, se han dividido en 39 y 18 zonas de grupos de ammonites, los que a su vez, corresponden respectivamente a 15 y 4 zonas de bivalvos, 15 y 2 de braquiópodos, y 11 y 9 zonas de microfósiles.



Introduction

■ The Neuquén Basin is a roughly north-south oriented back-arc basin with a southeastward expansion. Located in west-central Argentina, it covers more than 16,000 km² and its origin is referred to Early Mesozoic extensional processes. During the Jurassic and Cretaceous, the area evolved as a continental margin under active convergence. The back-arc depocenter produced a Mesozoic–Cenozoic sedimentary succession at least 7 km thick.

Mesozoic marine deposition of Pacific origin extended from Late Triassic to Middle Oxfordian and from Early Tithonian to Barremian. During Maastrichtian times, the area was covered by an Atlantic marine transgression. The succession has been divided in several sequences, and ammonites, present throughout, have been used to produce one of the best biozonations in the

southern hemisphere. There is an evident relationship between sequences and distribution and abundance of invertebrate fossils. Thus, the fossil faunas are widespread and more diverse in the middle to upper part, whilst geographic restriction, low diversity and extinctions occur close to sequence boundaries.

Biostratigraphic information has been summarized in Table 1. The Ammonite zonation has been prepared by A. C. RICCARDI (Triassic to Oxfordian, Maastrichtian) and H. A. LEANZA (Tithonian to Barremian) with some additions by A. ZEISS. Information on bivalves, brachiopods and microfossils is due to S. E. DAMBORENEA, M. O. MANCEÑIDO and S. C. BALLENT respectively.

Triassic

The Mesozoic marine succession begins with beds of Rhaetian age. They are restricted to the Arroyo Malo Formation in the Rio Atuel area, Mendoza province (RICCARDI & IGLESIA LLANOS, in press), and yield rare ammonites, bivalves, brachiopods and corals as well as microfossils.

Jurassic

Lower Jurassic

Hettangian and Sinemurian fossil assemblages are only present in the Río Atuel area, southern Mendoza province (Arroyo Malo and Puesto Araya / El Cholo Formations). Pliensbachian and Toarcian assemblages are widespread from southern San Juan (Los Patillos Formation) to southern Mendoza and Neuquén provinces (Puesto Araya / El Cholo and Los Molles and correlative formations). Ammonites are similar to those present in northern Chile, and different assemblages were defined mainly by HILLEBRANDT (see HILLEBRANDT et al. 1992). Bivalves, brachiopods and calcareous microfossils are also quite well represented (see RICCARDI et al. 1990a). Fossil invertebrates attain their maximum diversity during the Late Pliensbachian and the late Early Toarcian.

Middle Jurassic

Fossil assemblages are present from southern San Juan (Los Patillos Formation) to southern Mendoza (Bardas Blancas, below, and Tres Esquinas, above, Formations) and Neuquén (Los Molles, below and Lotena, above, Formations) provinces (see RICCARDI et al. 1994).

Early Aalenian faunal diversity is rather low and increases upwards reaching a maximum at the Aalenian-Bajocian boundary. Late Bajocian and Early Bathonian ammonoids are poorly represented and mostly restricted to the deepest parts of the basin. They become more abundant in the Late Bathonian and show a decrease during the Callovian, except for two small rises in the latest Early and Middle Callovian.

Upper Jurassic

The Oxfordian fauna and correlations with the European zonation are still poorly known and mostly restricted to the Middle Oxfordian (see RICCARDI et al. 1990b). Late Callovian and Early Oxfordian faunas are usually not present due to a regional hiatus, or are poorly preserved and geographically restricted. They are present in the deepest parts of the Neuquén basin from Loncopué and Rahueco (Neuquén province) to the Arroyo Santa Elena area (Mendoza province). Middle Oxfordian faunas are widespread throughout the Neuquén Basin.

Thus far there are no demonstrated records of Kimmeridgian faunas in the Neuquen Basin.

