

Miocene mammals from Lisbon and geologic age A showcase for marine-continental correlations

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The Lower Tagus basin in Lisbon and Setúbal Peninsula offers excellent conditions for marine-continental correlations, especially for Lower and Middle Miocene. A research Program was long (1960) conceived by us and is being carried on since then. Among its main goals, it deals with Stratigraphy, Palaeontology (and Palaeoecology and Palaeoclimatology), accurate dating (planktic foraminifera, K-Ar, Sr isotopes), other isotope data (O, C) and related tectonic events.

A huge volume of data has been obtained, much improving the already significant earlier status of knowledge. The time seems adequate for trying a global (and much more accurate) synthesis.

The following items will be presented:

- a corrected list of Lower and early Middle Miocene (mostly non marine) mammals, completed and thoroughly revised since earlier attempts (Antunes, 1984; Antunes *in* Antunes *et al.*, 1996).
- an updated model of the Lower Tagus Basin at its distal part (Lisbon & Setúbal Peninsula); the levels that yielded non marine mammals are shown in their accurate frame of marine units and age.
- an overview of environmental evolution, especially on temperature and moisture shifts.

The list of medium to large-sized mammals has been made possible owing to contributions by (among others) Léonard Ginsburg (Paris), Maria Teresa Alberdi & Jorge Morales (Madrid) and the author; for small mammals, by Pierre Mein (Lyon).

The geologic setting is mostly due in its present form to João Pais & Paulo Legoinha (Faculdade de Ciências e Tecnologia, UNL) with author's help. Most general data on vertebrate fauna (including fishes, reptiles and mammals) have been provided by M.T. Antunes.

Table 1

Lower and early Middle Miocene mammals from Lisboa

The ruminants are referred according to Antunes *et al.* (1994). Large to medium-sized mammals have been revised by L. Ginsburg (Paris) and the author. The small mammals were revised by P. Mein (Lyon).
Main localities: H. Tripas = Horta das Tripas; U.Cat. = Universidade Católica; Av. Urug. = Avenida do Uruguai; Qt. Narig. = Quinta do Narigão; Cr. Rei = Cristo Rei; Qt. Pomb./Pedreiras = Quinta do Pombeiro / Quinta das Pedreiras.

