Coloquios de Paleontología, Vol. Ext. 1 (2003) 127-132 ISSN: 1132-1660

The MN4 faunas of Aliveri and Karydia (Greece)

Las faunas de la MN 4 de Aliveri y Karydia (Grecia)

Constantin S. Doukas[1]

Abstract : The two main small mammal associations from Greece allocated to MN4, Aliveri (island of Evia) and Karydia (Greek Thrace) are discussed here. The age of the locality Aliveri was first thought to be MN3, but there is now general consensus that it represents MN4. This difference in age allocation shows clearly that the use of MN units becomes problematic when we are geographically far from the reference fauna in an area where the local succession of small mammal associations is not known. Detailed studies of the Rodentia and insectivores from Aliveri have shown that the rodents show, except for the presence of eomyids, strong Eastern Mediterranean (Turkish) affinities while the insectivores are similar to the Western European ones. Preliminary studies of the Karydia fauna suggest that this peculiar difference in affinity of the two groups occurs there also. This suggests that migration routes and ecological barriers were different for the two orders. The associations from Aliveri and Karydia share many genera and some species of rodents and are therefore considered to be not very different in age. The insectivores of these localities are similar on the generic level, but the species are not the same. This is unexpected because there is no reason to assume a clear difference in biotope between two sites that have a similar sedimentary environment.
Key Words: Greece, Biochronology, Miocene, Insectivores, Rodents.

Resumen: Se discuten las dos principales asociaciones de micromamíferos, Aliveri (Isla de Evia) y Karydia (Tracia Griega) de la MN4 de Grecia. Aliveri fue considerada coma MN3 pero en la actualidad existe un consenso general para su correlación con la MN4. Esta diferencia en asignación temporal muestra claramente que el uso de las unidades MN resulta problemática cuando estamos en un área alejada geográficamente de la fauna de referencia y donde no se conoce bien la sucesión de micromamíferos. Estudios detallados de los Rodentia e insectivoros de Aliveri han mostrado que los roedores presentan, excepto por la presencia de eomyidos, fuertes afinidades con el Este del Mediterraneo (Turquía) mientras que los insectivoros son similares a los de Europa occidental. Estudios preliminares de la fauna de Karydia sugieren que las rutas de migración y las barreras ecológicas fueron diferentes para ambos ordenes. Las asociaciones de Aliveri y Karydia comparten muchos géneros y algunas especies de roedores y son, por tanto, consideradas como de edad semejante. Los insectivoros son similares a nivel genérico pero no específico. Esto es inesperado puesto que no existe razón para asumir diferencias en el biotopo de ambas localidades puesto que poseen el mismo ambiente de sedimentación.
Palabras clave: Grecia, Biocronología, Mioceno, Insectivoros, Roedores.

INTRODUCTION

The L. Miocene (MN4) in Greece is found in two localities, Aliveri in the island of Evia and Karydia in Thrace near the city of Komotini.

Both localities contain small mammal assemblages, Rodentia and insectivores and do share many genera and some species. Therefore are considered to be not very different in age. What is interesting in these two faunas is the study of the differences and affinities to Anatolia in one hand and to the Central and Western Europe on the other. Also, the differences and affinities between the two groups.

ALIVERI

HANS DE BRUIJN, A. J. VAN DER MEULEN and G. KATSIKATSOS discovered the locality of Aliveri in 1977 and the reader is referred to their publication of Sciuridae (1980) for a description of the locality. Since then, many authors have worked on this diverse fauna. The Gliridae are described by van der Meulen *et al.* (1982), the Carnivora by SCHMIDT-KITTLER (1983), the Spalacidae and Anomalomyidae by KLEIN HOFMEIJER and DE BRUIJN (1985) as well as the Cricetidae (1988), the Insectivora by DOUKAS (1986), the Lagomorpha by LOPEZ-MARTINEZ (1986), the

[1] Department of Hist. Geology-Paleontology, Athens University, Greece e-mail: : cdoukas@geol.uoa.gr

Eomyidae by ALVAREZ SIERRA *et al.* (1987) and the paracricetodontin *Mirabella* by DE BRUIJN *et al.* (1987). To achieve this, six tons of sediment were washed, during 2 field campaigns.