The lower part of the Vaca Muerta Formation, which marks the beginning of the marine sedimentation of the Andico cycle, is characterized by early Tithonian ammonites. It is known in a belt which extends immediately south of Mount Aconcagua (Mendoza) to the Carrín Curá region (southern Neuquén). Tithonian ammonites are quite well represented and are the best preserved in the Neuquen Basin. They have been studied by different authors and were used to produce a detailed zonation (see LEANZA 1996).

Cretaceous

Lower Cretaceous

Faunal diversity decreased from the Tithonian onwards, although bivalves are well represented and ammonites support a quite detailed zonation (see AGUIRRE URRETA & RAWSON 1997).

Berriasian and Valanginian fossils are widespread in southern Mendoza and Neuquén within the Vaca Muerta Formation, although the latter are also present in the Mulichinco and Agrio Formation. Hauterivian fossils are widespread in the lower part of the Agrio Formation from southern Mendoza to southern Neuquén (Cerro Marucho area).

Early Barremian fossils are present in the uppermost beds of the Agrio Formation in central and northern Neuquén.

Upper Cretaceous

Represented in the Malargüe Group of Neuquén and Mendoza provinces, marine fossils are restricted to the Maastrichtian. The warm shallow-water environments resulting from a transgression of Atlantic origin were characterized by rare ammonoids and abundant bivalves and gastropods.

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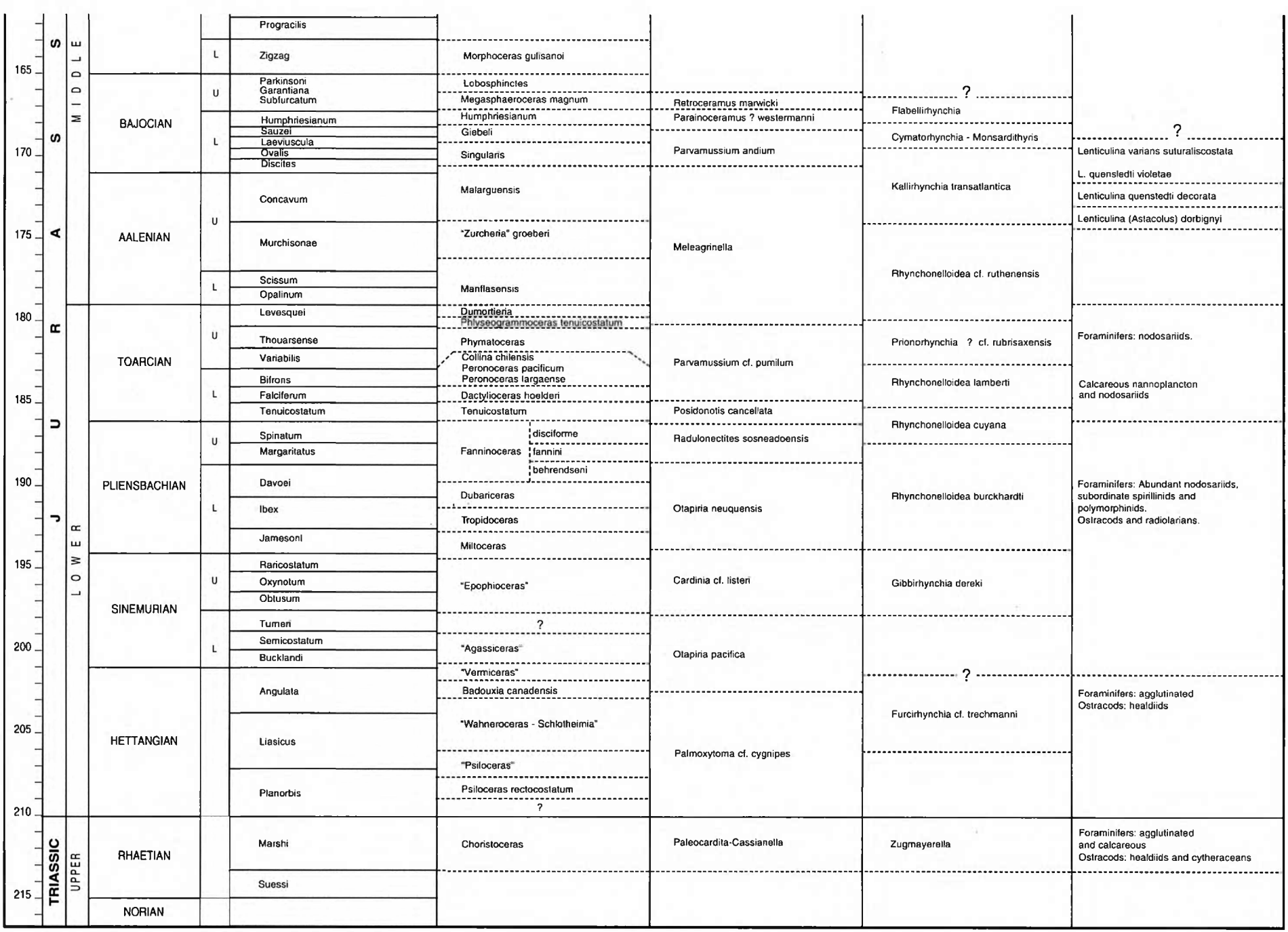
Table 1

