

# AMPHIBIANS FROM THE LOWER PLEISTOCENE BETFIA 9 LOCALITY (BIHOR COUNTY, ROMANIA)

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## INTRODUCTION

Betfia is a small village located 9-km south-east from the city Oradea, Romania. The fissure-filling system of the local limestone quarry has produced remarkable vertebrate faunae for nearly 100 years. Mihály Tóth discovered the fossil bearing sediments at the beginning of the 20<sup>th</sup> century, while Tivadar Kormos initiated the scientific study of the localities. Later Miklós Kretzoi, Elena Terzea and Tibor Jurcsák continued the field activity. The best known find point Betfia 2 gave the original type-fauna of the biochronological Biharian unit. During years 1994-1999 we re-excavated the locality Betfia 9 and we have collected two rich faunae named as Betfia 9/B and Betfia 9/C. A first report on the fossil microvertebrate faunae was given by HÍR and VENCZEL (1997). The amphibian fauna coming from these localities is listed below:

**Table 1.**  
*Amphibians from Betfia 9/B and Betfia 9/C (with minimum number of individuals)*

Species	Betfia 9/B	Betfia 9/C
<i>Parahynobius betfianus</i>	-	6
<i>Triturus</i> cf. <i>T. cristatus</i>	6	9
<i>Triturus</i> cf. <i>T. vulgaris</i>	2	4
<i>Bombina</i> cf. <i>B. bombina</i>	5	9
<i>Pliobatrachus langhae</i>	2	-
<i>Pelobates fuscus</i>	20	16
<i>Bufo bufo</i>	-	35
<i>Bufo viridis</i>	7	7
<i>Hyla</i> cf. <i>H. arborea</i>	-	14
<i>Rana</i> cf. <i>R. dalmatina</i>	11	300
<i>Rana temporaria</i>	-	5
<i>Rana</i> sp.	-	40

All the materials studied in this paper belongs to Țării Crișurilor Museum in Oradea (Romania), and are deposited in the Natural History Department. The anatomical nomenclature of the salamanders used in this paper follows ESTES (1981), and VENCZEL (1999), while that of anurans SANCHIZ (1998).

## Systematic accounts

### *Parahynobius betfianus*

**Material.** Betfia 9/C: right premaxilla (holotype)(MTC. No. 19913); a middle

trunk vertebra (paratype)(MTC. No. 19910); 110 vertebrae (MTC. No. 19908, 19909, 19911, 19914, 19916, 19917, 20390), 2 scapulocoracoids (MTC. No. 19912/1, 19915/1), 4 humeri (MTC. No. 19912/2-3, 19915/2, 20391), 6 femora (MTC. No. 19907, 19912/4-5, 19915/3-5).

**Description and comments.** This extinct land salamander species is known from the type locality only (VENCZEL, 1999). Based on the morphology of the holotype premaxilla (Fig. 1: A, B), *P. betfianus* has been included in the *Hynobius*-group of land salamanders (Fam. Hynobiidae). The members of the latter group lack for the premaxillary fontanelle, morphological character present in the members of the *Ranodon*-group only (ZHAO and HU, 1984). The transverse processes (= rib bearers) of the middle trunk vertebrae usually are bicipital, a primitive condition rarely occurring in other hynobiids (Fig. 1: C-F). The transverse process of the anterior trunk vertebrae is unicipital (dumb-bell shaped) (Fig. 1: G-I). The distribution of the living hynobiids is restricted to Asia only, except *Salamandrella keyserlingii*, which has the largest distribution among hynobiids: from the western Part of the Ural Mountains (within Europe's territory) to Eastern Asia.

#### ***Triturus cf. T. cristatus***

**Material.** Betfia 9/B: 39 vertebrae (MTC. No. 20415, 20417); Betfia 9/C: 5 oticooccipitals, 1 parietal, 2 maxillae, 1 premaxilla, 2 parasphenoids, 435 vertebrae, 4 scapulocoracoids, 3 humeri, 15 femurs (MTC. No. 20430, 20437, 20444, 20448, 20457, 20458, 20474).

**Description and comments.** The cranial, vertebral and appendicular skeletal remains closely resemble those of recent *T. cristatus* (Fig. 2: A-C). The trunk vertebrae are opisthocoelous; the neural arch is depressed, provided with a neural spine of low height. Another member of the *T. cristatus* group (*T. dobrogicus*) has a rather similar osteological morphology. Thus the assignment of the above remains to *T. cristatus* can not be fully demonstrated.

