Anurans and squamates from the Lower Pliocene (MN 14) Osztramos 1 locality (Northern Hungary)

by
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Abstract — The Lower Pliocene (MN 14) locality of Osztramos 1 (Hungary) yielded at least 7 anurans: *Latonia gigantea*, *Bombina* sp. (Discoglossidae), *Pliobatrachus* cf. *langhae* (Palaeobatrachidae), *Eopelobates* sp. (Pelobatidae), *Bufo bufo*, *B. viridis* (Bufonidae), *Rana* sp. (Ranidae); and 14 squamate taxa: Geckonidae indet., *Lacerta* sp. (Lacertidae), *Anguis fragilis*, *Pseudopus pannonicus* (Anguidae), *Eryx* sp. (Boidae), *Coluber hungaricus*, *Coronella austriaca*, *Elaphe kormosi*, *E. praelongissima*, *Elaphe* sp., *Natrix longivertebrata*, cf. *Neonatrix* sp. (Colubridae), *Vipera* cf. *ammodytes* and *V.* cf. *berus* (Viperidae). A number of taxa (*Eopelobates* sp., Geckonidae indet., *Eryx* sp., cf. *Neonatrix* sp., *Vipera* cf. *ammodytes* and *V.* cf. *berus*) are reported for the first time from the Hungarian Neogene. The composition of the fauna suggests mild and wet climate and a diversified paleoenvironment, with a water source in the area, which permitted the co-occurrence of a number of extinct and extant genera during the accumulation of the sediments.

Keywords — Anurans, squamates, Lower Pliocene, Hungary, taxonomy

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Introduction

Osztramos Hill is situated in North-Hungary (at northern latitude 49°30'), in the Upper-Bódva Basin between Tornaszentandrás and Bódvarákó. In the limestone quarry of Triassic (Ladinian – Anisian) age, 15 fossil localities were unearthed during years 1956–1976 (JÁNOSSY 1979; JÁNOSSY & KORDOS 1977).

Osztramos 1 locality was found in a fissure of more than 400 m length, of 3–4 m width, and in about 50 m depth. The first samples were collected by KRETZOI (1956), while the excavation of the entire material took place between 1970–1972 (JÁNOSSY & KORDOS 1977). In the fissure system different "bone-pockets" were identified and noticed as Loc. 1/a–1/f. The first description of the fossil remains, coming from Loc. 1/b and 1/c, was published by JÁNOSSY (1972), while a review of the entire locality complex (including Osztramos 1/a–1/f) was prepared by JÁNOSSY & KORDOS (1977). Based on micromammals, the age of the fauna may be defined as Lower Pliocene (MN 14) (KORDOS 1994; FEJFAR et al. 1998).

JÁNOSSY (1972) and JÁNOSSY & KORDOS (1977) reported *Anguis* (Loc.1/b, 1/c) and *Pseudopus* (=*Ophisaurus*) (Loc. 1/b, 1/c, 1/d), and mentioned that the fossil material contained also urodeles, anurans, snake vertebrae and turtle remains. VENCZEL (1997) listed a number of anurans from the Loc. 1:

Latonia gigantea (1/e),
Bombina sp. (1/c),
Pelobates sp. (1/b),
Pelobates cf. *fuscus* (1/c),
Bufo bufo (1/c),
Bufo viridis (1/b), and
Rana kl. *esculenta* (1/b, 1/c, 1/e).

Few land salamander vertebrae coming from the Loc. 1/c, have been assigned to *Parahynobius*, an extinct hynobiid genus (VENCZEL 1999).

The purpose of the present paper is to describe the fossil remains of anurans and squamate reptiles coming from Loc. 1. The entire material is deposited in the Hungarian Natural History Museum in Budapest.

Material and methods

The fossil material used in this study were selected off from the abundant microvertebrate remains coming from localities 1/b, 1/c and 1/e. The remains were cleaned from the brecciated sediments using acetic acid, and than impregnated. The terminology used follows SANCHÍZ (1998) for anurans, ROČEK (1984) and RAUSCHER (1992) for lizards, and SZYNDLAR (1984) and SZYNDLAR & SCHLEICH (1994) for snakes.