Ma	SYST.	SERIES	STAGE		AMMONITES: STANDARD ZONATION	AMMONITES: ARGENTINA	BIVALVES	BRACHIOPODS	MARINE MICROFOSSILS
110			APTIAN	L					
			BARREMIAN	U					"Hergotella" Faunule
115				L	Hugii	Paraspiticeras groeberi			Conorboides sp. - Epistomina cf. ornata Faunule (Nanconids: Ass. III)
			HAUTERIVIAN	U	Angulicostata Balearis Ligatus Sayni	Crioceratites diamantensis Crioceratites schlagintweiti	Steinmanella vacaensis	?	Planularia crepidularis - Lenticulina collignoni Ass. (Nanconids: Ass. II)
120				L	Nodosoplicatus Loryi Radiatus	Spitidiscus riccardii Weavericeras vacaensis Hoplitocrioceras gentilii Holcoptychites neuquenensis		Ptilorhynchia ?	Citharina cristellaroides Faunule (Nanconids: Ass. I)
			VALANGINIAN	U	Callidiscus Trinodosum Verrucosum	Pseudofavrella angulatiformis Olcostephanus atherstoni	Steinmanella quintucoensis		Abundant foraminifers, nodosariids, polymorphinids and epistominids.
125				L	Stephanophorus Pertransiens	Neocomites wichmanni			Very abundant ostracods (platycopids and cytheraceans).
130			BERRIASIAN		Boissieri Occitanica Jacobis / Grandis (Euxina)	Spiticeras damesi Argentiniceras noduliferum Substeueroceras koeneni	Virgotrigonia hugoi Isognomon nanus — Anditrigonia subnodosa		Foraminifers, ostracods and calcareous nannoplankton. Radiolarians
135			TITHONIAN	U	Durangites Transitorius Simplisphinctes	Corongoceras alternans			
				M	Ponti Fallauxi (Penicillatum) Semiforme	Windhauseniceras internispinosum Aulacosphinctes proximus	Anditrigonia carrincurensis	Lacunosella ?	Abundant foraminifers (epistominids) and radiolarians. Presence of calpionellids and calcareous nannoplankton.
140				L	Vimineus Triplicatus (Darwini) Hybonotum	Pseudolissoceras zitteli Virgatosphinctes mendozanus		?	
			KIMMERIDGIAN	U	Beckeri Eudoxus Acanthicum				
				L	Divisum Hypselocyclum Platynota				
145			OXFORDIAN	U	Planula Bimammatum Bifurcatum				
				M	Transversarium Plicatilis	Perisphinctes - Araucanites	?	Thurmannella ?	?
150				L	Cordatum Mariae	Peltoceratoides - Parawedekindia	Retroceramus aff. galoi		Citharinella anceps - Citharina serratocostata
			CALLOVIAN	U	Lamberti Athleta	?			
155				M	Coronatum Jason	Rehmannia (L.) patagoniensis Proximum		Rhynchonelloidella	Calcareous nannoplankton and ostracods.
				L	Gracilis / Calloviense Macrocephalus	Bodenbenderi Vergarensis	Retroceramus stehni	Torquirhynchia - Lophrothyris	?
			BATHONIAN	U	Discus Retrocostatum	Steinmanni	Retroceramus patagonicus	Eurysites	Foraminifers: nodosariids and polymorphinids. ill-preserved ostracods. Radiolarians.
160				M	Bremeri Subcontractus	Cadomites - Tulitidae			


