

# New *Allophaiomys* material from Betfia ix/b and ix/c, Bihor County, Romania

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## Abstract

*The Betfia fissure-filling system, located 9 km from the city of Oradea in Romania, has produced remarkable vertebrate faunas for almost 100 years. The study of the localities was initiated by Tivadar Kormos and the field activities were continued by Miklòs Kretzoi, Elena Terzea and Tibor Jurcsák. The best-known site, Betfia II, has yielded the original type-fauna of the biochronological Biharian Unit.*

*Márton Venczel re-excavated the Betfia IX site in 1994-1995 and collected two rich faunal assemblages. Examination of the *Allophaiomys* remains from these assemblages indicated the coexistence of two 'types'; one can be referred to *Allophaiomys pliocaenicus* and the other is closer to, but not identical with *Allophaiomys deucalion*.*

## Introduction

The locality of the Betfia complex, located 9 km from the Romanian city of Oradea<sup>1</sup> has been studied since 1904. The excavations were primarily carried out by the Hungarian palaeontologists Kormos (1914) and Kretzoi (1941a). The 'classical' localities Betfia II and Betfia IV, have yielded a number of new species (Méhely, 1914; Kormos, 1930, 1932; Schaub, 1930) and Betfia II became the type-locality of the Biharium biochronological unit (Kretzoi 1941b). Since the 1960s the sampling and evaluation of the fossil remains were continued by Terzea (1973, 1984, 1991, 1992, 1995) and Terzea & Jurcsák (1967, 1968, 1976). They described a new series of localities (Betfia V - Betfia XIII.). The fauna from the Betfia IX locality was first published by Terzea (1988); the rich *Allophaiomys* collection (946 m1) was referred to as *Allophaiomys pliocaenicus pliocaenicus*. Ruiz Bustos (1993) identified *Allophaiomys deucalion* in the fauna by using his special enamel unit analysis that he applied to Terzea's figures. Márton Venczel re-excavated the locality in 1994 and also found a rich microvertebrate fauna (Betfia IX/B) with an abundant series of *Allophaiomys* molars. In 1995 he found a 'terra rossa' layer (Betfia IX/C) under the brecciform sediment of Betfia IX/B. This lower layer yielded a fauna dominated by *Apodemus* and *Pliomys* indicating a forested palaeoenvironment (Table 1). The *Allophaiomys* molars from Betfia IX/B and Betfia IX/C show a mixture of characters typical of *A. deucalion* and *A. pliocaenicus*.

*Allophaiomys* is well represented in the Betfia IX/B fauna with 1219 complete lower M1 and 359 upper M3 molars. The *Allophaiomys* collection from Betfia IX/c is smaller: 108 lower m1 and 43 upper M3 complete molars.

### Analysis of the *Allophaiomys* molars

The metrical study of the lower M1 is based on the measurements and ratios defined by Van der Meulen (1973, Figure 22). The measurements and ratios of the upper M3 molars are according to Nadachowski (1990, Figure 1). The results of the analysis are presented in Figures 1-9 and Tables 1-4. The distinguished morphotypes of the M1 and the M3 molars are according to Rabeder (1981, 1986). Five different groups of morphotypes (A-E) could be distinguished in the assemblages from Betfia IX/B and Betfia IX/C.

- A: morphotypes: *mimomys*, *deucalion*, *latilaguroides*
- B: morphotypes: *laguroides*, *superlaguroides*
- C: morphotypes: *pliocaenicus*, *superpliocaenicus*
- D: morphotypes: *collolaguroides*, *protonivalis*, *eonivalis*, *nivalinus*

- E: morphotypes: *praehintoni*, *eoratticeps*, *ratticepoides*, *eomalei*, *protarvalidens*.

The representation of the group is illustrated in the Figures 4 and 6.