#### ***Triturus cf. T. vulgaris***

**Material:** Betfia 9/B: 6 vertebrae (MTC. No. 20416, 20418); Betfia 9/C: 55 vertebrae (MTC. No. 20438, 20445, 20475).

**Description and comments.** The great majority of the vertebrae are badly preserved. The vertebrae are distinctly smaller in size, compared to *T. cristatus* (Fig.2: D, E). The neural arch is depressed and provided with relatively high and posteriorly forked neural spine. The transverse processes (= rib bearers) are widely spaced.

#### ***Bombina cf. bombina***

**Material.** Betfia 9/B: 20 vertebrae, 5 ilia (MTC. No. 20419, 20420); Betfia 9/C: 1 parasphenoid, 41 vertebrae, 1 urostyle, 6 humeri, 16 ilia, 1 femur, 4 tibiofibulae (MTC. No. 20431, 20446, 20447, 20459, 20460, 20476).

**Description and comments.** The vertebrae assigned to this species are relatively small sized. The centrum of the presacral vertebrae is opisthocoelous. The transverse processes, according to their position in the vertebral column are variable in shape (Fig.2: F). The centrum of the sacral vertebra is bicondylar, while its transverse processes are extremely widened distally (Fig.2: G). The ilium is provided with a prominent tuber superior, oriented slightly laterally. The preacetabular fossa is usually well developed (Fig.2: H, I).

#### ***Bombina sp.***

**Material.** Betfia 9/C: 2 vertebrae, 1 tibiofibula (No. 20439).

**Description and comments.** The remains bear the generic characters of *Bombina*, but are unsuitable for more specific assignment.

### ***Pliobatrachus langhae***

**Material.** Betfia 9/B: 1 prearticular, 1 fused V1+V2, 1 fused centra of V8+V9 (MTC. No. 20428, 20429).

**Description and comments.** This is the first report of *Pliobatrachus langhae* from the locality Betfia, since the discovery and description of the type material (Fejérváry, 1917). The prearticular is relatively robust (Fig.3: D). The coronoid process is rounded, provided with a deep fossa in the middle. The atlas is firmly fused to the second vertebra (Fig. 3: A-C). The neural arch is depressed, provided with an irregularly ramified neural spine. The articular surface is extremely large (the cotyles are apparently fused in the middle). Two fused centra of V8+V9 are assigned with some doubt to this form too. The genus survived in the area up to the Middle Pleistocene (VENCZEL, 1991; SANCHIZ, 1998).

### ***Pelobates fuscus***

**Material.** Betfia 9/B: 2 exoccipitals, 18 frontoparietals, 3 nasals, 4 squamosals, 1 parasphenoid, 13 maxillae, 7 ethmoids, 31 vertebrae, 13 urostyles, 2 scapulae, 22 ilia, 13 tibiofibulae (MTC. No. 20421, No.20422, 20425); Betfia 9/C: 1 prooticoccipital, 10 fragmentary frontoparietals, 1 nasal, 2 squamosals, 1 ethmoid, 3 maxillae, 1 premaxilla, 7 vertebrae, 5 urostyles, 2 scapulae, 1 humerus, 28 ilia, 2 tibiofibula (MTC. No. 20432, 20440, 20449, 20450, 20461, 20462, 20477).

**Description and comments.** The outer surface of the frontoparietals, nasals, squamosals and maxillae are covered by a bony sculpture. The shape of the incrassatio frontoparietalis in the inner surface of the frontoparietal is rather similar to recent *P. fuscus* (Fig.3: E). The opening of the canalis pro arteria orbitonasalis is located in the anterior half of the margo orbitalis. The shape of the ilia is also similar to recent *P. fuscus* (they are lacking for tuber superior and vexillum, and the anterior margin of pars descendens ilii is distinctly convex) (Fig.3: F). Unfortunately in all the specimens the distal part of pars descendens is broken off.

### ***Bufo bufo***

**Material.** Betfia 9/C: 2 prooticoccipitals, 22 frontoparietals, 15 premaxillae, 6 maxillae, 8 prearticulars, 1 ethmoid, 4 squamosals, 10 parasphenoids, 128 vertebrae, 18 urostyles, 20 scapulae, 1 coracoid, 57 humeri, 5 radioulnae, 65 ilia, 2 femurs, 5 tibiofibulae (MTC. No. 20435, 20441, 20451, 20455, 20465, 20466, 20478).

