

Miocene/Pliocene insectivores from China and their relationship to European insectivores

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Accepted for publication: 5 March, 1995

STORCH G., QIU Z.-D. 1996. Miocene/Pliocene insectivores from China and their relationship to European insectivores. Acta zool. cracov. 39(1): 507-512.

Abstract. Insectivores from three local faunas are discussed. Lufeng, Yunnan Prov., South China, represents an equivalent of MN 11/12, while Ertemte and Bilike, Inner Mongolia, North China, are equivalents of MN 13 and MN 14, respectively. Lufeng insectivores show close affinities to European faunas of somewhat older age, while various Ertemte soricids belong to a potential source of younger invasions into Europe around the Miocene/Pliocene boundary. Alleged Tertiary relics among living East Asian insectivores, such as *Blarinella*, *Anourosorex*, *Scapanulus*, and *Hylomys* are known as fossils only slightly beyond their present ranges. The taxonomic positions of the species *kormosi* SCHLOSSER, 1924 and *inexpectatus* SCHLOSSER, 1924 is revised.

Key words: Insectivores, Soricidae, late Miocene, early Pliocene, Yunnan, Inner Mongolia, China.

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I. INTRODUCTION

In the early 1960's, Professor Kazimierz KOWALSKI studied Chinese shrews and as one result, he and Chuankuei LI in 1963 described a new genus, *Peisorex*. Professor KOWALSKI and his wife, Dr. Barbara RZEBIK-KOWALSKA, have made outstanding contributions to our understanding of soricid evolution during the European Neogene and Quaternary. It is with great pleasure that we are able to contribute to this volume in honour of Professor KOWALSKI.

Our paper is centered on Chinese shrews, family Soricidae, while leaving aside hedgehogs and moles. We restrict our paper to two topics: firstly, the alleged Tertiary relics among living Southeast Asian shrews, and secondly, changes in soricid faunas at the Miocene-Pliocene boundary. We will focus on Chinese-European connections. To this end, we selected three local paleofaunas that are rich in insectivore remains. These are Shihuiba near Lufeng, Yunnan Province, in the very south of China, and Ertemte and Bilike, Inner Mongolia Autonomous Region, in the north (see QIU 1988). The age of Lufeng is Middle Baodean and is an equivalent of the late early (MN 11) or early middle Turolian (MN 12) European Land Mammal Age. Ertemte is of latest Baodean and Bilike of early Yushean Chinese Land Mammal Age and thus these faunas represent the latest Miocene (MN 13) and early Pliocene (MN 14).

II. ALLEGED TERTIARY RELICS

Lufeng has yielded fossils that shed some light upon Tertiary relic genera in Southeast Asia. The fossiliferous lignites have thus far produced more than one hundred mammal species, including 9 insectivore taxa (STORCH & QIU 1991). The micromammals were obtained by screen-washing operations in 1983; today the locality is protected as a National Monument for its fossils and in particular for its remarkably well-preserved hominoids.

In comparison with the living insectivore fauna of Yunnan Province (see WANG & YANG 1989), the fossil Lufeng sample obviously exhibits some shortcomings. Major extant groups like Neomyini, Crocidurinae, Talpini, and Uropsilinae are missing. They evolved somewhere else and had not yet appeared in Yunnan. Accordingly, the genera *Chimarrogale*, *Crocidura*, and *Soriculus sensu lato* are well represented in younger mammalian faunas from Yunnan Province (see QIU et al. 1984). On the other hand, the Lufeng insectivore fauna includes a number of extant genera which have rather restricted distributions in Southeast Asia and which are generally considered typical Tertiary relics, namely *Hylomys*, *Scapanulus*, *Blarinella*, and *Anourosorex*.

Close comparisons with supposed Neogene members of these genera from Europe and Asia show, however, that there is actually no fossil record outside Southeast and East Asia. The living echinosoricines are confined to Southeast Asia, and the Lufeng *Hylomys* aff. *suillus* is the first reliable Tertiary record of any living echinosoricine genus. *Yunoscaptor scalprum* from Lufeng, a rather small scalopine mole, is a good candidate for the ancestry of the living Gansu mole, *Scapanulus oweni*, from Central China. The humerus of *Yunoscaptor* is strikingly similar to that of *Scapanulus* and the dentition of *Yunoscaptor* shows only a few more primitive features. Alleged European *Scapanulus* fossils, on the other hand, depart clearly from this condition and we exclude them from such a close generic relationship on the basis of arguments presented elsewhere (STORCH & QIU 1983).

The Chinese short-tailed shrews of the genus *Blarinella* have restricted and very scattered ranges in the mountains of Sichuan, Shaanxi, Gansu, Yunnan, and northern Burma. Fossil *Blarinella* species are also recognized in Europe, from whence the genus is recorded at various localities dating from the Middle Miocene through the Pliocene (REUMER 1984, RZEBIK-KOWALSKA 1989). While the Lufeng remains almost duplicate the characteristic dentition of the living animal, the European taxa differ in several respects and are better placed outside this genus. We do not present extensive character lists here; apomorphous features of *Blarinella sensu stricto* are, for example, the postprotocrista on the square upper molars which runs approximately parallel to the lingual tooth margin on the rectangular hypoconal flange posteriorly, and the lack of a distinct metaloph.

