

A lithostratigraphic and palaeoenvironmental framework for the Late Miocene El Caracolar section (Granada Basin, Betic Cordillera, Spain) and description of decapod crustaceans

Guillermo Díaz Medina, Matúš Hyžný *, Adiël A. Klompmaker

* Corresponding author; e-mail address: hyzny.matus@gmail.com (M. Hyžný).

Article published in *Geobios*
(<http://www.sciencedirect.com/science/journal/00166995>)

Please note: <i>Geobios</i> is not responsible for the content, quality or functionality of any supplementary materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.
--

Supplementary materials

Appendix A. Taxonomic list of all fossil taxa found to date at the El Caracolar locality and their occurrence within the local units.

Appendix A. Taxonomic list of all fossil taxa found to date at the El Caracolar locality and their occurrence within the local units.

A = Abundant (>50 specimens)
 C = Common (10-50 specimens)
 R = Rare (<10 specimens)
 ? = Doubtful

TAXA (species)	LOCAL UNITS			
	1	2	3	4
BIVALVIA				
<i>Aequipecten malvinae</i>				R
<i>Aequipecten scabrellus</i>	A		R	A
<i>Amussium cristatum</i>				R
<i>Flabellipecten fraterculus</i>	C			A
<i>Flabellipecten solarium</i>	R			
<i>Hinnites</i> aff. <i>ercolanianus</i>			R	
<i>Macrochlamys latissima</i>	R		R	
<i>Manupecten fasciculatus</i>			R	
<i>Manupecten jaklowecianus</i>			R	
<i>Oppenheimopecten revolutus</i>			R	
<i>Pecten</i> gr. <i>prae-benedictus</i>			R	
<i>Talochlamys multistriata</i>	C	R	R	A
<i>Limaria tuberculata</i>				R
<i>Limea strigillata</i>				R
<i>Parvamussium</i> sp.			R	
<i>Similipecten</i> sp.			R	
<i>Anomia ephippium</i>	A		A	A
<i>Pododesmus</i> sp.	?			R
<i>Crassostrea gryphoides</i>	C			
<i>Hyotissa hyotis</i>	R			R
<i>Neopycnodonte navicularis</i>	C		R	?
<i>Ostrea digitalina</i>				R
<i>Ostrea lamellosa</i>	C			C
<i>Spondylus concentricus</i>				C
<i>Spondylus</i> aff. <i>crassicosta</i>	R			
<i>Spondylus</i> sp.	R			
<i>Nucula</i> aff. <i>placentina</i>			R	
? <i>Yoldia</i> sp.			R	
? <i>Acila</i> sp.			R	
<i>Pseudochama gryphina</i>				R
Veneridae indeterminate			R	R
Vesicomyidae indeterminate	R		C	
cf. <i>Calyptogena</i> sp.			R	
<i>Discors</i> aff. <i>spondylioides</i>				R
<i>Jouannetia</i> aff. <i>semicaudata</i>			C	
<i>Glycymeris insubrica</i>				R
<i>Anadara</i> sp. cf. <i>Anadara geissei</i>		R		
Arcidae indeterminate			R	
<i>Pecchiolia argentea</i>	R			
Thyasiridae indeterminate				R
<i>Septifer</i> sp.				R
TAXA (families)	LOCAL UNITS			
	1	2	3	4
BIVALVIA				
Pectinidae	A	R	R-C	A
Limidae			R	R
Propeamussidae			R	
Anomiidae	C-A		C	A
Crassostreidae	C			
Gryphaeidae	C-A		R	R
Ostreidae	C-A			C-A
Spondylidae	R			C
Nuculanidae			R	
Yoldiidae			R	
Nuculidae			R	
Chamidae				R-C
Veneridae	R		?	R
Cardiidae				R
Pholadidae			C	
Glycymeridae				R
Arcidae		R	R	
Verticordiidae	R			
Thyasiridae				R
Mytilidae			R	R
GASTROPODA				
Vermetidae				C
Epitoniidae	R			
Turritellidae	R			
Conidae	R			R
SF. Cavolinioidea			R	
POLYCHAETA				
Serpulidae	C	R		R
MALACOSTRACA				
Ctenochelidae	R		R	
Callianassidae	C			A
Diogenidae	R			R
Raninidae			R	
Calappidae			R	R
Chasmocarcinidae			R	
Goneplacidae			C	
Leucosiidae			R	