### Conclusions

Terzea (1988) identified the *Microtus* assemblage from Betfia IX as *Allophaiomys pliocaenicus pliocaenicus*. The entire *Allophaiomys* collections from Betfia IX/B and IX/C cannot be referred to this taxon because:

- all 3 types of enamel differentiation (*Mimomys*, *Microtus* and undifferentiated) are represented, with a dominance of the undifferentiated enamel pattern (Figure 1);
  - the frequency of the M1 morphotypes is bimodal, the *deucalion* and the *pliocaenicus* morphotypes are both well represented (Figure 2);
  - 3 the M3 morphotypes with a confluent T2 and T3 (terminology according to Van der Meulen, 1973) Simplex and Parasimplex are well represented in the assemblage from Betfia IX/B (Figure 7);
  - 4 the distribution of the L values is not normal (Figure 3): in the class 2.695 - 2.775 there are secondary maxima, caused by the bimodal distribution of the morphotype-group A (Figure 4). (The curves of Betfia IX/C are not so clear, because the sample is smaller). The class 2.695 - 2.775 refers to the mean L-value of (2.747) *Allophaiomys deucalion* in Villany 5 (Van der Meulen, 1974);
  - 5 the ranges of the a/L-values, the Betfia IX/B in particular, are unusually wide in comparison to other Central European *Allophaiomys* assemblages (Figure 8).
- The A and C morphotypes show a normal distribution in

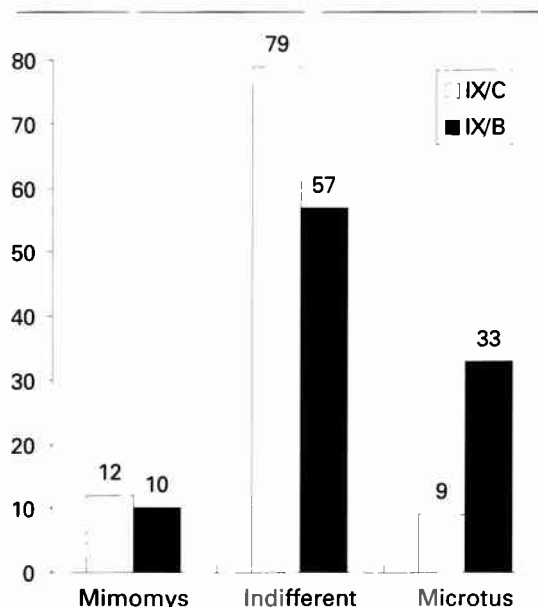
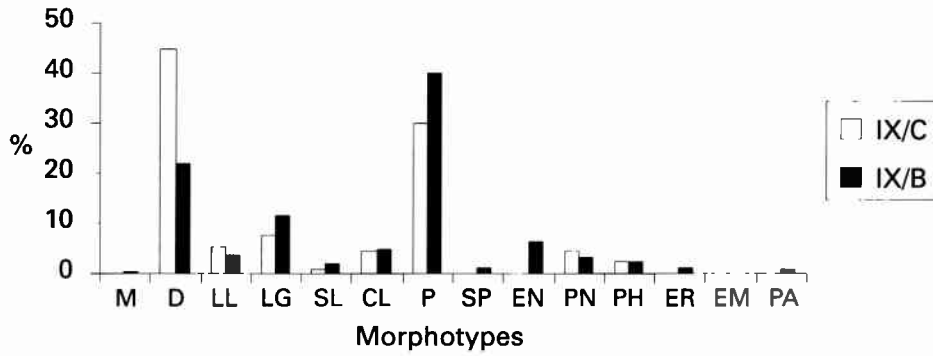