**Description and comments.** The frontoparietal is never fused with the prooticoccipital complex (Fig.4: C). The supraorbital tectum is relatively small. The dorsal surface of the frontoparietal and the supraorbital tectum show little rugosity. The incrassatio frontoparietalis (in ventral view) is rather similar to the recent *B. bufo*. The tuber superior of the ilium is robust, moderately high and undivided (Fig.4: A, B). The preacetabular fossa is always lacking.

### ***Bufo viridis***

**Material.** Betfia 9/B: 1 fragmentary frontoparietal, 1 ethmoid, 15 presacral vertebrae, 2 scapulae, 2 humeri, 10 ilia (MTC. No. 20423, 20424); Betfia 9/C: 3 fragmentary frontoparietal+prootic+exoccipital, 2 premaxillae, 5 vertebrae, 12 ilia (MTC. No. 20467, 20468, 20479).

**Description and comments.** The frontoparietal is firmly fused to prooticoccipital complex (Fig. 4: F). The tectum supraorbitale is relatively wide. Little rugosity on the dorsal surface of the frontoparietal and tectum supraorbitale is present. The tuber superior of the ilium is prominent and it is divided in two or three protuberances (Fig.4: D, E). The preacetabular fossa is well developed.

### ***Hyla cf. H. arborea***

**Material.** Betfia 9/C: 21 vertebrae, 4 scapulae, 22 ilia (MTC. No. 20433, 20442, 20452, 20453, 20463, 20464).

**Description and comments.** The pars descendens of the ilium is distinctly larger than the pars ascendens (Fig.5: A, B). The anteroventral margin of pars descendens is extremely thin; the tuber superior is prominent, undivided and distinctly projected laterally.

### ***Rana cf. R. dalmatina***

**Material.** Betfia 9/B: 1 premaxilla, 2 ethmoids, 12 vertebrae, 3 scapulae, 4 humeri, 18 ilia, 2 tibiofibulae (MTC. No.20426, 20427); Betfia 9/C: 25 frontoparietals, 26 squamosals, 3 parasphenoids, 27 ethmoids, 30 maxillae, 8 premaxillae, 56 prearticulars, 140 vertebrae, 28 urostyles, 51 scapulae, 19 coracoids, 43 humeri, 10 radioulnae, 590 ilia, 36 tibiofibulae, 8 ischia, 8 femurs (MTC. No. 20434, 20443, 20454, 20456, 20469, 20473, 20480).

**Description and comments.** The incrassatio frontoparietalis in the inner surface of the frontoparietal is similar to recent *R. dalmatina*. The processus zygomaticus of the squamosal is relatively long and equals that of ramus paroticus (Fig.5: E). Among the skeletal material the most numerous elements are the ilia. The height of the tuber superior usually does not reach that of the crista dorsalis (Fig.5: C, D). The maximum height of the latter usually is reached at the middle part of the iliac shaft (endowing to the ilium a distinctly curved shape, when viewed laterally or medially).

### ***Rana temporaria***

**Material.** Betfia 9/C: 2 vertebrae, 4 humeri, 1 scapula, 6 ilia (MTC. No.20436).

**Description and comments.** The tuber superior of the ilium is prominent and has rounded shape, and it is slightly projected laterally (Fig.5: F, G). The crista dorsalis never reaches the height of the tuber superior.

### ***Rana sp.***

**Material.** Betfia 9/C: 77 ilia, 6 ethmoids (MTC. No. 20470, 20473, 20481).

**Description and comments.** The fragmentary ilia assigned to this taxon are provided with well-developed tuber superior (their lateral surface flattened), and with well-developed supraacetabular fossa. The height of the tuber superior equals that of the crista dorsalis. The above characters mostly resemble those of *Rana esculenta* synklepton, but owing to the fragmentary state of the material in hand it could not be fully demonstrated.