TAXA (species)	LOCAL UNITS				TAXA (families)	LOCAL UNITS			
	1	2	3	4		1	2	3	4
<i>Adipicola</i> sp.			R		MAXILLOPODA				
Bivalvia indeterminate	R	R	R	C	Balanidae	R			R-C
					Scalpellidae				C
GASTROPODA					STENOLAEMATA				
Vermetidae indeterminate				C	Horneridae				R
<i>Epitonium</i> sp.	R				Ceriporidae				R-C
<i>Turritella</i> sp.	R				Phidoloporidae	R			R
<i>Conus</i> spp.	R			R	Celleporidae	R			
Gastropoda indeterminate		R	R		Smittinidae				R
Cavolinioidea indeterminate			R						
					RHYNCHONELLATA				
POLYCHAETA					Terebratulidae	R		R	
<i>Ditrupa arietina</i>	C	R		R					
					ANTHOZOA				
MALACOSTRACA					Stenocyathidae			R	
<i>Ctenocheles</i> sp.	R		R		Caryophylliidae	R			
“ <i>Callianassa</i> ” <i>almerai</i>	C			A	Isididae	?			R
<i>Petrochirus priscus</i>	R			R					
<i>Raninoides pliogenicus</i>			R		ECHINOIDEA				
<i>Calappa praelata</i>			R	R	Histocidaridae				R
<i>Styrioplax</i> sp.			R		Cidaridae	C		R-C	A
<i>Goneplax gulderi</i>			R		Schizasteridae	R		R	R
<i>Typilobus moralejai</i>			R		Brissidae			A	
Portunoidea indeterminate	R		R	R	Clypeasteridae	C			C-A
Decapoda indeterminate		R	R		Echinolampadidae	R			
					Diadematidae		R	R	?
MAXILLOPODA					Toxopneustidae?				R
<i>Balanus concavus</i>				R	Astropectinidae	R			R
Balanoidea indeterminate	R			R					
<i>Arcoscalpellum</i> sp.				C	CHONDRICHTHYES				
					Odontaspidae	A			A
STENOLAEMATA					Mitsukurinidae	?			R
Horneridae indeterminate				R	Alopiidae	?			?
Ceriporidae indeterminate				R	Lamnidae				R
“ <i>Berenicea</i> ” sp.	R				Otodontidae				R
<i>Reteporella</i> sp.	R			R	Hemigaleidae	?			?
Celleporidae indeterminate	R				Carcharinidae	A		R	A
? <i>Smittina</i> sp.				R	Pristiophoridae	?			?
					Squatinidae	R			?
RHYNCHONELLATA					Myliobatidae				R
<i>Terebratula maugeri</i>	R								
<i>Maltaia</i> aff. <i>costae</i>	R				OSTEICHTHYES				
? <i>Gryphinae</i> indeterminate			R		Sparidae	R			R
					Labridae				R
ANTHOZOA					Balistidae				R-C
Faviina indeterminate				R	Scombridae			R	
<i>Stenocyathus</i> aff. <i>vermiformis</i>			R		Siluroidei indeterminate				R
Caryophylliidae indeterminate	R				Clupeidae			R	
<i>Keratoisis melitensis</i>	?			R	Cheloniidae				R
Isididae indeterminate				R					
					TUBOTHALAMEA				
ECHINOIDEA					Hauerinidae		C		
<i>Histocidarid</i> aff. <i>rosaria</i>				R	Cibrolinoididae		R-C		
<i>Prionocidarid</i> sp.			R						