The Aliveri fauna was first thought to be MN3 (DE BRUIJN *et al.* 1980) but today there is a general consensus that it is MN4. This difference in age allocation shows clearly that the use of MN units becomes problematic when we are geographically far from the reference fauna and in an area where the local succession of small mammal associations is not known.

A fauna list of Aliveri, together with the absolute frequencies of the species (N=M1+M2+m1+m2) is given on Table 2.

The rodent assemblage has no W. European equivalent in faunal structure but rather an E. Mediterranean. Not necessarily Turkish, because of the faunal composition and the fact of the absence of eomyids, which arrive in Turkey later at MN5. The earliest find of eomyids in Turkey is in Candir with *Keramidomys* and *Eomyops.*

Aliveri shares with the locality of Rembach (MN4**)** the cricetids *Mirabella, Democricetodon, Megacricetodon* and *Eumyarion,* the sciurids *Miopetaurista* and *Blackia,* the glirid *Microdyromys* and the anomalomyid *Anomalomys*, (ZIEGLER *et al.*1986) (Table 1). However the only Aliveri species present also in Rembach are *Democricetodon* aff. *franconicus, Eumyarion weifurteri, Mirabella tuberosa, Miopetaurista dehmi, Blackia miocaenica.* Moreover the species *Anomalomys aliveriensis* and *Cricetodon aliveriensis* are not known from W. Europe (DE BRUIJN *et al.* 1987).

On the other hand in Turkey, in MN4 localities, the species *Mirabella tuberosa, Cricetodon tobieni, Democricetodon franconicus, D. gracilis, Anomalomys minor, A. aliveriensis,* and *Aliveria* sp. are found (SEN *et al.* 1998, ÜNAY *et al.* in press). It should be noted that C*ricetodon aliveriensis* is closest to *C. tobieni* than any other species and a migration East to West is suggested (DE BRUIJN *et al.* 1993).

The insectivores assemblage contains all the known families present at that time. All the genera present are known from W. Europe. Soricids dominate the fauna (51.8 %), while erinacids (25.4%) and talpids (20.2%) are well represented (DOUKAS, 1986).

The erinacid, *Galerix symeonidisi,* is of particular interest. With the data available today this species first described by DOUKAS (1983) it appears to have had a large distribution as it is also known from Ger-

Taxa		Localities		
		Aliveri	Karydia	Rembach
Erinaceidae	*Galerix*	x	x	x
Talpidae	*Desmanodon*		x	x
Dimylidae	*Plesiodimylus*	x		x
Soricidae	*Heterosorex*	x		x
Cricetidae	*Democricetodon*	x	x	x
	Megacricetodon	x		x
	Eumyarion		x	x
	Mirabella	x	x	x
Sciuridae	*Blackia*	x	x	x
	Miopetaurista	x		x
Eomyidae	*Ligerimys*		x	x
Anomalomyidae	*Anomalomys*	x	x	x
Gliridae	*Glirulus*	x	x	x
	Glirudinus		x	x
	Bransatoglis	x		x
	Microdyromys	x		x

Table 1.- Similarities of faunal elements in Aliveri, Karydia and Rembach.
Tabla 1.- Similitudes en elementos faunísticos entre Aliveri, Karydia y Rembach.

many (ZIEGLER *et al.* 1986, ZIEGLER, 1990), Anatolia (SEN *et al.* 1998) and Spain (VAN DEN HOEK OSTENDE *et al.* in press). It also had a remarkable short biostratigraphic span. The species *Desmanodon meuleni* is not known from other localities either in W. Europe or in Anatolia. However, the genus is known from Anatolia, Germany and Spain. It is suggested that it is an immigrant from the East arriving in Europe in MN3 at Stubersheim 3 (ZIEGLER, 1990, VAN DEN HOEK OSTENDE, 1997). Although there is no question of the assignment of the Aliveri species to the genus *Desmanodon,* humerii, which could provide an additional and critical information are not found.