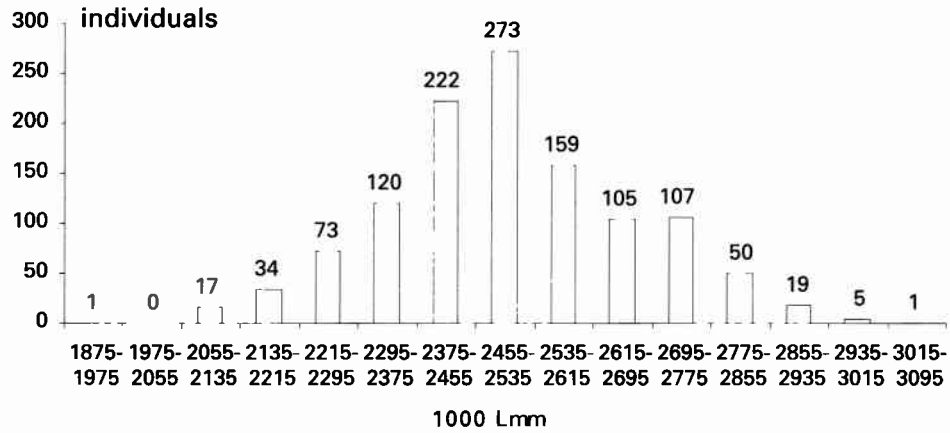
Figure 1  
The distribution of the *Allophaiomys* M1 enamel patterns in Betfia IX/C and IX/B.

<sup>1</sup> Different geographical names are used in the Hungarian and Romanian literature to indicate the same locality and/or regions. In the Hungarian literature the names Bihar, Nagyvárád, Püspöktördő and Somlyő-hegy are used, whereas in the Romanian literature the respective equivalents Bihor, Oradea, Baile 1 Mai and Dealul Somleu can be found. Nagyvárád and Somlyő-hegy are replaced respectively by Grosswardein and Somlyöberg in some of the German papers.

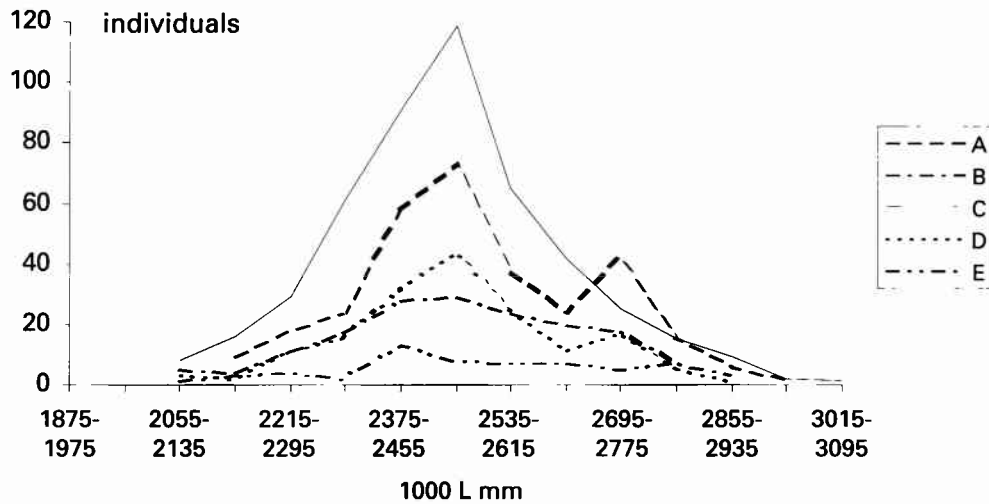
**Figure 2**  
 The distribution of the *Allophaiomys* M1 morphotypes in Betfia IX/C and IX/B. Explanation: M: *mimomys*, D: *deucalion*, LL: *latilaguroides*, LG: *laguroides*, SL: *superlaguroides*, CL: *collolaguroides*, P: *pliocaenicus*, SP: *superpliocaenicus*, EN: *eonivalis*, PN: *protonivalis*, PH: *praehintoni*, ER: *eoratticeps*, EM: *eomalei*, PA: *protarvalidens*.



**Figure 3**  
 The distribution of the L-values of the *Allophaiomys* M1 from Betfia IX/B (total material).



**Figure 4**  
 The distribution of the L-values of the five morphotype-groups that can be distinguished in the *Allophaiomys* M1 from Betfia IX/B.