A similar Chinese-European case is seen in the fossil history of the mole-shrew, genus *Anourosorex*. It is presently distributed from Shaanxi and Hubei south to Yunnan and adjacent parts of Burma, Thailand, and Vietnam, and further to Taiwan, Bhutan, and Assam. Again, alleged Neogene *Anourosorex* finds from the Vallesian through Early Turolian of Europe differ greatly from late Miocene *Anourosorex oblongus* from Lufeng, various Pleistocene *Anourosorex* species from China and Japan, and the living *Anourosorex squamipes*. The European fossils are better referred to a different genus, *Crusafontina* (see STORCH & QIU 1991). Our compilation of fossil records suggests that the genus *Anourosorex* was always confined to Southeast and East Asia (Fig. 1). This does not necessarily mean that closely related taxa were always excluded from the western Palearctic, and we consider the extinct genus *Amblycoptus*, which invaded Europe during the Vallesian, to be the sister taxon of *Anourosorex*. *Anourosorex* differs from *Crusafontina* in having, among other features, the anterior occlusal outline of P4/ square, M1/ lengthened mesiodistally and with exaggerated parastyle and subdued mesostyle, and the lower molars without entocristids. *Anourosorex* differs from *Amblycoptus* in having retained the third molars.

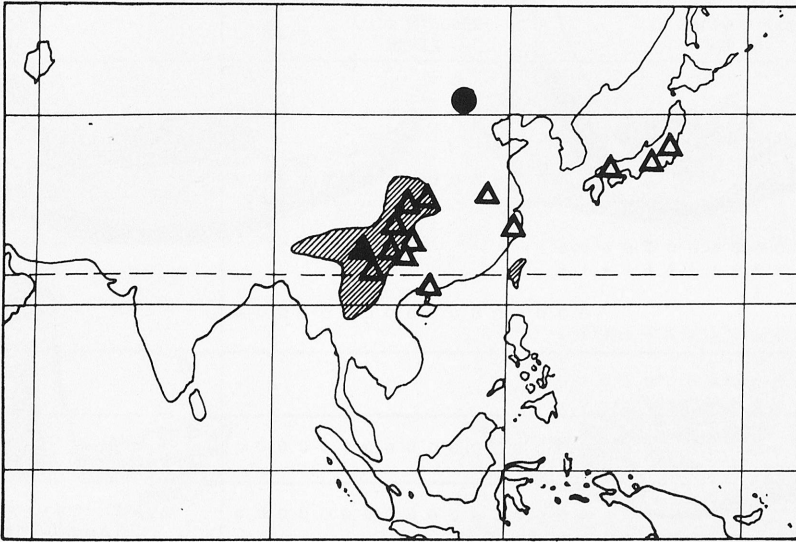


Fig. 1. Distributions of *Anourosorex squamipes* (shaded area), Recent; *Anourosorex* spp. (open triangles), Quaternary; *Anourosorex oblongus* (solid triangle), middle Baodean; and n.g.n., *inexpectatus* (solid circle), latest Baodean.

We thus conclude that the aforementioned genera are indigenous to Southeast and East Asia, that they are known as fossils only slightly beyond their present ranges, and hence that their living species are in no way Tertiary relics. The Lufeng fauna does, however, include two Miocene relics.

The extinct genera *Heterosorex* and *Lanthanotherium* show striking affinities to Miocene European forms and have their latest known records at Lufeng (STORCH & QIU 1991). The genus *Heterosorex* was previously known only from the Early and Middle Miocene of Europe and the most derived species, *Heterosorex wangi* from Lufeng, extends the stratigraphic and geographic ranges considerably. Evolutionary trends within the genus include the strengthening of the lower incisor (Fig. 2).

The echinosoricine *Lanthanotherium* was previously known from the Neogene of Europe and North America, and the minute species *L. sanmigueli* from Lufeng compares well with late Vallesian and early Turolian (MN 10-11) specimens of the same species from Europe. *Heterosorex* and *Lanthanotherium* probably disappeared from Europe as a result of climatic deterioration, and the Lufeng populations can therefore be considered as Miocene subtropical relics.

III. FAUNAL CHANGES AT THE MIOCENE/PLIOCENE BOUNDARY OF INNER MONGOLIA

We now move from Yunnan Province to the higher latitudes of Inner Mongolia in order to briefly comment on faunal changes at the Miocene/Pliocene boundary. To exclude latitudinal ecological variation and faunal provinciality, we selected the localities Ertemte and Bilike, which are only 45 km apart.