The occurrence of *Myxomygale* is surprising since the genus is known from the Oligocene of France. The *Plesiodimylus* species was first thought to be *P. huerzeleri* (DOUKAS, 1983) but later changed (DOUKAS, 1986) to *P. chantrei.* This change in identification was due to considering *P. huerzeleri* to be a junior synonym of *P. chantrei.* However SCHÖTZ (1985) considers those two species to be separate, to which VAN DEN HOEK OSTENDE (1995b) agrees. The presence of a mesostyle in the Aliveri species, which is one of the characters differentiating the two species according to SCHÖTZ (1985), makes reversal to the original assignment to *P. huerzeleri* (DOUKAS, 1983) necessary. In the Rembach locality, should be noted the presence of *Galerix* aff. s*ymeonidisi* also of *Plesiodimylus chantrei* and the genera *Desmanodon* and *Heterosorex.* The presence of these species in Germany is one of the reasons for assigning Aliveri to MN4.

KARYDIA

The locality of Karydia, near the city of Komotini, was discovered by Hans DEBRUIJN and D. FOUSSEKIS (1989). Eight and half tons of sediments have been washed during three consecutive field campaigns. A provisional fauna list of the rodent assemblage together with the available (THEOCHAROPOULOS, 2000), absolute frequencies of the species (N=M1+M2+m1 +m2) is given on Table 2. The genera K*arydomys, Deperetomys* and *Debruijnia* are found only in this locality. However the genera and species *Cricetodon aliveriensis, Democricetodon franconicus, D. gracilis, Eumyarion, Mirabella tuberosa, Palaeosciurus, Aliveria luteijni, Blackia miocaenica, Anomalomys aliveriensis, Glirulus (Paraglirulus) agelakisi, Glirulus (Glirulus) diremptus, Glis galitopouli, Glirudinus,* and *Miodyromys* are also present in the Aliveri assemblage (THEOCHAROPOULOS, 2000). The Karydia locality is also assigned to MN4, but on the basis of the stage of evolution of *Cricetodon* and *Anomalomys* is considered younger than Aliveri. The Eastern Mediterranean uniqueness of this locality as in Aliveri is obvious. The composition of the assemblages of Aliveri and Karydia are more diverse than the assemblages from Anatolia (THEOCHAROPOULOS, 2000). The genus *Karydomys* although showing a large geographical range is an immigrant from the east. THEOCHAROPOULOS (2000) suggests a common ancestor relation for *Democricetodon* and *Karydomys* due to close similarities between the two genera. The same author also suggests that because of the presence of two species of *Karydomys* in Karydia, the genus was already diverse before its migration towards W. Europe.

The insectivores assemblage of Karydia contains, except for Dimylidae, all the genera present in the Aliveri fauna. However, no species are similar between the two assemblages. This is definitely not expected because there is no reason to assume a clear difference in biotope between two sites that have a similar sedimentary environment. The absence of Dimylidae, which are indicative of moist environment, does not change our biotope assessment of Karydia since all the other elements of the fauna are associated with humid preferences.

The *Galerix* species from Karydia differs from *G. symeonidisi* (DOUKAS *et al.* in prep) showing *Schizogalerix* morphological characters. Close to the locality of Karydia, the locality of Komotini, assigned to MN5, has given a *Galerix* species different of Karydia. Moreover, it is not *G. exilis* but rather shows more common characters to *Schizogalerix.* In W. Europe *G. symeonidisi* is present until the lower MN5, being replaced by *G. exilis* (ZIEGLER*et al.* 1986, SCHÖTZ 1988, VAN DEN HOEK OSTENDE *et al.* in press). It appears that the replacement *G. symeonidisi-G. exilis* does not occur in the E. Mediterranean area. Rather a replacement or an ancestor-descendant relation between *G. symeonidisi* and *Schizogalerix* might occur. The genus *Desmanodon* is accompanying *Galerix* in all MN4 localities. The Karydia species is not *D. meuleni* which has been described from Aliveri (DOUKAS, 1983) and its assignment to species will be dealt in the near future (DOUKAS *et al.* in prep.) trying to explain the migration patterns of *Desmanodon.*