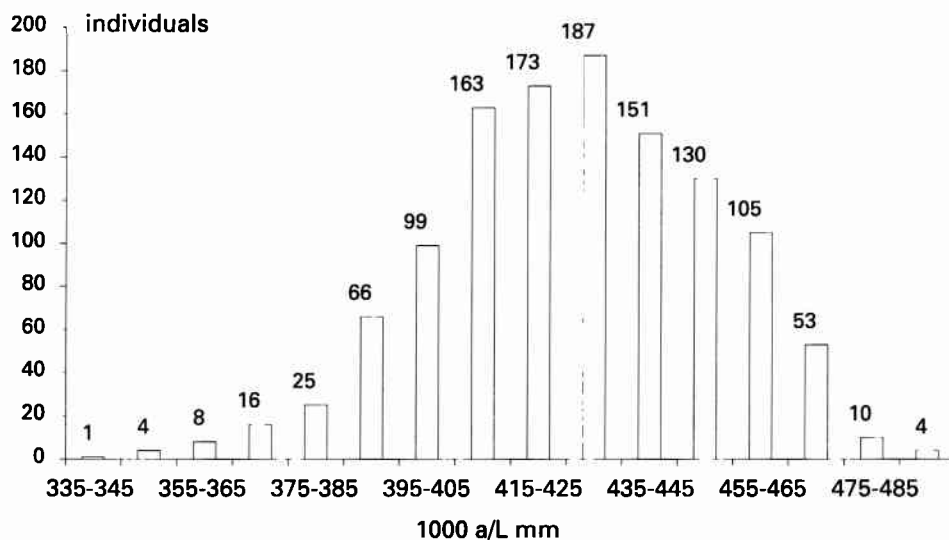


Figure 5  
The distribution of the a/L-values of the Allophaiomys M1 from Betfia IX/B (total assemblage).

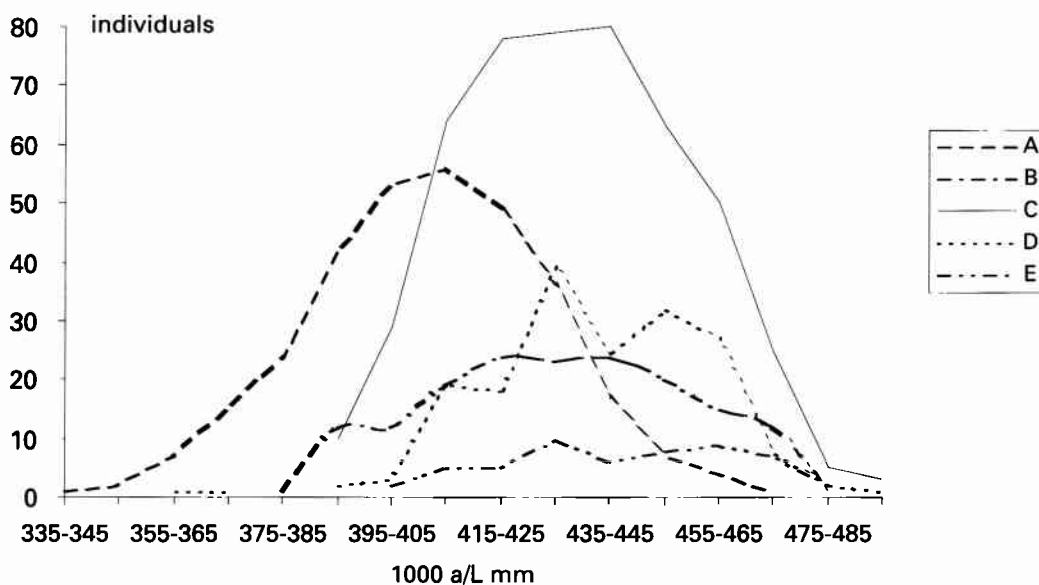


Figure 6  
The distribution of a/L values of the five morphotype-groups that can be distinguished in the Allophaiomys M1 from Betfia IX/B.