## **CONCLUDING REMARKS**

Based on micromammals, the vertebrate fauna of the locality Betfia 9/C is somewhat older in age than that of Betfia 9/B (HÍR, 1998). The most common element among the amphibians of the Betfia 9/B was *Pelobates fuscus*. The dominance of the above form suggests a steppe-dominated paleoenvironment, but with water source, indicated by the presence of forms closely related to aquatic environment (e.g. *Triturus*, *Pliobatrachus* and *Bombina*). The locality Betfia 9/C yielded a more diversified amphibian fauna (with the dominance of *Rana cf. R. dalmatina*), which probable was living in a mild and relatively humid climate. The paleoenvironment of the latter locality was dominated by dense forested vegetation, with abundant water source in the area (HÍR and VENCZEL, 1997). The unique character of the fauna in the locality Betfia 9/B is given by the presence of *Pliobatrachus langhae*, the last representative of the family Palaeobatrachidae, while that of the locality Betfia 9/C by the presence of *Parahynobius beffianus*, the sole fossil representative of the family Hynobiidae in the Qua-

ternary of Western and Central Europe. The differences observed in the composition of the faunae and of the paleoenvironment may be attributed to the rapid climatic fluctuations known in the Lower Pleistocene times.

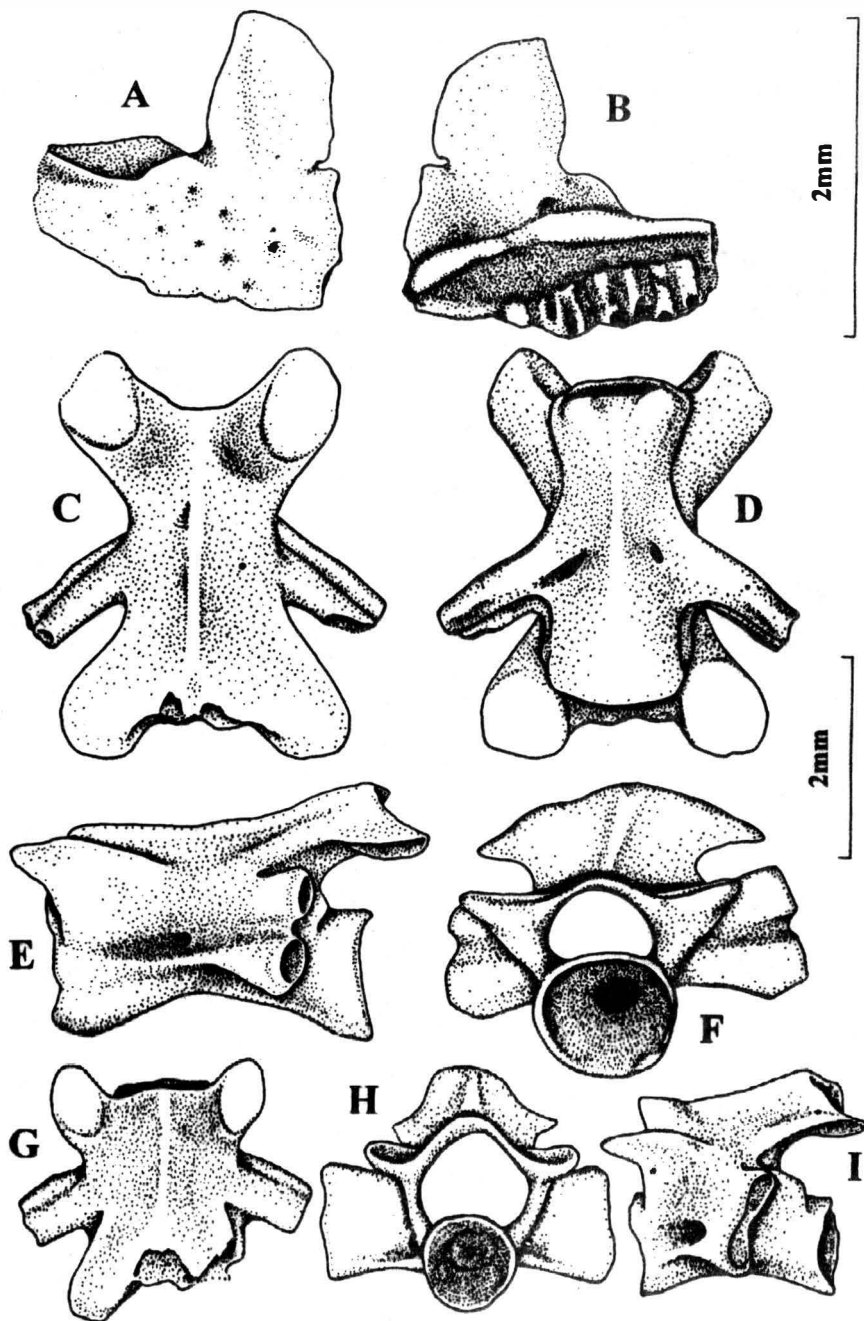
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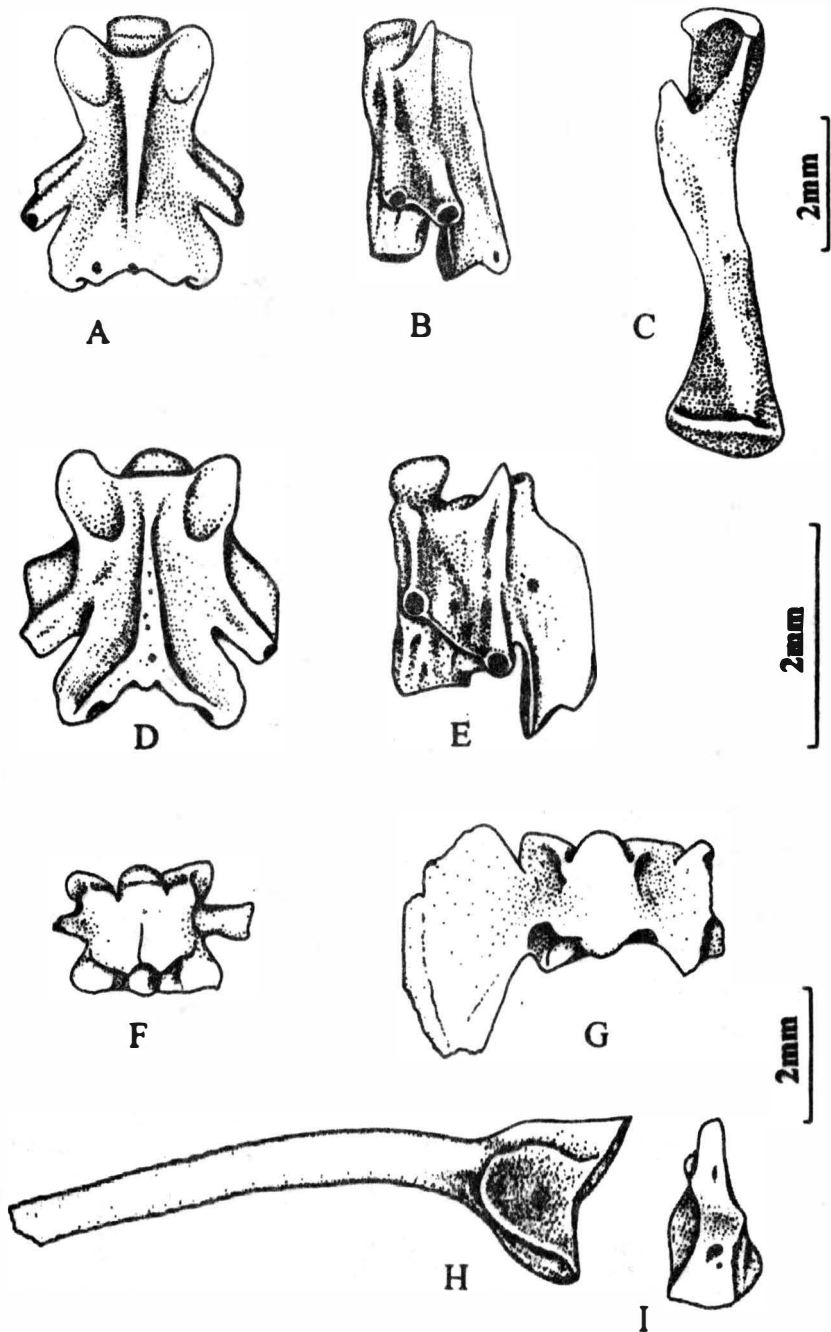
### *Amfibienii din Pleistocenul inferior, localitatea Betfia 9 (jud. Bihor, România)* (Rezumat)

Punctele fosilifere Betfia 9/B și 9/C, de vârstă pleistocenă inferioară, au furnizat până acum următoarele specii: *Parahynobius betfianus*, *Triturus* cf. *T. cristatus*, *Triturus* cf. *T. vulgaris* (urodele); *Bombina* cf. *B. bombina*, *Pliobatrachus langhae*, *Pelobates fuscus*, *Bufo bufo*, *Bufo viridis*, *Hyla* cf. *H. arborea*, *Rana* cf. *R. dalmatina*, *Rana temporaria* și *Rana* sp (anure) (vezi tabelul 1.).