Taxa		Locality		Locality	
		Aliveri	N	Karydia	N
Erinaceidae	*Galerix symeonidisi*	x	29		
	Galerix sp.			x	N.A.
Talpidae	*Desmanodon meuleni*	x	19		
	Desmanodon sp.			x	N.A.
	Myxomygale engesseri	x	4		
Dimylidae	*Plesiodimylus chantrei*	x	3		
Heterosoricidae	*Dinosorex* sp.			x	N.A.
	Heterosorex ruemkeae	x	28		
Soricidae	Crocidurinae	x	31		
Mustelidae	*Palaeogale* sp.	x			
Lophocyoninae	*Euboictis aliverensis*	x			
Cricetidae	*Cricetodon aliveriensis*	x	56	x	
	Democricetodon gracilis	x	167	x	62
	Democricetodon franconicus	x	104	x	57
	Democricetodon anatolicus			x	9
	Democricetodon cf.*gaillardi*			x	7
	Karydomys symeonidisi			x	45
	Karydomys boskosi			x	12
	Megacricetodon primitivus	x	43		
	Eumyarion weifurteri	x	33		
	Eumyarion aff. *latior*			x	N.A.
	cf. *Deperetomys* sp.			x	N.A.
	Mirabella tuberosa	x	32	x	N.A.
Sciuridae	*Aliveria brinkerinki*	x	23		
	Aliveria luteijni	x	27	x	N.A.
	Miopetaurista dehmi	x	-		
	Blackia miocaenica	x	16	x	N.A.
	Tamias eviensis	x	14		
	Palaeosciurus aff. *fissurae*	x	3	x	N.A.
Eomyidae	*Pseudotheridomys parvulus*	x	404		
	Ligerimys sp.			x	N.A.
Anomalomyidae	*Anomalomys aliveriensis*	x	140	x	N.A.
Spalacidae	*Debruijnia* n.sp.			x	N.A.
	Heramys eviensis	x	22		
Gliridae	*Glirulus (Glirulus) diremptus*	x	50	x	N.A.
	Glirulus (Paraglirulus) agelakisi	x	41	x	N.A.
	Glis galitopouli	x	54	x	N.A.
	Glirudinus gracilis			x	N.A.
	Glirudinus euryodon	x	29		
	Bransatoglis cf. *fugax*	x	3		
	Microdyromys sp.	x	2		
	Miodyromys cf. *praecox*			x	N.A.
	Seorsumuscardinus alpinus			x	N.A.
Ochotonidae	*Albertona balcanica*	x	208		

Table 2.- Fauna list of Aliveri and Karydia plus the absolute frequencies (N=M1+M2+m1+m2) of the species.
Tabla 2.- Lista faunística de Aliveri y Karydia mostrando la abundancia relativa de las especies (N=M1+M2+m1+m2).

DISCUSSION

MN4, in Greece is present in two, rich in material, localities. Unfortunately the local knowledge of zone succession is poor. MN3 is not known and MN5 is only found in a rather poor locality. In Greece the upper Miocene to lower Pliocene interval is better known where the local zonation has been calibrated by magnetostratigraphical methods (VAN VUGT, 2000, STEENBRINK, 2001).

The poor understanding of the local zonation makes difficult the reconstruction of migration patterns. Any attempt is highly speculative. The MN zonation was never meant to be a formal zonation since we recognize regional differences. By recognizing this we also understand the reason for not defining boundaries between subsequent zones (DE BRUIJN *et al.* 1992).

However, one has to have a working hypothesis in order to explain the available fossil record. THEOCHAROPOULOS (2000), suggests that *Karydomys* and *Democricetodon* are related through sharing a common ancestor. This suggestion, rather than an ancestor-descendant relation, is explained by the fact that for a notoriously stable group as the Democricetodontinae, a high rate of evolution (in dental morphology) is not possible.