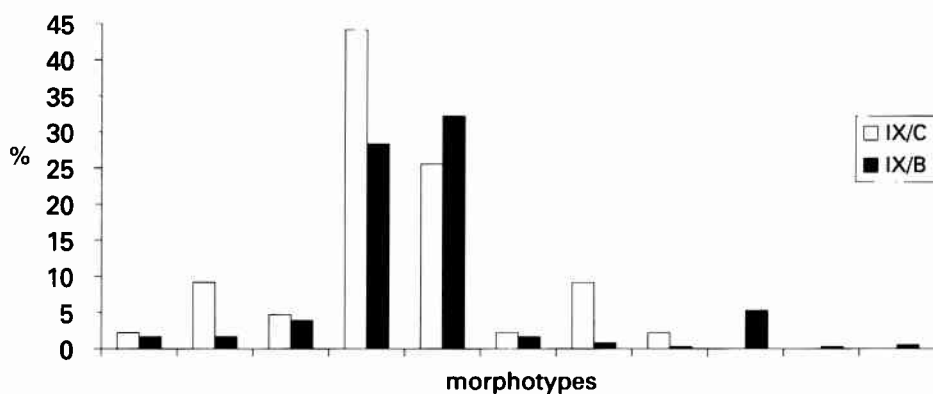


Figure 7  
The distribution of the Allophaiomys M3 morphotypes in Betfia IX/C and Betfia IX/B.  
Explanation: PR: Protosimplex, PS: Prosimplex, PP: Paraprosimplex, SX: Simplex, PSX: Parasimplex, PRO: Protoeconomus, PO: Praoeconomus, CX: Complex, PCX: Paracomplex, ACX: Articomplex, IB: Ibericus.

Figure 8

The means and ranges of the a/L-values of a number of European *Allophaiomys* populations. The data are from Fejfar & Horaček (1983), Van der Meulen (1973, 1974) and Rabeder (1981).