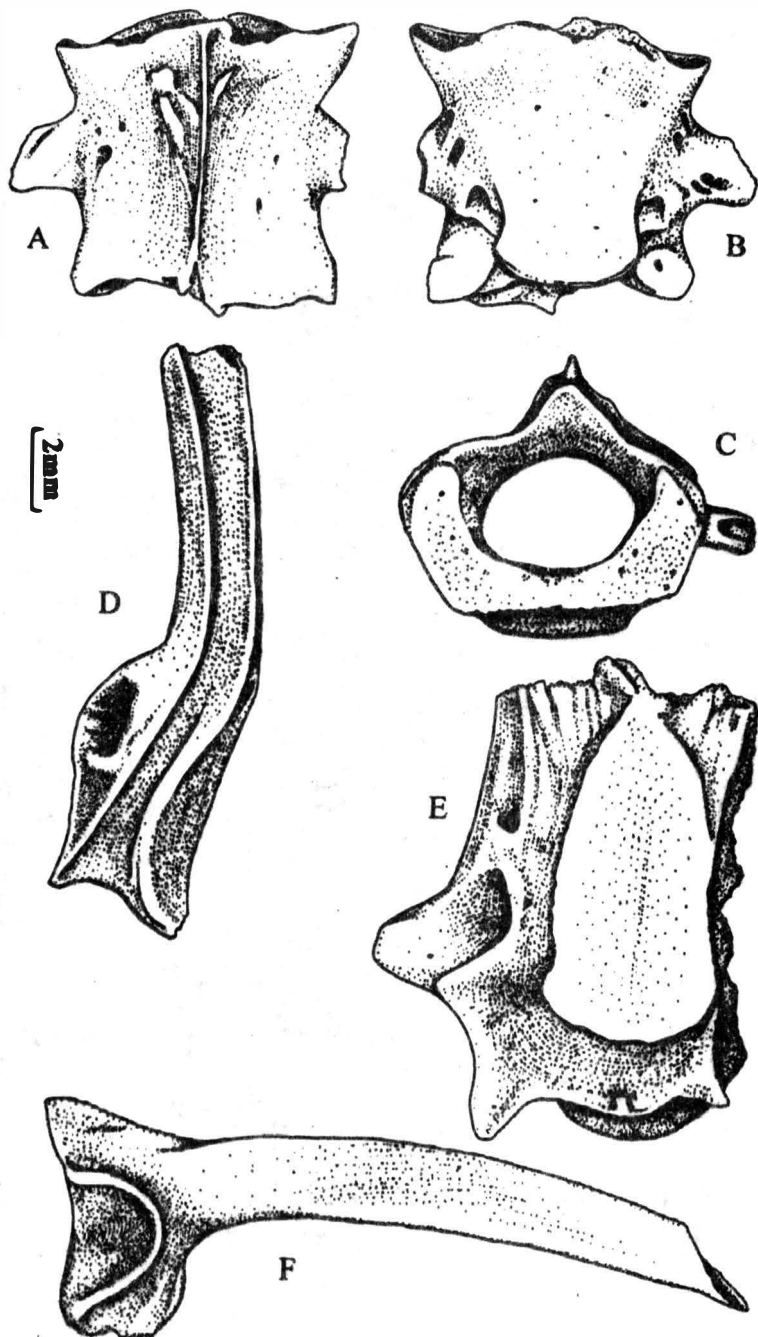
Morfologia resturilor osteologice se apropie de cele ale speciilor recente, în afara celor de *P. betfianus* și *P. langhae*, care aparțin unor specii dispărute. Faunele de amfibieni de la Betfia 9/B erau dominate de *Pelobates fuscus* (indicând un paleomediu dominat cu vegetație de stepă), iar cele de la Betfia 9/C de *Rana* cf. *R. dalmatina* (sugerând un paleomediu cu vegetație forestieră). Resursele de apă din zonă erau abundente, iar temperatura medie anuală era ușor mai ridicată față de cea actuală. Caracterul unic al faunei de la Betfia 9/B este dat de prezența lui *Pliobatrachus langhae*, ultimul reprezentant al familiei *Palaeobatrachidae* (fiind descris pentru prima oară de la Betfia 2), iar *Parahynobius betfianus*, cunoscut numai din fauna de la Betfia 9/C, este unicul reprezentant fosil al familiei *Hynobiidae* din Quaternarul Europei Centrale și de Vest.