The presence of *Mirabella tuberosa* in both localities should be noted here. *Mirabella* is not a migrant to Greece at this time since the oldest record, *M. hansoulii,* is from the Up. Oligocene locality of Kyprinos in the Greek Thrace (DOUKAS *et al.* 1999).

What is obvious, studying both localities is the differences, which are observed in the two groups, Rodentia and insectivores. What is surprising is that the Rodentia, although usually more "plastic" show a number of similar species in both localities. However the rather conservative insectivores do not share even one species. If our working hypothesis that *Galerix symeonidisi* is being replaced by *Schizogalerix* and not by *G. exilis,* as it is the case for W. Europe, the Western influence observed in Aliveri is being lost in Karydia.

Through our knowledge of the connections between Turkey and Greece at that time (DERMITZAKIS *et al.* 1981) it appears that a land bridge existed in the North but a sea barrier was present at where Aliveri is today. This rather explains an Eastern influence in the Karydia fauna and a Western influence in the Aliveri fauna.

Therefore we can suggest that a migration from the East was possible in Karydia but not in Aliveri. The similar rodent elements between the two faunas are present due to North-South connection and not to simultaneous invasion from the East.

In any case we have to accept that different migration barriers exist for the two groups, Rodentia and insectivores.

ACKNOWLEDGMENTS

This paper is dedicated to the memory of Remmert DAAMS, a great scientist and good friend.

I am grateful to Dr. Hans DE BRUIJN and Dr. Albert VAN DER MEULEN (Utrecht) for even in their time of stress, preparing their own manuscripts for this volume, had time to critically reading the manuscript and making suggestions. As referees Dr. Engin ÜNAY (Sivas) and Dr. Pablo PELÁEZ-CAMPOMANES (Madrid), made critical suggestions, that greatly improved this manuscript. Ioannis DIMITRIOU (Athens) has helped to bypass moments of panic and helped with the reference list and the tables.

REFERENCES

ALVAREZ SIERRA, A., DAAMS R., MEULEN A. J. VAN DER. 1987. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 7. The Eomyidae. *Proc. Kon. Ned. Akad. Wetensch.* B **90 (1)** 47-56.

BRUIJN, H., DE, DAAMS, R., FAHLBUSCH, V., GINSBURG, L., DAXNER-HOCK, G., MEIN, P. & MORALES, J. 1992. Report of the RCMNS working group on fossil mammals, Reisensburg 1990: *Newsl. Statigr*., **26 (2/3)** 65-118.

—, FAHLBUSCH, V., SARAÇ, G. & ÜNAY E. 1993. Early Miocene rodent faunas from the eastern Mediterranean area. *Proc. Kon. Ned. Akad. Wetensch*. B **96 (2)** 151-216.

—, MEULEN A. J. VAN DER, KATSIKATSOS G. 1980. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 1. The Sciuridae *Proc. Kon. Ned. Akad. Wetensch*. B **83 (3)** 241-261.

—, ÜNAY E., SARAÇ G., KLEIN HOFMEIJER G. K. 1987. An unusual new eucricetodontine from the Lower Miocene of the Eastern Mediterranean *Proc. Kon. Ned. Akad. Wetensch.* B **90 (2)** 119-132.

DERMITZAKIS, M. D., PAPANIKOLAOU, D. J.1981. Paleogeography and Geodynamics of the Aegean region during the Neogene: *Ann. Geol. des Pays Hell.* Hors Serie Fasc. **IV** 245-289.

DOUKAS, C. S. 1983. Insectivores (Insectivora, Mammalia) from the Lower Miocene of Aliveri, Evia. *Diss. Univ. Athens*. 1-91. (in Greek).

— .1986. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 5. The Insectivores. *Proc. Kon. Ned. Akad. Wetensch*. B **89 (1),** 15-38.

—, Hoek Ostende L. W., van den. In prep. L. Miocene insectivores from the Komotini area (N. Greece).

—, Theocharopoulos, C. 1999. Smaller mammals from the Oligocene of Kyprinos (Thrace, Greece). In: *Elephants have a snorkel*. Reumer, de Vos. Eds. *DEINSEA* (7) 133-145.

