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Late Turolian Bats from Brisighella (Northern Italy)

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ABSTRACT — A preliminary study of the fossil herpetofauna collected in the site of Brisighella (Romagna, N Italy), of Late Miocene age (MN 13), indicates the presence of the following species: *Rana* sp., *Trionyx* sp., *Emydidae* gen. et sp. indet., (?) *Testudinidae* gen. et sp. indet., *vetus* (Lavocat), *Asellia* cfr. *A. mariaethersae* Mein and *Myotis* cfr. *M. boyeri* Mein. The megadermatid, the first rhinolophid and the vespertilionid seem more evolved than the corresponding forms from Lissieu (France, Late Turolian). The presence of a megadermatid and two bipposiderids indicates a warm climate and the presence of the genus *Asellia* an arid sandy environment.

RIASSUNTO — I chiroteri del Turoliano superiore di Brisighella (Italia settentrionale) — In questa nota vengono esaminati i resti di chiroteri del Turoliano superiore di Brisighella (Romagna, Italia settentrionale). Sono state individuate sei specie: *Megaderma* cfr. *M. mediterraneum* Sigé, *Rhinolophus* cfr. *R. kowalskii* Topal, *Rhinolophus* sp., *Hipposideros* (*Syndesmotis*) cfr. *vetus* (Lavocat), *Asellia* cfr. *A. mariaethersae* Mein e *Myotis* cfr. *M. boyeri* Mein. Il megadermatide, il primo rinolofide ed il vespertilionide sembrano più evoluti delle corrispondenti forme presenti nel giacimento di Lissieu (Francia, Turoliano superiore). La presenza di un megadermatide e di due bipposideridi indica un clima caldo, mentre la presenza di un rappresentante del genere *Asellia* suggerisce un ambiente arido, sabbioso.

INTRODUCTION

The Brisighella (Romagna, Northern Italy) fissures contain a rich mammalian fauna, with murids as a dominant component of the association. These rodents and also the other mammals collected here indicate a Late Turolian age (MN 13). The fossil remains of bats discovered in these fissures are very scarce. Only eighteen specimens belong to the order Chiroptera, but despite the small number of fossils they are represented by six species belonging to four families.

The tooth terminology used in this paper follows Sigé *et al.* (1982).

SYSTEMATICS

Family MEGADERMATIDAE

Genus MEGADERMA E. Geoffroy, 1810

MEGADERMA cfr. *M. MEDITERRANEUM* Sigé, 1974

Material — 1 fragment of right C/ (BRS5/1); 1 fragment of left M₁ (BRS3/1).

Locality — Brisighella (Romagna, N Italy).

Age — Late Turolian (MN 13).

A fragmentary right C/ belongs to this form. Only the root and the cingulum of the tooth are preserved, but in occlusal view it is possible observe the base of a strong posterior accessory cusp. A smaller accessory cusp is placed antero-lingually. The second tooth belonging to this species is also extremely fragmentary. Only the crown of the trigonid of a left M₁ is preserved. A strong protoconid, a paraconid and a much smaller, robust metaconid, the former stronger than the latter, and the lateral compression of this trigonid are the characteristics of this fossil. All these features are peculiar to the genus *Megaderma*.

Remarks — Many fossil species of *Megaderma* have been described from Cenozoic sites of the Mediterranean area: *M. brailloni* Sigé, *M. lugdunensis* (Depéret), *M. gaillardi* (Trouessart), *M. jaegeri* Sigé, *M. vireti* Mein, *M. mediterraneum* Sigé, *M. janossyi* Topal, *M. watwat* Bate. On the base of the scanty material in our possession we observe that the dimensions of the

canine and especially its width closely correspond to the Late Neogene forms *M. vireti* from Lissieu (France) and Kohfidisch (Austria) and *M. mediterraneum* of Sète (France) (cfr. Mein, 1964; Bachmayer & Wilson, 1970; Sigé, 1974, 1976; Topal, 1974). The dimensions of our fossils are somewhat larger than these of *M. vireti* and for this reason we tentatively ascribe the material from Brisighella to *Megaderma* cfr. *M. mediterraneum* Sigé.

Family RHINOLOPHIDAE

Genus RHINOLOPHUS Lacepède, 1799

RHINOLOPHUS cfr. *R. KOWALSKII* Topal, 1979

Material — 1 right M² (BRS6/2a); 2 left M₁ (BRS3/3a; BRS6/2b); 1 left M₂ broken (BRS6/2c); 1 left M₃ (BRS3/3b).