TAXA (species)	LOCAL UNITS				TAXA (families)	LOCAL UNITS			
	1	2	3	4		1	2	3	4
<i>Stylocidaris melitensis</i>	R			R	GLOBOTHALAMEA				
Cidaridae indeterminate	R			R	Nodosariidae			A	
<i>Schizaster eurynotus</i>	R			R	Polymorphinidae			R-C	
Schizasteridae indeterminate				R	Lagenidae			R-C	
<i>Brissopsis</i> aff. <i>duciei</i>			A		Stilostomellidae			R-C	
<i>Clypeaster marginatus</i>	C			C	Vaginulinidae		R-C	C	
<i>Clypeaster portentosus</i>	C			C	Bolivinitidae			A	
<i>Hypsoclypus</i> aff. <i>lucae</i>	R				Buliminidae			A	
<i>Hypsoclypus</i> sp.	R				Uvigerinidae			R-C	
Diadematidae indeterminate		R	R	?	Cassidulinidae			R-C	
Camarodonta indeterminate				R	Alabaminidae		R	R-C	
<i>Astropecten</i> aff. <i>granulatus</i>	R			R	Cancrisidae			A	
Ophiuroidea indeterminate				R	Discorbidae			R-C	
CHONDRICHTHYES					Globigerinidae		C-A	A	
<i>Carcharias acutissimus</i>	A			A	Catapsydracidae			R	
<i>Mitsukurina</i> sp.	?			R	Globorotaliidae		C-A	A	
<i>Alopias</i> sp.	?			?	Nummulitidae	C			A
<i>Isurus</i> sp.				R	Nonionidae			A	
<i>Parotodus benedeni</i>				R	Cibicididae			C	
<i>Chaenogaleus affinis</i>	?			?	Planorbulinidae			R-C	
<i>Carcharhinus obscurus</i>	?			R	Rotaliidae		R-C	C	
<i>Carcharhinus priscus</i>	C			C	Elphidiidae			R-C	
<i>Carcharhinus</i> sp.	C			C	RHODOPHYCEAE				
Carcharhinidae indeterminate			R		Corallinaceae	C-A			A
<i>Pristiophorus</i> sp.	?			?	CONIFEROPSIDA				
<i>Squatina subserata</i>	R			?	Taxodiaceae			R	
Myliobatidae indeterminate				R	EQUISETOPSIDA				
OSTEICHTHYES					Lauraceae			R-C	
<i>Diplodus jomnitanus</i>				R	Juglandaceae			R	
“ <i>Sparus</i> ” aff. <i>cinctus</i>				R	Poaceae			C-A	
“ <i>Sparus</i> ” <i>neogenus</i>				R	Ceratophyllaceae			R	
Sparidae indeterminate	R			R	Nyssaceae			R	
<i>Trigonodon jugleri</i>				R					
<i>Balistes lerichei</i>	?			R-C					
?Istiophoridae indeterminate				R					
Scombridae indeterminate			R						
Siluroidei indeterminate				R					
<i>Alosa</i> aff. <i>elongata</i>			R						
Percoidei indeterminate			C						
REPTILIA									
Cheloniidae indeterminate				R					
MAMMALIA									
Sirenia indeterminate				R					
TETRAPODA indeterminate	R		R	R					
TUBOTHALAMEA									
<i>Triloculina</i> spp.		C							
<i>Sigmoilopsis</i> sp.		R							
<i>Quinqueloculina buchiana</i>		R-C							
<i>Quinqueloculina</i> spp.		C							