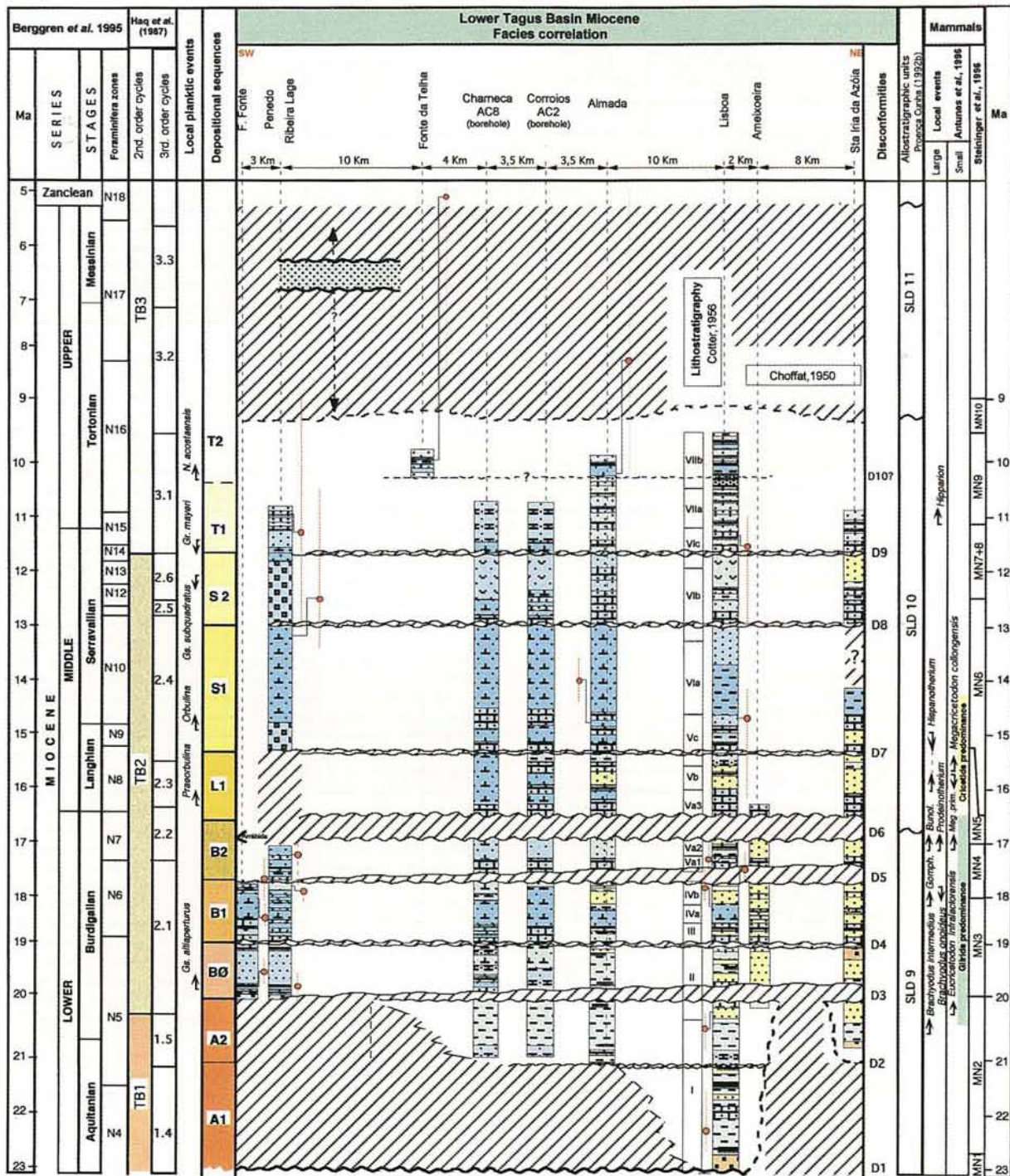
Stages	Aquitanian	Burdigalian		Langhian				
Upper boundary isotopic age of the DS		20Ma	17.8Ma	16.4Ma	15.3Ma			
Mammal zones	MN2b	MN3	MN3/4	MN4	MNS			
Iberian zones	Z (lower)	Z (upper)	A/B	C	Db	Dc	D (c?)	Dd/E
Main localities	Km 10	Tripas/U.Cat/Av. Urug.	Qt. Narig./Cr. Rei	Qt. Pomb./Pedreira	Chelas 1	Chelas 2	Quintanela	Amor
Depositional sequences (DS)		A2	B1	B2	L1			
CREODONTA								
<i>Hyainallurus sulzeri</i>					*			
CARNIVORA								
<i>Amphicyon olisiponensis</i>			*					
<i>Amphicyon giganteus</i>				*	*			
<i>Amphicyon sp.</i>				*	*			
<i>Hemicyon cf. stehlini</i>			*					
<i>Hemicyon stehlini</i>				*				
<i>Hemicyon sansaniensis parvus</i>					*			
<i>Plithocyon antunesi</i>			*		*			
<i>Ischyricictis cf. bezianensis</i>				*	*			
<i>Martes cf. munki</i>				*				
Mustelidae ind.				*				*
<i>Viverra (Viverrictis) modica aff. vetusta</i>				*	*			
<i>Pseudaelurus transitorius</i>		*						
<i>Pseudaelurus turnauensis</i>			*	*	*			
<i>Pseudaelurus lorteti</i>				*	*			
<i>Pseudaelurus romieviensis</i>					*			
ARTIODACTYLA								
<i>Brachyodus intermedius</i>		*						
<i>Brachyodus onoides</i>			*					
<i>Aureliachoerus aurelianensis</i>		*						
<i>Bunolistriodon lockarti</i>				*	*			
<i>Hyootherium soemmeringi</i>					*			*
<i>Taouanamo primum</i>				*	*			
<i>Cainotherium sp.</i>	*	*						
<i>Cainotherium miocaenicum</i>			*	*	*	*		*
<i>Dorcatherium crassum</i>				*	*		*	
<i>Andegameryx andegaviensis</i>	*							
<i>Amphitragulus aurelianensis</i>				*	*			
<i>Procervulus dichotomus</i>				*	*	*	*	
? <i>Lagomeryx ruetimeyeri</i>				*				
<i>Lagomeryx minimus</i>				*			*	*
Cervidae ind. 1								*
Cervidae ind. 2								*
<i>Palaeomeryx kaupi</i>			*	*	*	*	*	*
<i>Eotragus artienensis</i>				*				
PERISSODACTYLA								
<i>Anchitherium sp.</i>			*					
<i>Anchitherium cf. ezquerra</i>					*			
<i>Protaceratherium minimum</i>		*						
<i>Diaceratherium cf. aurelianensis</i>		*						
<i>Plesiaceratherium platyodon</i>			*					
<i>Plesiaceratherium lumiarense</i>				*	*			
<i>Prosantorhinus cf. germanicus</i>			*	*	*			
<i>Larietotherium sansanensis</i>					*			
<i>Hispanotherium matritensis</i>					*		*	*
<i>Iberotherium rexmanuelli</i>				*				
<i>Iberotherium rexmanuelli zbyzewski</i>					*			
Schizotheriinae ind.					*			
PROBOSCIDEA								
<i>Gomphotherium angustidens</i>			*	*	*		*	*
<i>Zygotaphodon turicensis</i>			*	*	*			
<i>Prodeinotherium cuvieri</i>				*	*		*	
SIRENIA								
Cf. <i>Halitherium sp.</i>		*						
<i>Metaxytherium medium</i>			*(?)	*	*		*(?)	