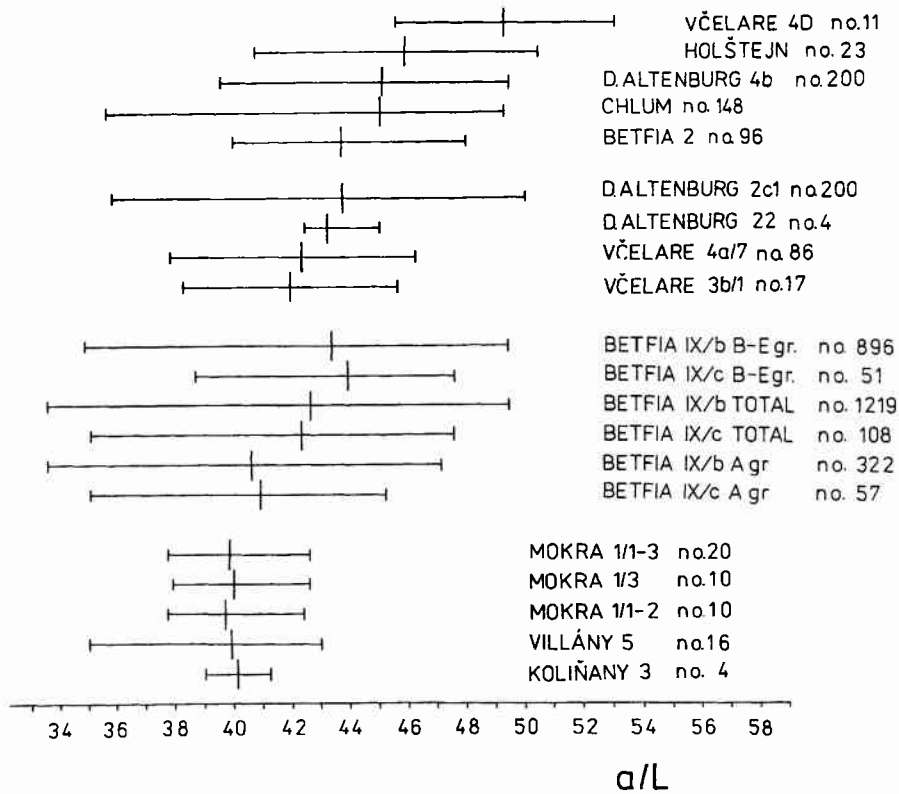
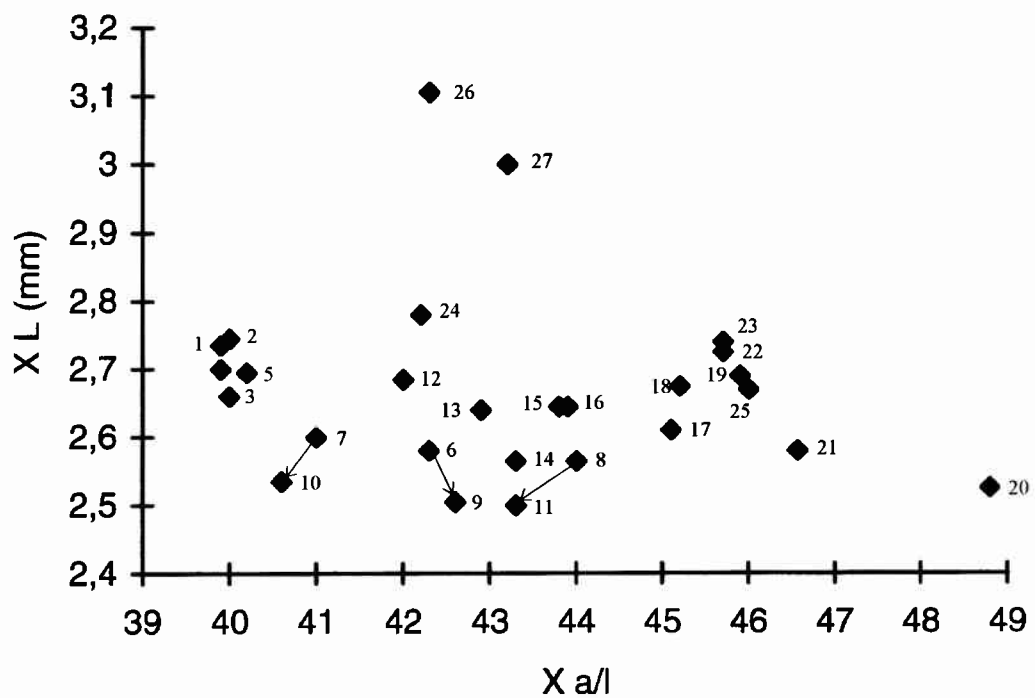


Figure 9

The mean L- and the mean a/L-values of a number of European *Allophaiomys* populations. The data are after Agusti (1991), Fejfar & Horaček (1983), Van der Meulen (1973, 1974) and Rabeder (1981). The arrows show the evolutionary trend from *Betfia IX/C* to *Betfia IX/B*.



Explanation 1: Mokra 1/1-2;

2: Villany 5;

3: Mokra 1/3;

4: Mokra 1/1-3;

5: Kolinany 3;

6: *Betfia IX/C* total;

7: *Betfia IX/C* morphotype-group A;

8: *Betfia IX/C* morphotype-groups B-C-D-E;

9: *Betfia IX/B* total;

10: *Betfia IX/B* morphotype-group A;

11: *Betfia IX/B* morphotype-groups B-C-D-E;

12: *Vcelare 3B/1*;

13: *Vcelare 4A/7*;

14: *Deutsch-Altenburg 22*;

15: *Deutsch-Altenburg 2C1*;

16: *Betfia 2*;

17: *Chlum*;

18: *Deutsch-Altenburg 4B*;

19: *Holstejn*;

20: *Vcelare 4D*;

21: *Monte Peglia 63*;

22: *Monte Peglia 8*;

23: *Monte Peglia 3*;

24: *Venta Micena*;

25: *Bagur 2*;

26: *Barranco de los Conejos*;