Locality — Brisighella (Romagna, N Italy).

Age — Late Turolian (MN 13).

Five teeth belong to a large rhinolophid. A right M² shows the typical morphology of the genus *Rhinolophus* with a strong protocone and a heel without a hypocone. Four lower molars were collected in two different fissures. Three of them are M₁ or M₂. They present a nyctalodont condition, thin labial cingulum, and the hypoconulid is more labial than entoconid. The talonid is more robust but shorter than the trigonid. In the single M₃ the trigonid is wider than the talonid. The dimensions are similar to those of living *R. ferrumequinum* of Central Europe (Topal, 1979).

Remarks — The most common large European species of *Rhinolophus* during the Miocene is *Rhinolophus delphinensis* Gaillard. According to Topal (1979) the dimensions of some specimens from the type locality, La Grive St. Alban (France), are smaller than those of some populations from Pliocene sites of Poland and Hungary which have dimensions very similar to those of *R. ferrumequinum*. Also Mein (1964) describes the remains from Lissieu (France) as smaller than *R. ferrumequinum*. On the other hand the dimensions given by Gaillard (1899), Zapfe (1950), and Sesé (1986) for Miocene specimens from La Grive (France), Devinska Nova Ves (= Neudorf) (Czechoslovakia), Escabosa de Calatañazor (Spain) are slightly bigger (lower limits of living *R. ferrumequinum* populations). According to Mein (1964) the lower molars of *R. delphinensis* are wider and lower than in *R. ferrumequinum* and the labial border of the upper molars is rectilinear. None of these characters is present in the material from Brisighella. Recently Topal (1963, 1979) erected many species for Pliocene and Pleistocene fos-

sil remains of the *R. ferrumequinum*-group from Hungary and Poland: *Rhinolophus kowalskii* Topal of Poddlesice (Poland), *Rhinolophus estramontis* Topal of Osztramos 1f (Hungary), *Rhinolophus postdelphinensis* Topal of Osztramos 1c (Hungary), *Rhinolophus macrorhinus* Topal of Beremend 4 (Hungary)⁽¹⁾. The most important characters for the erection of these species are concentrated in the premolars and we have no premolars in the material of Brisighella. Nevertheless the dimensions of our material and the morphology of the molars agree better with the specimens from Poddlesice. These fossils have been ascribed by Kowalski (1956, 1962) first to *R. cfr. ferrumequinum* Schreber and later to *R. delphinensis* and have been considered as the type population of *R. kowalskii* by Topal (1979). So, tentatively, we ascribe the specimens of the big rhinolophid from Brisighella to *R. cfr. kowalskii* Topal.

RHINOLOPHUS sp.

Material — 1 right M₁ (BRS5/3).

Locality — Brisighella (Romagna, N Italy).

Age — Late Turolian (MN 13).

A right M₁ is similar to the molars belonging to the previous species but is more hypsodont and of smaller dimensions.

Remarks — The morphology of this specimen is typical of the genus *Rhinolophus*. Small rhinolophids from Neogene sites of Europe are assigned to numerous species: *Rhinolophus grivensis* (Depéret), of La Grive (France), *Rhinolophus lissiensis* Mein of Lissieu (France), *Rhinolophus variabilis* Topal of Osztramos 1 and 9 (Hungary), but their dimensions are smaller than those of the M₁ from Brisighella (Mein, 1964; Topal, 1975; Bachmayer & Wilson, 1978; Sesé, 1986). Comparison with another form, *Rhinolophus talonifer* Kretzoi, from the Late Vallesian of Csakvar (Hungary) (Kretzoi, 1952) is impossible. From the figure published by Heller (1936) as *Rhinolophus neglectus* Heller from Gundersheim 1 (Germany) and by the measures inferred from his table, our specimen is very similar to this form, but the material, limited to only one tooth does not permit a classification at the specific level.

⁽¹⁾ Two other Miocene species of the group of *R. ferrumequinum*, *Rhinolophus mellali* Lavocat of the Middle Astaracian of Beni Mellal (Morocco) and *Rhinolophus csakvarensis* Kretzoi of the Late Vallesian of Csakvar (Hungary) are clearly smaller (Lavocat, 1961; Topal, 1979).

Family HIPPOSIDERIDAE
Genus HIPPOSIDEROS Gray, 1831
Subgenus SYNDESMOTIS Peters, 1871

HIPPOSIDEROS (SYNDESMOTIS) cfr. *H.(S.) VETUS* (Lavocat, 1961)

Material — ?1 left M^2 (BRS21/1); 1 fragment of left mandible with M_1 and M_2 (BRS21/2); 1 left M_1 (BRS21/3).