Systematics

Class **Amphibia** LINNEAUS, 1758
Order **Anura** RAFINESQUE, 1815
Family **Discoglossidae** GÜNTER, 1859
Genus *Latonia* MEYER, 1843

Latonia gigantea (LARTET, 1851)
(Figure 1: A–D)

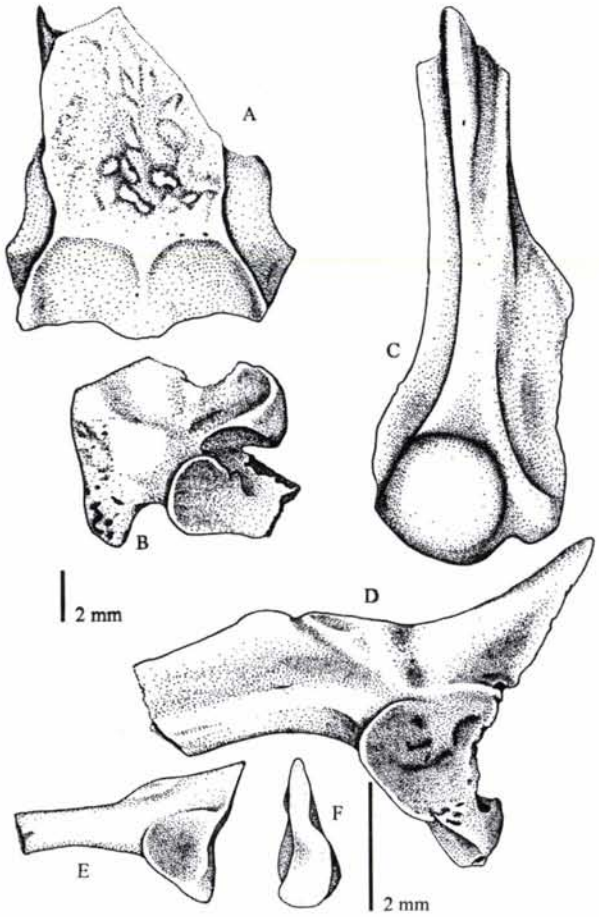


Figure 1 — ***Latonia gigantea*** **(A–D) and** ***Bombina*** **sp. (E, F) from Osztramos 1.** — **A**: frontoparietal (O1/b); **B**: scapula (O1/e); **C**: humerus (O1/e), **D**: ilium (O1/e); **E**, **F**: ilium (O1/e). — ***A: dorsal view; B, D, E: lateral views; C: ventral view; F: posterior view.***

Material — Osztramos 1/b: 1 frontoparietal, 1 urostyle, 1 ilium (HNHM. No. V.99.1); Osztramos 1/c: 1 prooticooccipital, 1 frontoparietal, 1 maxilla, 1 presacral vertebra, 1 scapula, 2 humeri, 1 ilium (HNHM. No. V.99.2); Osztramos 1/e: 4 prooticooccipitals, 1 sphenethmoid, 2 premaxillae, 12 maxillae, 3 frontoparietals, 3 prearticulars, 4 atlases, 20 presacral vertebrae, 2 sacral vertebrae, 4 urostyles, 3 clavicles, 1 coracoid, 6 scapulae, 8 humeri, 1 radioulna, 10 ilia, 2 femora, 2 tibiofibulae (HNHM. No. V. 74.129).

Description and comments — The material belonged to specimens of various sizes. The dorsal surface of the frontoparietal is sculptured and the facies posterior lacks the foramen pro arteria occipitalis. The maxilla is toothed; in large individuals the outer surface of its posterior part is covered by a secondary sculpture. Two coronoid processes provide the prearticular, and a distinct depression is observed above the crista mandibulae externa (ROČEK 1994). The vertebrae are opistocoelous; the urostyle is elongated, bicotylar, with a narrow dorsal fissure, and usually with a pair of transverse processes. The scapula is relatively short, with well-developed pars acromialis. The external surface in a large specimen is covered also by a secondary sculpture. The distal portion of the humerus is bent laterally, having a distinctly larger epicondylus medialis than epicondylus lateralis; the caput humeri is shifted laterally. The tuber superius of the ilium is well developed, while the pars ascendens is distinctly larger than the pars descendens. The fossula tuberis superioris, situated ventrally from the tuber superius, is usually well evidenced.

According to HOSSINI (1993), ROČEK (1994) and SANCHÍZ (1998), in the evolution of the genus *Latonia,* two distinct lineage may be distinguished: the lineage of *L. vertaizoni* – *L. ragei* (without secondary sculpture on maxillae) and the lineage of *L. gigantea,* (with secondary sculpture on maxillae), both of them exhibit a marked trend toward gigantism (ROČEK 1994).

Genus *Bombina* OKEN, 1816

Bombina sp.
(Figure 1: E, F)

Material — Osztramos 1/c: 2 ilia (HNHM. No. V.99.3).

Description and comments — The tuber superius of the ilium, situated above the anterior margin of the acetabulum, is ovaloid in shape, and slightly projected laterally. The preacetabular fossa is lacking. The pars descendens in a specimen, possessing a small tubercle when viewed medially. The above characters are variable in recent specimens of *B. bombina* and *B. variegata* (HODROVA 1981, 1985, 1987), thus closer assignment of the remains in hand are actually impossible.