27: *Cueva Victoria*

	the 'old' assemblage	new assemblages	
	Terzea (1988)	IX/B	IX/C
<i>Muscardinus</i> sp.	+	5	174
<i>Eliomys</i> sp.	-	-	14
<i>Dryomys</i> sp.	-	2	-
<i>Glis sackdillingensis</i>	-	4	47
<i>Spalax</i> sp.	+	2	-
<i>Citellus primigenius</i>	+	3	-
<i>Sicista</i> sp.	+	69	1
<i>Apodemus</i> sp.	+	77	429
<i>Allocricetus ehiki</i>	-	1	-
<i>Cricetus nanus</i>	+	63	2
<i>Cricetus praeglacialis</i>	+	-	-
<i>Ungaromys nanus</i>	-	1	19
<i>Mimomys pusillus</i>	+	675	169
<i>Mimomys tornensis</i>	+	-	-
<i>Mimomys</i> sp.	+	-	-
<i>Pliomys episcopalis</i>	+	22	345
<i>Clethrionomys</i> sp.	+	25	1
<i>Lemmus</i> sp.	-	1	-
<i>Allophaiomys pliocaenicus</i>	939	-	-
<i>Allophaiomys</i> cf. <i>pliocaenicus</i>	-	1750	108
<i>Lagurus prepannonicus</i>	735	-	-
<i>Lagurus pannonicus</i>	-	1399	57
<i>Lagurus arankae</i>	-	448	36
<i>Ochotona</i> sp.	+	1	-
<i>Hypolagus brachygnathus</i>	+	1	-
Total:	-	4549	1402

Table 1  
List of Rodentia and Lagomorpha represented in the assemblages from Betfia IX with numbers of specimens.

	total assemblage							
	L	a	w	b	c	a/L	b/w	c/w
N	1219	1220	1207	1217	1217	1219	1206	1207
Min.	1.918	0.77	0.588	0.014	0.014	0.335366	0.014286	0.017241
Max.	3.025	1.323	1.924	0.84	0.28	0.494118	0.448276	0.344828
X	2.509725	1.068566	0.86384	0.197565	0.16804	0.426332	0.228156	0.195865
SD	0.175218	0.087292	0.081003	0.065206	0.039484	0.025081	0.068452	0.047535
95% k.i.(+)	0.00984	0.0049	0.004572	0.003665	0.002219	0.001409	0.003865	0.002683

	morphotype-group A							
	L	a	w	b	c	a/L	b/w	c/w
N	322	323	323	324	324	322	321	326
Min.	1.96	0.77	0.14	0.112	0.028	0.335366	0.140625	0.029412
Max.	3.0	1.274	1.924	0.84	0.28	0.471338	0.448276	0.344828
.X	2.534651	1.028737	0.902015	0.248262	0.180193	0.406236	0.298507	0.201111
SD	0.17553	0.078363	0.09428	0.064932	0.04465	0.022516	0.06189	0.052382
95% k.i.(+)	0.019202	0.008559	0.010314	0.007081	0.004869	0.001265	0.006781	0.005695

	morphotype-groups B-C-D-E							
	L	a	w	b	c	a/L	b/w	c/w
N	896	897	885	894	894	896	884	885
Min.	1.918	0.84	0.588	0.014	0.014	0.348392	0.014286	0.017241
Max.	3.025	1.323	1.882	0.378	0.28	0.494118	0.427273	0.326923
X	2.499474	1.0828	0.849121	0.179221	0.163683	0.433535	0.211687	0.194175
SD	0.174195	0.08587	0.074553	0.054738	0.036485	0.02188	0.062994	0.045638
95% k.i.(+)	0.011412	0.005623	0.004915	0.00359	0.002393	0.001433	0.004155	0.003009

Table 2  
Dimensions and ratios of the *Allophaiomys* M1 molars from Betfia IX/B

the a/L diagram (Figure 6). The distributions for the B, D and E morphotypes fit better with that of the C morphotypes. The morphotypes B-E are therefore combined in the Tables 2 and 3.

How should the variation in the *Allophaiomys* assemblages be judged? Are these results caused by the coexistence of two different taxa a transitional status between *Allophaiomys deucalion* and *Allophaiomys pliocaenicus* or another special evolutionary situation?