Locality — Brisighella (Romagna, N Italy)

Age — Late Turolian (MN 13).

A fragment of a left mandibular ramus, broken anteriorly at the alveolus of the canine and posteriorly at the anterior alveolus of M_3 and bearing M_1 and M_2 , is the best preserved specimen in the entire collection of bats from Brisighella. Three alveoli correspond to two premolars, the first one-rooted and the second two rooted. The M_1 and M_2 are nyctalodont, with very thin cingulum. A second M_1 shows the same morphology. Perhaps a left M^2 with the postprotocrista linked to the crest of the posterior cingulum and closing the protofossa, belongs to the same species.

Remarks — Morphologically the lower molars of the mandibular fragment are very similar to the mandible from the Middle Miocene of Beni Mellal (Morocco) ascribed by Lavocat (1961) to *Asellia vetus* Lavocat. This form has been transferred to *Hipposideros (Syn-desmotis)* by Legendre (1982a) who tentatively assigned to the same species some remains from the Late Ruscinian site of Sète (France). The dimensions of our fossils correspond better to these last fossils. Also the morphology of a left M^2 collected in the same fissure is intermediate between the M^2 of Beni Mellal illustrated by Lavocat (1961) and that of Sète illustrated by Legendre (1982a). For all these reasons we classify our fossils as *Hipposideros (Syn-desmotis)* cfr. *H.(S.) vetus* (Lavocat).

Genus ASELLIA Gray, 1838

ASELLIA cfr. *A. MARIAETHERESAE* Mein, 1958

Material — 1 left M^2 (BRS6/1).

Locality — Brisighella (Romagna, N Italy).

Age — Late Turolian (MN 13).

A single left M^2 is subquadrate, without hypocone.

The preprotocrista is continuous with the anterior cingulum while the postprotocrista almost reaches the base of the metacone. The posterior cingulum is almost united to the posterolingual cingulum. The morphology of this specimen is characteristic of the fossil European form of the genus *Asellia*.

Remarks — European fossil hipposiderids are assigned to three distinct genera: *Palaeophyllophora*, *Hipposideros* (with three subgenera) and *Asellia* (see Legendre, 1982a). The last genus is known by one species, *Asellia mariaetheresae* Mein, a form collected in four French layers of Early and Middle Miocene age (Mein, 1958; Legendre, 1982a). The morphology and the dimensions of the M^2 of Brisighella is identical with the corresponding molar of *A. mariaetheresae* from Port-la-Nouvelle (France) illustrated by Legendre (1982a). However as we are in possession of only one tooth, we prefer to ascribe this fossil to *Asellia* cfr. *A. mariaetheresae* Mein. This discovery is stratigraphically the most recent one for the genus *Asellia* in Europe.

Family VESPERTILIONIDAE
Genus MYOTIS Kaup, 1829

MYOTIS cfr. *M. BOYERI* Mein, 1964

Material — A fragment of left mandible broken in the second alveolus of M_3 , bearing M_2 (BRS5/2a); 1 right $M_{1/2}$ (BRS3/2); ?1 fragment of right mandible with P_4 fragmentary (BRS5/2b); 1 fragment of C (BRS5/2c).

Locality — Brisighella (Romagna, N Italy).

Age — Late Turolian (MN 13).

Two lower molars (one of them in position in a fragmentary left mandible with the alveoli of M_1 and M_3) belong to the family Vespertilionidae. They are characterized by mytodont condition and thick labial cingulum at the trigonid and thin cingulum at the talonid. The trigonid is shorter and narrower than the talonid. The posterior border of these teeth is rectilinear. The metaconid is higher than the paraconid and entoconid. Tentatively we ascribe to the same species a fragment of a right P_4 belonging to the family Vespertilionidae and also a fragment of canine. Both these fossils were collected in the same fissure which yielded the fragment of mandible with M_2 .

Remarks — The morphology of the molars is typical of the genus *Myotis*. To this genus have been assigned a great number of species from European Neogene and Early Pleistocene sites (Kormos, 1934;

Heller, 1936; Viret, 1951; Kowalski, 1956, 1962; Mein, 1964; Topal, 1983, 1985, etc.). Our material is very scanty for a classification beyond any doubt, but the morphology of our specimens agree perfectly with the material from Lissieu (France, Late Turolian), illustrated by Mein (1964) under the name *Myotis boyeri* Mein. On the contrary, the dimensions of the vespertilionid of Brisighella indicates a more robust bat. Despite this difference in size, for morphological reasons we classify these remains as *Myotis* cfr. *M. boyeri* Mein.