TAXA (species)	LOCAL UNITS			
	1	2	3	4
<i>Adelosina</i> aff. <i>pulchella</i>		R-C		
GLOBOTHALAMEA				
<i>Dentalina catenulata</i>			R-C	
<i>Dentalina leguminiformis</i>			A	
<i>Annulofrondicularia</i> aff. <i>anularis</i>			R	
<i>Polymorphina spinosa</i>			R-C	
<i>Lagena</i> sp.			R-C	
<i>Siphonodosaria consobrina</i>			R-C	
<i>Lenticulina inornata</i>		R		
<i>Lenticulina</i> spp.		R-C	C	
<i>Bolivina alata</i>			R-C	
<i>Bolivina arta</i>			R-C	
<i>Bolivina spathulata</i>			R-C	
<i>Fursenkoina schreibersiana</i>			A	
<i>Bulimina striata</i>			R-C	
<i>Globobulimina affinis</i>			A	
<i>Uvigerina cylindrica</i>			R-C	
<i>Cassidulina carinata</i>			R-C	
<i>Globocassidulina subglobosa</i>			R-C	
<i>Oridorsalis umbonatus</i>		R	R-C	
<i>Cancris auriculus</i>			A	
<i>Valvulineria complanata</i>			A	
<i>Discorbina planorbis</i>			R-C	
<i>Neoeponides schreibersii</i>			R-C	
<i>Globigerina</i> gr. <i>bulloides</i>		R-A	A	
<i>Globigerina druryi</i>		R-A		
<i>Globigerina nepenthes</i>			R-C	
<i>Globigerina apertura</i>		R-A	R-C	
<i>Globigerina woodi</i>			R	
<i>Globigerinella obesa</i>		R-A	R	
<i>Globigerinella praecalida</i>		R-A		
<i>Globigerinoides quadrilobatus</i>			A	
<i>Globigerinoides</i> gr. <i>trilobus</i>		C-A	C	
<i>Globoturborotalia bulloidea</i>		R-A		
<i>Orbulina universa</i>		R-A	C	
<i>Sphaeroidinellopsis seminulina</i>		R-A		
<i>Globoquadrina (altispira) globosa</i>			R	
<i>Globorotalia merotumida</i>		R-A	A	
<i>Globorotalia scitula</i> sin.		R-A	R-C	
<i>Globorotalia (scitula) ventriosa</i>		R-A		
<i>Hirsutella</i> cf. <i>gigantea</i>		R-A		
<i>Neogloboquadrina acostaensis</i>		R-A	R	
<i>Neogloboquadrina atlantica</i>		R-A		
<i>Neogloboquadrina</i> cf. <i>atlantica</i>			R	
<i>Neogloboquadrina incompta</i>		R-A		
<i>Neogloboquadrina</i> cf. <i>pachyderma</i>		R-A		
<i>Neogloboquadrina</i> spp.		R-A		
<i>Paragloborotalia partimlabiata</i>			R	
<i>Turborotalita quinqueloba</i>		R-A		
Nummulitidae indeterminate	C			A
<i>Melonis barleeanus</i>			R-C	
<i>Nonion commune</i>			A	

TAXA (species)	LOCAL UNITS			
	1	2	3	4
<i>Cibicides dutemplei</i>			R-C	
<i>Cibicides floridanus</i>			R-C	
<i>Cibicoides pseudoungerianus</i>			R-C	
<i>Lobatula lobatula</i>			R-C	
<i>Planorbulina mediterraneensis</i>			R-C	
<i>Ammonia beccarii</i>		R-C	C	
<i>Elphidium crispum</i>			R-C	
RHODOPHYCEAE				
Corallinaceae indeterminate	C-A			A
CONIFEROPSIDA				
<i>Glyptostrobus europaeus</i>			R	
EQUISETOPSIDA				
Lauraceae indeterminate			R-C	
<i>Engelhardia</i> sp.			R	
Poaceae indeterminate			C-A	
? <i>Ceratophyllum</i> sp.			R	
? <i>Nyssa</i> sp.			R	
Cormophyta indeterminate			A	
Plantae indeterminate	R	R	R	R