Table 1
Lower and early Middle Miocene mammals from Lisboa (cont.)

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Mammal zones	MN2b	MN3	MN3/4	MN4	MNS			
Iberian zones	Z (lower)	Z (upper)	A/B	C	Db	Dc	D (e?)	Dd/E
Main localities	Km 10	.Tripas/U.Cat/Av. Un	Qt. Narig./Cr. Re	Qt.Pomb./Pedreira	Chelas 1	Chelas 2	Quintanelas	Amor
Depositional sequences (DS)	A2		B1		B2			
INSECTIVORA								
<i>Galerix symeonidisi</i>					*			
<i>Galerix cf. exilis</i>								*
<i>Galerix</i> sp.	*					*	*	
<i>Crocidosorex antiquus</i>		*						
<i>Miosorex aff. grivensis</i>								*
Soricidae ind.	*							
<i>Amphechinus</i> sp.		*						
<i>Paratalpa</i> sp.		*						
Dimylidae ind.		*						
LAGOMORPHA								
<i>Lagopsis spiracensis</i>	*							
<i>Lagopsis cadeoti</i>		*						
<i>Lagopsis peñai</i>			*	*	*	*		
<i>Lagopsis cf. peñai</i>								*
<i>Prolagus vasconiensis</i>		*						
<i>Prolagus oeningensis</i>								*
RODENTIA								
<i>Heteroxerus paulhiacensis</i>	*							
<i>Heteroxerus cf. paulhiacensis</i>		*						
<i>Heteroxerus rubricati</i> (archaic)		*						
<i>Heteroxerus rubricati</i>			*	*	*	*		
<i>Atlantoxerus blacki</i>				*	*			
<i>Palaeosciurus fissurae</i>	*							
<i>Blackia miocaenica</i>	*							
Sciuridae ind.	*							
<i>Myoglis</i> sp.		*						
<i>Glirudinus modestus</i>	*	*						
<i>Microdyromys legidensis</i>		*						
<i>Microdyromys koenigswaldi</i>					*	*		*
<i>Peridyromys murinus</i>	*	*	*					
<i>Pseudodryomys ibericus</i>	*	*		*	*			
<i>Pseudodryomys robustus</i>			*					
<i>Praearmantomys ginsburgi</i>				*				
<i>Armantomys</i> sp. (parsani ?)		*						
<i>Armantomys aragonensis</i>					*			
<i>Prodryomys brailloni</i>	*							
<i>Ligerimys antiquus</i>	*	*	*					
<i>Melissiodon dominans</i>	*							
<i>Melissiodon</i> sp.						*		
<i>Eucricetodon infralactorensis</i>		*						
<i>Megacricetodon collongensis</i>				*	*	*		*
<i>Democricetodon</i> sp. (hispanicus ?)				*				
<i>Democricetodon</i> sp. nov.					*			
<i>Pseudofahlbuschia jordensi</i>						*		
? <i>Cricetodon</i> sp.								*
CETACEA Odontoceti								
Delphinidae ind.			*					