Family **Palaeobatrachidae** COPE, 1865
Genus *Pliobatrachus* FEJÉRVÁRY, 1917

Pliobatrachus cf. ***langhae*** FEJÉRVÁRY, 1917
(Figure 2: A–D)

Material — Osztramos 1/b: 1 fragmentary frontoparietal, 1 fragmentary right ilium (HNHM. No. V.99.4).

Description and comments — The dorsal surface of the frontoparietal fragment is smooth, and slightly concave in its median part. The anterior margin was presumably trifurcated with observable evidence of overlying the sphenethmoid (SANCHÍZ 1998). The fragmentary ilium belonged to a relatively small specimen. The tuber superius, situated anterodorsally from the acetabulum, is without any trace of division into gluteus tubercle and iliofibularis–iliofemoralis attachment (as it is usually observed in *Palaeobatrachus*); the preacetabular fossa is lacking; the pars descendens ossis ilii (which was probably weakly defined) and the interiliac process are broken off. The basis for the assignment of the specimens to the genus *Pliobatrachus* was the morphology of the tuber superius and the shape of the outer surface of the frontoparietal. However, it could be mentioned that in Central Europe both genera survived up to the Upper Pliocene (MŁYNARSKI et al. 1984). In the case of *Pliobatrachus* the latest occurrences are from the Lower Pleistocene (SANCHÍZ 1998).

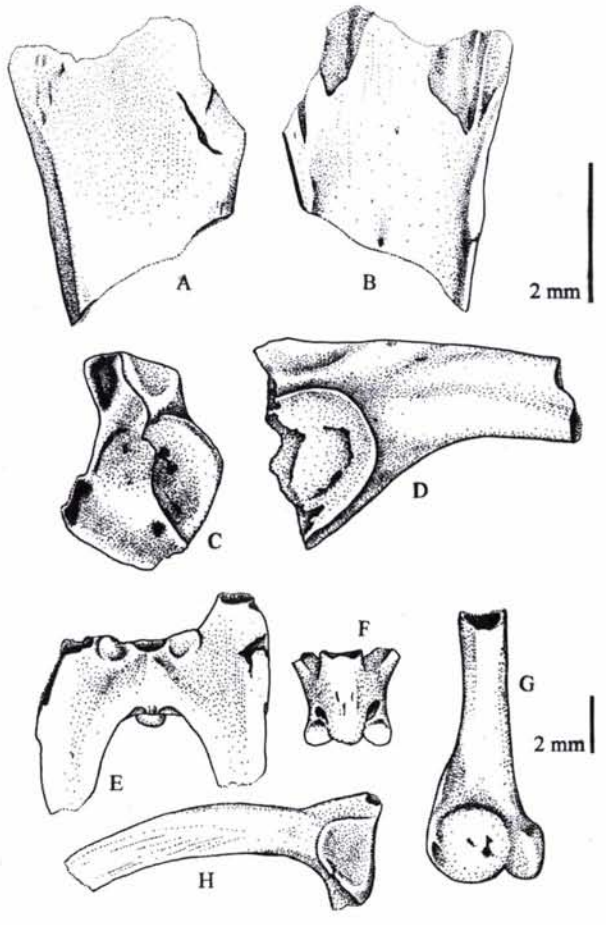


Figure 2 — ***Pliobatrachus* cf. *langhae* (A–D) and *Eopelobates* sp. (E–H) from Osztramos 1.** — **A**, **B**: frontoparietal (O1/b); **C**, **D**: ilium (O1/b); **E**: sacral vertebra (O1/c); **F**: presacral vertebra (O1/c); **G**: humerus (O1/c), **H**: ilium (O1/c). — ***A, E: dorsal views; B, F, G: ventral views; C: posterior view; D, H: lateral views.***

Family **Pelobatidae** BONAPARTE, 1850
Genus *Eopelobates* WAGLER, 1830

Eopelobates sp.
(Figure 2: E–H)

Material — Osztramos 1/b: 1 scapula, 1 vertebra, 1 sacral vertebra, 5 ilia (HNHM. No. V.99.5); Osztramos 1/c: 1 fragmentary maxilla, 2 presacral vertebrae, 2 sacral vertebrae, 2 humeri, 4 ilia (HNHM. No. V.99.6); Osztramos 1/e: 1 vertebra, 1 fragmentary humerus (HNHM. No. V.99.7).