**Figure 1.** *Parahynobius betfianus*. A, B: holotype premaxilla; C-F: middle trunk vertebra (paratype); G-I: anterior trunk vertebra. A,B,G – dorsal views; B, D – ventral views; E, I – lateral views; F, H – anterior views.

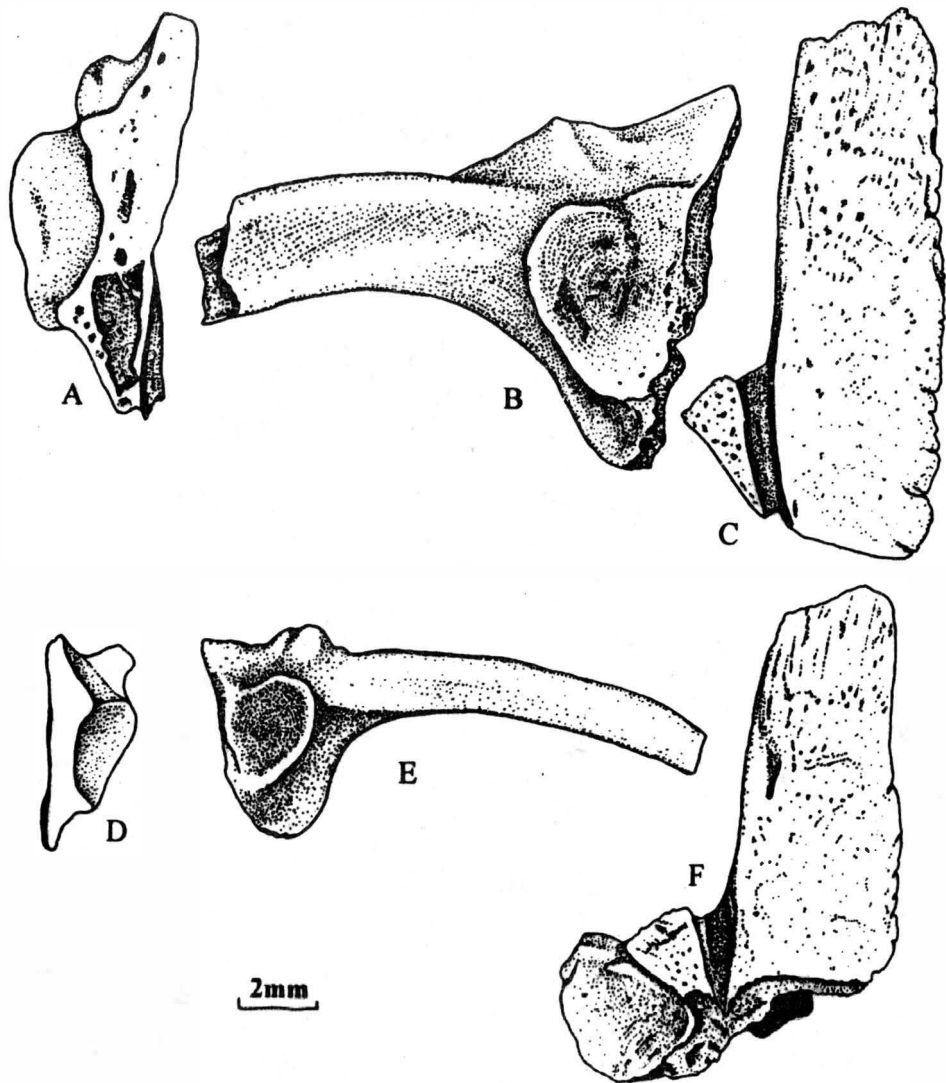


**Figure 2.** Fossil remains of *Triturus* cf. *T. cristatus* (A – C), *Triturus* cf. *T. vulgaris* (D,E), and *Bombina* cf. *B. bombina* (F – I). A, B: presacral vertebra; C: femur; D, E: presacral vertebra; F: presacral vertebra; G: sacral vertebra; H, I: ilium. A, D – dorsal views; B, E, H – lateral views; C, F, G – ventral views; I – posterior view.