Megaderma cfr. *M. mediterraneum*

C/ 1 L=3.35 l=2.00

M₁ 1 L/T=1.80 l/T=1.65

Rhinolophus cfr. *R. kowalskii*

M² 1 L=2.17 l=2.95

M₁ 2 L=2.20-2.25 l=1.42-1.55

M₃ 1 L=1.95 l=1.30

Rhinolophus sp.

M₁ 1 L=1.80 l=1.02

Hipposideros (Syndesmotis) cfr. *H.(S.) vetus*

M₁ 2 L=1.50-1.53 l=0.93-0.95

M₂ 1 L=1.41 l=0.90

?M² 1 L=1.48 l=1.80

Asellia cfr. *A. mariaethersae*

M² 1 L=1.50 l=1.82

Myotis cfr. *M. boyeri*

M₂ 1 L=1.65 l=1.10

M_{1/2} 1 L=1.62 l=1.05

Tab. 1 - Measurement of the Chiroptera of the Monticino quarry. The dimensions are expressed in mm. L= length; l= width; T= trionid.

CONCLUSIONS

Six species of bats are present in the site of Brisighella: *Megaderma* cfr. *M. mediterraneum* Sigé, *Rhinolophus* cfr. *R. kowalskii* Topal, *Rhinolophus* sp., *Hipposideros (Syndesmotis)* cfr. *H. (S.) vetus* (Lavocat), *Asellia* cfr. *A. mariaethersae* Mein and *Myotis* cfr. *M. boyeri* Mein.

Stratigraphically the chiropteran fauna of Brisighella is more recent than that of Lissieu (MN 13) as indicated by the evolutionary level of three species. In fact *Megaderma* from Brisighella seems closely allied to the *Megaderma* of Sète (MN 15), the big rhinolophid is more robust than the classical *R. delphinensis* of Miocene sites still present at Lissieu and is very similar to the big Pliocene forms of Eastern Europe, and the *Myotis* of Brisighella probably belongs to a more evolved stage of the lineage of *M. boyeri* from Lissieu.

Ecologically three of the species collected in Brisighella, the two rhinolophids and the vespertilionid, are similar to forms living today in Europe and in particular in the same area of the site. On the contrary the megadermatid and the two hipposiderids belong to genera living in tropical and sub-tropical areas. If the conditions of life of the fossil megadermatid were similar to that of the living species of the family, we must presume temperatures not lower than 14/15 centigrade (Sigé, 1976). The presence of two cavernicolous hipposiderids confirms the tropical character of the association. On the other hand living *Asellia* prefer arid sub-desertic areas. For the site of Port-la-Nouvelle (France), Legendre (1982b) postulated a littoral sandy area as the environment of *A. mariaethersae*. Very probably, similar conditions were present near the site of Brisighella. The high temperatures indicated by the bats are confirmed by the presence of a varanid and also the aridity of the environment of Brisighella is confirmed by the predominance of the anguid *Ophisaurus* cfr. *O. panonicus* Kormos among the reptiles. Also a sandy covered area is indicated by the presence not only of *Asellia* but also by a fossorial snake of the subfamily Erycinae (Kotsakis, 1989).