Hoek Ostende, L. W. van den. 1995b. Insectivore faunas from the Lower Miocene of Anatolia.Part 2. Dinosorex Heterosoricidae.*: Proc. Kon. Ned. Akad. Wetensch*. B **98 (1)** 1-18.

—. 1997. Insectivore faunas from the Lower Miocene of Anatolia.Part 4. The genus Desmanodon, with the description of a new species from the Lower Miocene of Spain. *Proc. Kon. Ned. Akad. Wetensch.* B **100 (1/2)** 27-65.

—, Doukas C. S. In press. Distribution of the Early Miocene erinaceid *Galerix symeonidisi* Doukas 1983: *DEINSEA* (10).

Hofmeijer, G. K., Bruijn. H. de. 1985. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 4. The Spalacidae and Anomalomyidae**.** *Proc. Kon. Ned. Akad. Wetensch.* B **88 (2)**, 185-198.

—, Bruijn. H. de. 1988. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 8. The Cricetidae**.** *Proc. Kon. Ned. Akad. Wetensch*. B **91 (2)**, 185-204

Lopez- Martinez, N. 1986. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 6. The ochotonid lagomorph *Albertona balcanica* n.gen n. sp. And its relationships. *Proc. Kon. Ned. Akad. Wetensch*. B **89 (2)**, 177-194.

Meulen, A. J. van der, Bruijn. H. de. 1982. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 2. The Gliridae**.** *Proc. Kon. Ned. Akad. Wetensch*. B **85(4)** 485-524.

Schmidt-Kittler, N. 1983. The Mammals from the Lower Miocene of Aliveri (Island of Evia, Greece) Part 3. On a new species of Sivanasua Pilgrim, 1931(Feliformia, Carnivora) and the phylogenetic position of this genus. *Proc. Kon. Ned. Akad. Wetensch*. B **86 (3)**, 301-318.

Schötz, M. 1985. Die Dimyliden (Mammalia, Insectivora) aus dem Kiesgrube Niederaichbach und Maßendorf (Obere Süßwassermolasse Niederbayerns). *: Mitt. Bayer. Staatsslg. Paläont. Hist. Geol*. **25**: 95-130.

—. 1988. Die Erinaceiden (Mammalia, Insectivora) aus dem Kiesgrube Niederaichbach und Maßendorf (Obere Süßwassermolasse Niederbayerns). *: Mitt. Bayer. Staatsslg. Paläont. Hist. Geol*.28: 65-87.

Sen, S., Seyitoglu G., Karadenizli L., Varol B. & Araz H.. 1998. Mammalian biochronology of Neogene deposits and its correlation with the lithostratigraphy in Çankiri-Çorum Basin, central Anatolia, Turkey. *Eclogae geological Helvetiae*, **91** : 307-320.

Steenbrink, J. 2001. Orbital signatures in lacustrine sediments. The late Neogene intramontane Florina-Ptolemais-Servia basin, northwestern Greece.: *Geologica Ultraiectina*, **205**,1-167.

Theocharopoulos, C. D. 2000. Late Oligocene-Middle Miocene Democricetodon, Spanocricetodon and Karydomys n. gen. From the Eastern Mediterranean Area.: *GAIA* **8** Univ. Athens 1-92.

Unay E., Bruijn De H. And Sarac G. In press. A preliminary zonation of the continental Neogene of Anatolia based on rodents. *DEINSEA* (10).

Vugt, N., van. 2000. Orbital forcing in late Neogene lacustrine basins from the Mediterranean.A magnetostratigraphic and cyclostratigraphic study. *Geologica Ultraiectina*: **189**,1-167.

Ziegler, R.,. Fahlbusch. V. 1986. Kleinsauger-Faunen aus der basalen Oberen Süßwasser-Molasse Niederayerns. *Abh. Bayer. Staatsslg. Paläont. Hist. Geol*.: **14**, 3-80.

Ziegler, R. 1990. Talpidae (Insectivora, Mammalia) aus dem Oberoligozän und Untermiozän Süddeutschlands. *Stuttgarter Beitr. Naturk*.: Series B, **167,** 1-81.