The fossil locality Ertemte was discovered and excavated in 1919/20 by J. G. ANDERSSON and Chinese co-workers. Mammalian fossils from lacustrine deposits were described and reviewed by

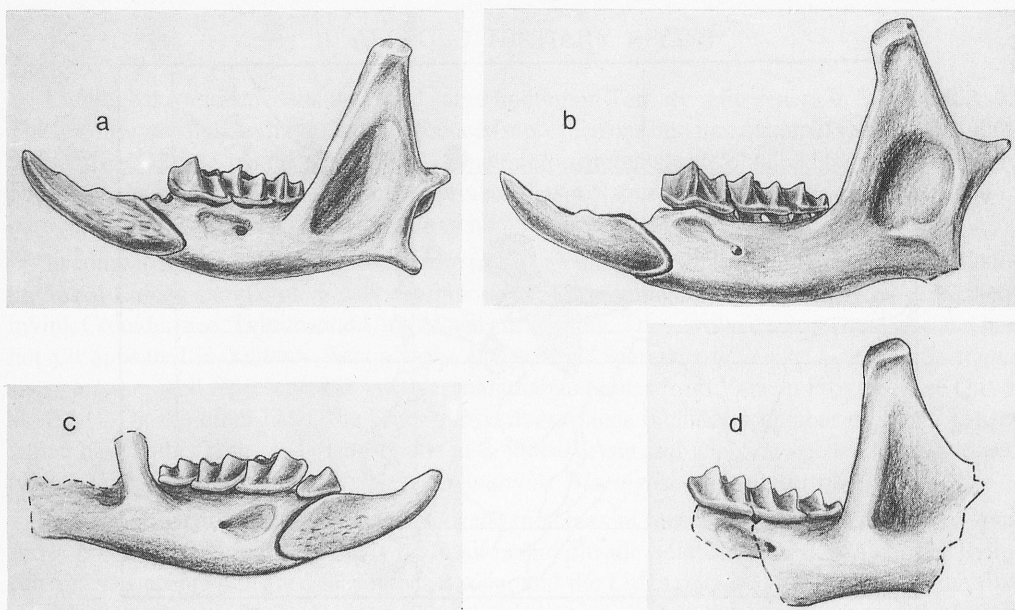


Fig. 2. *Heterosorex* species from the Miocene of Eurasia. Figures a and b redrawn from ENGESSER (1975), c and d redrawn from STORCH & QIU (1991). a = *H. neumayrianus*, early Miocene, Europe; b = *H. delphinensis*, middle Miocene, Europe; c-d = *H. wangi*, late Miocene, Lufeng, China.

SCHLOSSER (1924), MILLER (1927), SCHAUB (1934), and others. Insectivores from this early collection were represented by rather scarce and fragmentary remains. Joint Chinese-German excavating and screen-washing operations in 1980 enriched the collections enormously (FAHLBUSCH et al. 1983) and now the fauna, with more than 50 micromammal species, is the most diverse and abundant among the Chinese Neogene mammal assemblages. The micromammals are published in a continuing monograph series; thus far the paper on talpids is the only one published on insectivores (STORCH & QIU 1983).

The Bilike locality was first sampled in 1986 by Zhuding QIU and proved to be very rich in micromammals (QIU 1988). Thereafter, joint Chinese-German field work in 1991 added thousands of specimens. It is one of the ironies of mammalian paleontology that the construction of a railroad track in the endlessness of the remote Inner Mongolian steppes exactly transected our locality of some hundred square meters in extent. If we would have arrived a few days later we would have recovered not a single fossil!

In an influential paper, REUMER (1984) presented a range chart of selected European soricid species from the early Turolian through the early Biharian. The Miocene/Pliocene boundary and the early Ruscinian are characterized by arrivals of a large number of new genera and subsequent extensive radiations. Most of these newcomers are without plausible European ancestors and thus suggest a more eastern origin on the Eurasian continent.

Inner Mongolia is one of these potential regions. Our preliminary list of the shrews from Ertemte and Bilike (Fig. 3) is based on 13 species of the subfamily Soricinae, representing the tribes Soricini, Soriculini, Blarinini, Anourosoricini, ?Allosoricini, and ?Beremendiini (Fig. 3, from top). For the present, we will mainly follow REUMER's (1984) views on taxonomic subdivisions. Forthcoming taxonomic studies of Chinese soricids will, however, somewhat modify our classification (for example, by separating the clade including *Blarinella* and *Petenya* from the Soricini proper).

with *Beremendia* and we prefer to modify the diagnosis of Beremendiini rather than to place this species in a new tribe.

The soricine taxa from Ertemte and Bilike demonstrate that the radiation of *Sorex* was well on its way in East Asia during the late Turolian. Both faunas include three *Sorex* species, which compare in size with the living species *S. gracillimus* (the fossils average even smaller!), *S. bedfordiae*, and *S. daphaenodon*, respectively. The soriculine clade appears in the early Pliocene of Bilike in the form of two clearly differentiated genera; one of the two species can be assigned to the genus *Soriculus sensu stricto*.

A taxonomically and biochronologically simplified combination of Inner Mongolian and European soricid range charts across the Miocene/Pliocene boundary (Fig. 3) suggests an eastern Palaearctic origin for several Ruscinian immigrants into Europe, namely *Sorex*, the tribe Blarinini, *Paranourosorex*, and certain members of the *Blarinella-Petenya* clade. More information from the Miocene and Pliocene of East and Central Asia will refine our current understanding of this important period in soricid evolution, and will help us to learn more about the centres of origin and radiations of particular taxa and their migrations and dispersal across the Holarctic.

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