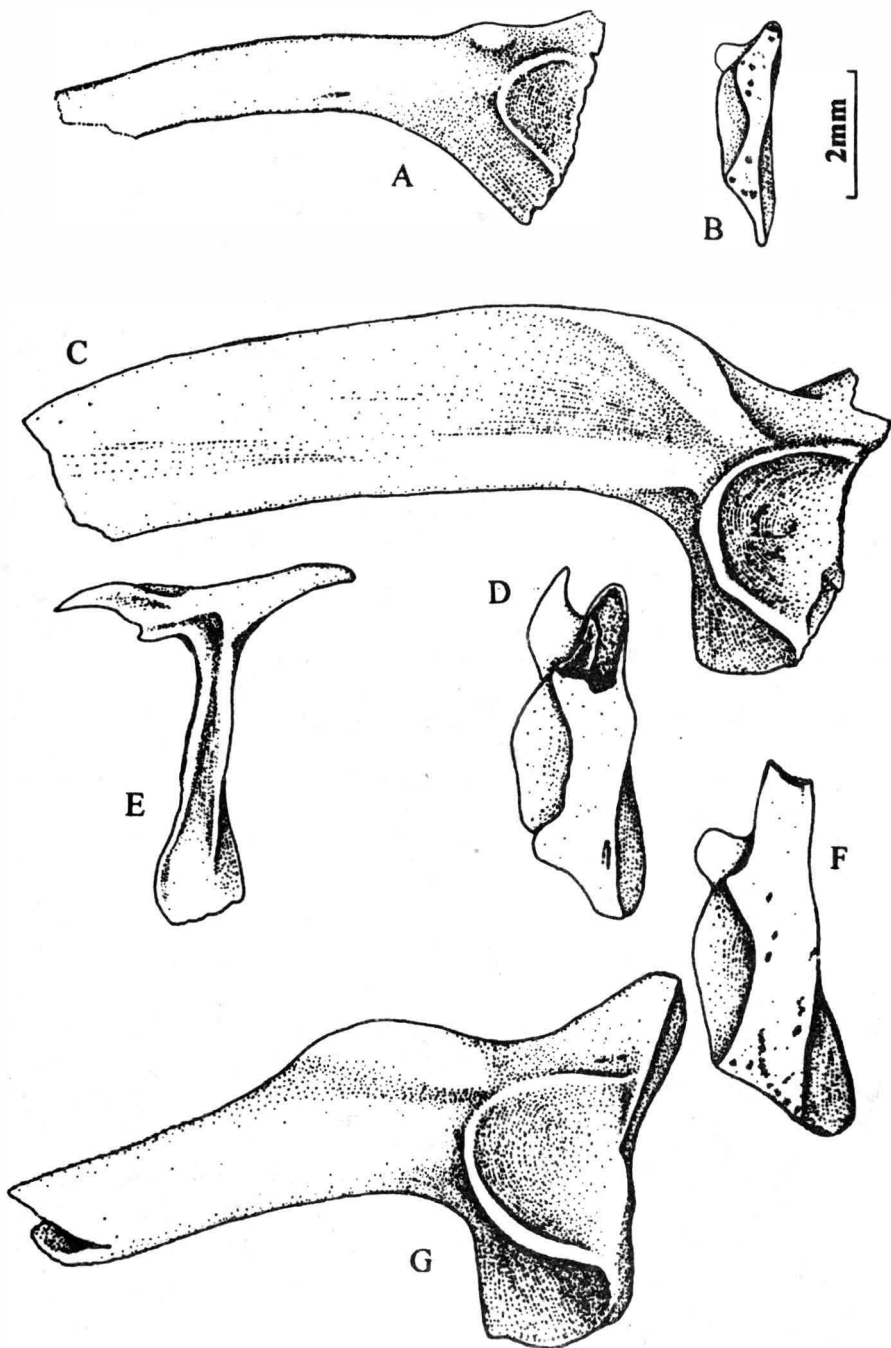


**Figure 3.** Fossil remains of *Pliobatrachus langhae* (A – D) and *Pelobates fuscus* (E, F). A-C: Fused VI+V2; D: prearticular; E: frontoparietal; F: ilium. A, D, E – dorsal views; B – ventral view; C – anterior view; F – lateral view.





**Figure 4.** Fossil remains of *Bufo bufo* (A – C) and *B. viridis* (D – F). A, B, D, E: ilium; C: frontoparietal; F: fragmentary frontoparietal+prootic+occipital. A, D – posterior views; B, E – lateral views; C, F – dorsal views.



**Figure 5.** Fossil remains of *Hyla* cf. *H. arborea* (A, B), *Rana* cf. *R. dalmatina* (C – E), and *R. temporaria* (F, G). A – D, F, G: ilium; E: squamosal. A, D, G – lateral views; B, D, F – posterior views; E – medial view.