Progracilis
Zigzag
Morphoceras gulisanoi
Parkinsoni
Garantiana
Subfurcatum
Lobosphinctes
Megasphaeroceras magnum
Retroceramus marwicki
Humphriesianum
Sauzei
Laeviuscula
Ovalis
Discites
Humphriesianum
Giebeli
Parainoceramus ? westermanni
Singularis
Parvamussium andium
Concavum
Malarguensis
Kallirhynchia transatlantica
Murchisonae
"Zurcheria" groeberi
Meleagrinella
Scissum
Opalinum
Manflasensis
Rhynchonelloidea cf. ruthenensis
Levesquei
Dumortieria
Physeogrammoceras tenuicostatum
Thouarsense
Phymatoceras
Prionorhynchia ? cf. rubrisaxensis
Variabilis
Collina chilensis
Peronoceras pacificum
Peronoceras largaense
Parvamussium cf. pumilum
Bifrons
Rhynchonelloidea lamberti
Falciferum
Dactylioceras hoelderi
Tenuicostatum
Posidonotis cancellata
Spinatum
Fanninoceras
disciforme
fannini
Radulonectites sosneadoensis
Rhynchonelloidea cuyana
Margaritatus
behrendseni
Davoei
Dubariceras
Rhynchonelloidea burckhardti
Ibex
Tropidoceras
Otapiria neuquensis
Jamesoni
Miltoceras
Raricostatum
Cardinia cf. listeri
Gibbirhynchia dereki
Oxynotum
"Epophioceras"
Obtusum
Tumeri
?
Semicostatum
"Agassiceras"
Otapiria pacifica
Bucklandi
"Vermiceras"
Angulata
Badouxia canadensis
Furcirhynchia cf. trechmanni
"Wahneroceras - Schlotheimia"
Liasicus
Palmoxytoma cf. cygnipes
"Psiloceras"
Planorbis
Psiloceras rectocostatum
?
Marshi
Choristoceras
Paleocardita-Cassianella
Zugmayerella
Suessi
Flabellirhynchia
Cymatorhynchia - Monsardithyris
Lenticulina varians suturaliscostata
L. quensledti violetae
Lenticulina quenstedti decorata
Lenticulina (Astacolus) dorbignyi
Foraminifers: nodosariids.
Calcareous nannoplancton
and nodosariids
Foraminifers: Abundant nodosariids,
subordinate spirillinids and
polymorphinids.
Ostracods and radiolarians.
Foraminifers: agglutinated
Ostracods: healdiids
Foraminifers: agglutinated
and calcareous
Ostracods: healdiids and cytheraceans
165
170
175
180
185
190
195
200
205
210
215
MIDDLE
LOWER
UPPER
JURASSIC
TRIASSIC
BAJOCIAN
AALENIAN
TOARCIAN
PLIENSBACHIAN
SINEMURIAN
HETTANGIAN
RHAETIAN
NORIAN
U
L

- Dr. Nat. Sci. ALBERTO C. RICCARDI,
  Departamento Paleozoología
  Invertebrados,
  Museo de La Plata, 1900 (Argentina)

- Dr. HÉCTOR A. LEANZA,
  SEGEMAR,
  Avda. Julio A. Roca 651,
  Buenos Aires (Argentina)

- Dr. Nat. Sci. SUSANA E. DAMBORENEA,
  Departamento Paleozoología
  Invertebrados,
  Museo de La Plata, 1900 (Argentina)

- Ph. D. MIGUEL O. MANCEÑIDO,
  Departamento Paleozoología
  Invertebrados,
  Museo de La Plata, 1900 (Argentina)

- Dr. Nat. Sci. SARA C. BALLENT,
  Departamento Paleozoología
  Invertebrados,
  Museo de La Plata, 1900 (Argentina)

- Dr. ARNOLD ZEISS,
  Institut für Paläontologie
  der Universität Erlangen,
  Loewenichstrasse 28,
  91054 Erlangen (Germany)