At present the possibility of the coexistence of *A. pliocaenicus* and an other taxon, which is closer to but not identical with *A. deucalion* cannot be excluded. The means of the a/L values for the A morphotype-groups are a little higher than those of the typical *A. deucalion* assemblages (Van der Meulen, 1974; Fejfar & Horaček, 1983) (Figure 8). The presence of a separate lineage is also possible as shown in Figure 9.

The most important trend in the evolution of the European *Allophaiomys* is the development of a more elongated and more complicated anteroconid complex ACC of the m1 molars (Van der Meulen, 1972; Agustí, 1991), reflected in higher a/L values and higher frequencies of the more complex morphotypes. The most characteristic trend in the Betfia IX/C to Betfia IX/B sequence seems to be the decrease in the L values. An increase of the a/L ratio or the frequency of more complex morphotypes could not be indicated.

The evaluation of the new *Allophaiomys* materials from Betfia needs further investigations, especially a higher level statistical analysis. Another important task is the geochronological correlation of the Betfia IX/C fauna, because it represents a mild and wet climatic event during the Lower Pleistocene. This rodent association is unique among the Middle European *Allophaiomys* faunas.

Table 3  
Dimensions and ratios of the  
*Allophaiomys M1 molars*  
from Betfia IX/C

	total material							
	L	a	w	b	c	a/L	b/w	C/W
N	108	117	117	117	117	108	117	117
Min.	2.1	0.882	0.7	0.091	0.07	0.350654	0.112069	0.080645
Max.	3.0	1.302	1.05	0.448	1.182	0.475472	0.457143	1.206122
X	2.583991	1.095709	0.886325	0.233197	0.178624	0.423223	0.263554	0.201871
SD	0.199075	0.094509	0.072684	0.063536	0.10078	0.026158	0.065266	0.103859
95% k.i.(+-)	0.037721	0.017199	0.013227	0.011562	0.01834	0.004957	0.012367	0.012367
	morphotype-group A							
	L	a	w	b	c	a/L	b/w	c/w
N	57	58	59	59	59	57	57	57
Min.	2.212	0.882	0.77	0.154	0.07	0.350654	0.173333	0.115942
Max.	3.0	1.246	1.05	0.448	1.182	0.451977	0.457143	1.206122
X	2.599263	1.061707	0.902559	0.261102	0.189542	0.409186	0.290021	0.211649
SD	0.194139	0.094929	0.070008	0.05851	0.137673	0.023206	0.055859	0.141853
95% k.i.(+-)	0.036786	0.017275	0.01274	0.010865	0.025054	0.006148	0.0108	0.010584
	morphotype-groups B-C-D-E							
	L	a	w	b	c	a/L	b/w	c/w
N	51	59	58	58	58	51	60	60
Min.	2.1	0.91	0.7	0.091	0.084	0.386364	0.112069	0.080645
Max.	3.0	1.302	1.05	0.322	0.224	0.475472	0.392857	0.288462
X	2.566922	1.129136	0.86981	0.20481	0.167517	0.438911	0.237984	0.192425
SD	0.205022	0.081946	0.072207	0.055732	0.033682	0.019634	0.06314	0.043922
k.i.(+-)	0.038848	0.014913	0.011798	0.010349	0.006255	0.005201	0.012208	0.008492

Table 4  
Dimensions and ratios of the  
*Allophaiomys M3 molars*  
from Betfia IX/B and IX/C.

	Betfia IX/B			Betfia IX/C		
	L	p	p/L	L	p	p/L
N	359	359	359	43	43	43
Min.	1.34	0.532	0.326531	1.4	0.532	0.339286
Max.	2.058	1.008	0.598291	1.932	0.854	0.48538
X	1.684911	0.731972	0.4345	1.675488	0.716512	0.427518
SD	0.111517	0.071787	0.032188	0.123514	0.071589	0.02682
k.i.(+-)	0.011552	0.007436	0.003334	0.038117	0.022093	0.008277

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