REFERENCES

- BACHMAYER, F. & WILSON, R.W., 1970, Small Mammals (Insectivora, Chiroptera, Lagomorpha, Rodentia) from the Kohfidisch fissures of Burgenland, Austria: Ann. Naturhist. Mus. Wien, 74: 533-587.
- & —, 1978, A second contribution to the small mammal fauna of Kohfidisch, Austria: Ann. Naturhist. Mus. Wien, 81: 129-161.
- GAILLARD, C., 1899, Mammifères miocènes nouveaux ou peu connus de La Grive-Saint-Alban (Isère). Arch. Mus. Hist. Nat. Lyon, 7: 1-79.
- HELLER, F., 1936, Eine oberpliozäne Wirbeltierfauna aus Rheinhessen: N. Jb. Geol. Pal., Abt. B, 76: 99-160.
- KORMOS, T., 1934, Neue Insektenfresser, Fledermäuse und Nager aus dem Oberpliozän der Villanyer gegend: Földt. Közl., 64: 296-321.
- KOTSAKIS, T., 1989, Late Turolian Amphibians and Reptiles from Brisighella (N Italy). Preliminary note: Boll. Soc. Paleont. Ital., 28 (2/3): 277-280.
- KOWALSKI, K., 1956, Insectivores, Bats and Rodents from the early Pleistocene bone breccia of Podlesice near Kroczyce (Poland): Acta Palaeont. Pol., 1: 331-394.
- , 1962, Fauna of Bats from the Pliocene of Weze in Poland: Acta Zool. Cracov., 7: 39-51.
- KRETZOI, M., 1952, Rapport final des fouilles paléontologiques dans la grotte de Csakvar: Mag. All. Földt. Int. Evi Jel., 1952(1954): 37-69 (in Hungarian and French).
- LAVOCAT, R., 1961, Le gisement de vertébrés miocènes de Beni Mellal (Maroc). Etude systématique de la faune de mammifères et conclusions générales: Notes Mém. Serv. Géol. Maroc, 155: 29-94.
- LEGENDRE, S., 1982a, Hipposideridae (Mammalia: Chiroptera) from the Mediterranean Middle and Late Neogene, and evolution of the genera *Hipposideros* and *Asellia*: J. Vert. Paleont., 2: 372-385.
- , 1982b, La faune de micromammifères du gisement burdigala-

- lien de Port-la-Nouvelle (Aude). Compléments et indications paléocéologiques: Bull. Soc. Géol. Fr., s.7, 24: 383-387.
- MEIN, P., 1958, Les mammifères de la faune sidérolithique de Vieux-Collonges: Nouv. Arch. Mus. Hist. Nat. Lyon, 5: 1-122.
- , 1964, Chiroptera (Miocène) de Lissieu (Rhône): C. R. 89 Congr. Soc. Sav.: 237-253.
- SESÉ, C., 1986, Chiroptera (Mammalia) del yacimiento del Mioceno medio de Escobosa de Calatañazor (Soria, España): Estud. Geol., 42: 33-39.
- SEVILLA, P. & LOPEZ MARTINEZ, N., 1986, Comparative systematic value between dental and external/skeletal features in Western European Chiroptera: Mém. Mus. Natn. Hist. Nat. Paris, s. C. 53: 255-266.
- SIGÉ, B., 1974, Présence d'un *Megaderma* (Mammalia, Chiroptera) dans le Pléistocène inférieur à Sète (Hérault): Géol. Méditerran., 1: 97-104.
- , 1976, Les Megadermatidae (Chiroptera, Mammalia) miocènes de Beni Mellal, Maroc: Géol. Méditerran., 3: 71-86.
- , HAND, S. & ARCHER, M., 1982, An Australian Miocene *Brachiposideros* (Mammalia, Chiroptera) related to Miocene representatives from France: Palaeovertebrata, 12: 149-172.
- TOPAL, G., 1963, Description of a new bat, *Rhinolophus macrorhinus* sp.n., from the Lower Pleistocene of Hungary: Vertebr. Hungar., 5: 219-228.
- , 1974, The first record of *Megaderma* in Hungary (Pliocene sediments of Osztramos, Locality 10): Vertebr. Hungar., 15: 95-104.
- , 1975, A new fossil Horseshoe Bat (*Rhinolophus variabilis* n.sp.) from the Pliocene sediments of the Osztramos Hill, NE Hungary (Mammalia: Chiroptera): Fragm. Min. Pal., 6: 5-29.
- , 1979, Fossil Bats of the *Rhinolophus ferrumequinum* Group in Hungary (Mammalia: Chiroptera): Fragm. Min. Pal., 9: 61-101.
- , 1983, New and rare fossil Mouse-eared Bats from the Middle Pliocene of Hungary (Mammalia: Chiroptera): Fragm. Min. Pal., 11: 43-54.
- , 1985, Pliocene species of *Myotis* from Hungary: Acta Zool. Fennica, 170: 153-155.
- VIRET, J., 1951, Catalogue critique de la faune des mammifères miocènes de La Grive Saint-Alban (Isère). Première partie. Chiroptères, Carnivores, Edentés, Pholidotes: Nouv. Arch. Mus. Hist. Nat. Lyon, 3: 5-104.
- ZAPFE, H., 1950, Die Fauna der miozänen Spaltenfüllung von Neudorf an der March (CSR). Chiroptera: Sitzb. Österr. Akad. Wiss. Wien, s.1, 159: 51-64.
- , 1952, *Rhinolophus grivensis* (DEP.) aus der miozänen Spaltenfüllung von Neudorf an der March (CSR): Anz. Akad. Wiss. Wien, 89: 21-32.

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