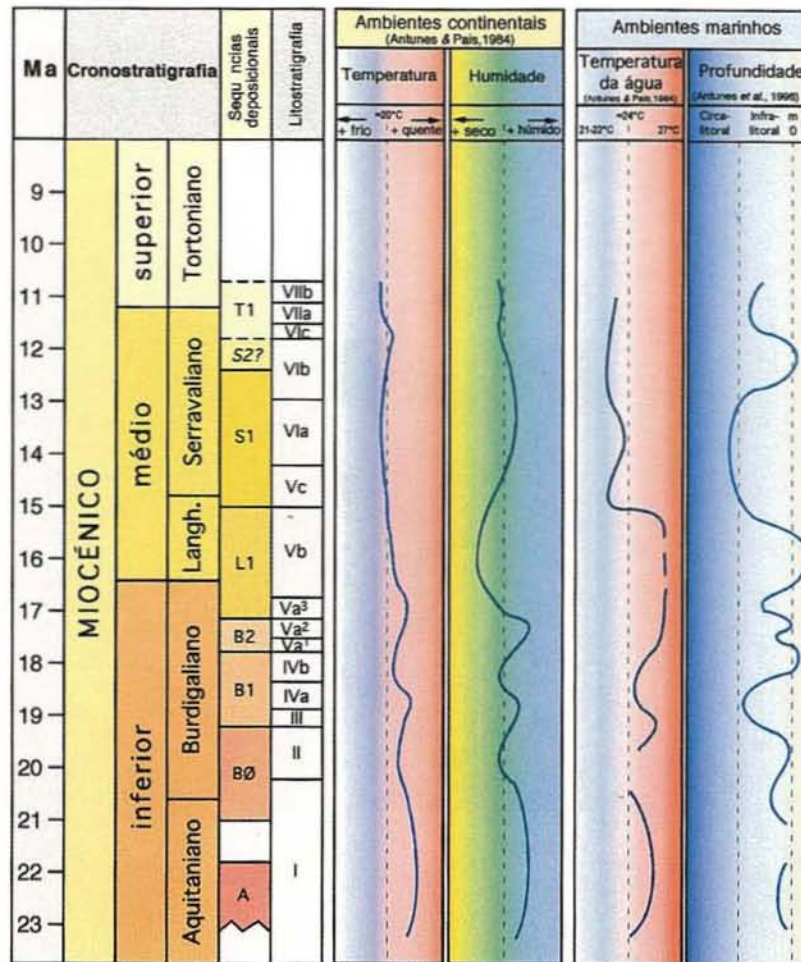
Table 2

Model of Lower Tagus basin (distal part), Lisboa & Setúbal Peninsula area (Antunes *et al.*, 2000).



<p> Sr isotopic age and error</p> <p> Main tectonic event at Arrabida chain (angular unconformity)</p> <p> Sequence boundaries</p> <p> First and last occurrence</p>	<p>Lithology</p> <p> Lignites</p> <p> Mudstones</p> <p> Sands and Sandstones</p> <p> Conglomerates</p> <p> Bioclasts</p> <p> Marls</p> <p> Biocalcarentes</p>	<p>Paleoenvironment</p> <p> Fluvial</p> <p> Delta/Estuary channels and bars</p> <p> Tidal flats</p> <p> Marine subtidal</p> <p> Marine infralittoral</p>	<p>Mammals</p> <p> Gomph. - Gomphotherium</p> <p> Buncl. - Bunolistriodon</p> <p> Meg. prim. - Megacricetodon primitivus</p>
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Table 3
Temperature and moisture evolution during Miocene (Pais, 1999).



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