Description and comments — The outer surface of the fragmentary maxilla is covered by an incipient pit-and-ridge sculpture. The few presacral vertebrae from the posterior trunk region are procoelous, and provided with small transverse processes directed anteriorly. A peculiarity of these vertebrae is the presence of spinal nerve foramina, a character observed in *Eopelobates* by VERGNAUD–GRAZZINI (1970), SANCHÍZ & MŁYNARSKI (1979), and HODROVA (1987). The sacral vertebra has an extremely widened diapophyses. The sacral vertebra is not fused with the urostyle, and the sacral–urostylar articulation is monocondylar. The fragmentary ilia are of two size categories. In all the specimens the pars descendens is damaged. The humerus lacks any characters of diagnostic value.

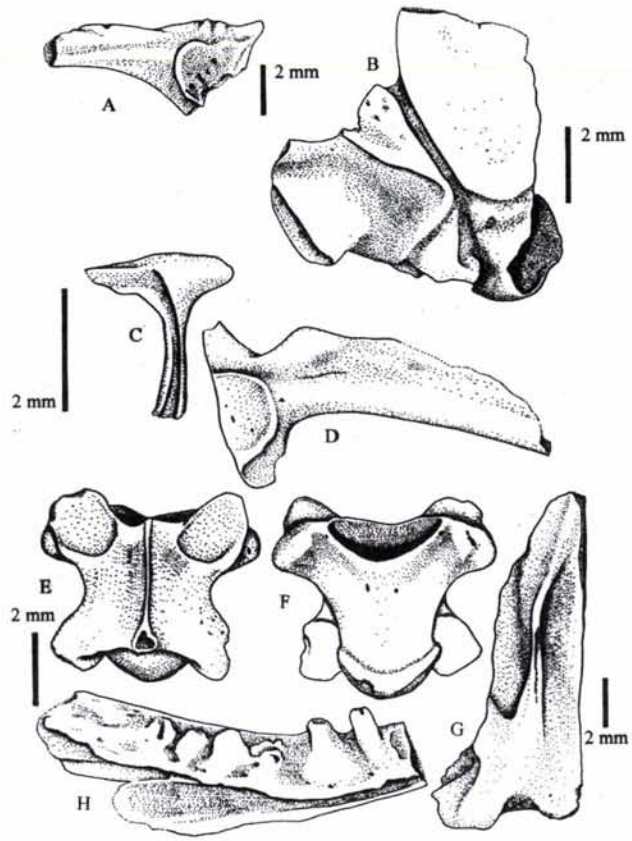
Family **Bufonidae** GRAY, 1825
Genus *Bufo* LAURENTI, 1768

Bufo bufo (LINNAEUS, 1758)
(Figure 3: A)

Material — Osztramos 1/c: 1 vertebra, 1 sacral vertebra, 1 scapula, 2 humeri, 5 ilia (HNHM. No. V.99.8); Osztramos 1/e: 1 vertebra, 1 humerus, 1 ilium (HNHM. No. V.99.9).

Description and comments — The fragmentary ilia belonged to specimens of two size categories. The tuber superius is situated above the acetabulum, is compressed laterally, and slightly divided in 2–3 tubercles. In all the specimens the preacetabular fossa is lacking. The other elements are damaged, and only tentatively are assigned to this species.

Bufo viridis LAURENTI, 1768
(Figure 3: B)



Material — Osztramos 1/b: 3 fragmentary skulls, 1 atlas, 1 vertebra (HNHM. No. V.99.10); Osztramos 1/c: 2 fragmentary skulls, 1 ilium, 1 urostyle (HNHM. No. V.99.11).

Description and comments — The frontoparietal is always fused with the prootic and exoccipital. The supraorbital canal is not closed posteriorly, similarly to a specimen coming from the Late Miocene (MN 13) Polgárdi 5 locality (VENCZEL 1997: fig. 14). A fragmentary ilium, which belonged to a large individual, has a distinct preacetabular fossa. An extinct species with close affinities to *B. viridis* is *B. priscus*, known from the Middle Miocene (MN 6) of Devinska Nova Ves locality (ŠPINAR et. al. 1993), and probably from the French Middle Miocene, too (SANCHÍZ 1998, and references therein). However, it could be mentioned that the type material of *B. priscus* originally was assigned to *Bufo* cf. *viridis* by HODROVA (1988: fig. 4).

Figure 3 — ***Bufo bufo* (A), *B. viridis* (B), *Rana* sp. (C, D) and *Pseudopus pannonicus* (E–H) from Osztramos 1.** — **A**: ilium (O1/c), **B**: fragmentary skull (O1/b), **C**: squamosal (O1/b), **D**: ilium (O1/b), **E**, **F**: trunk vertebra (O1/b), **G**: frontal (O1/c), **H**: dentary (O1/b). — ***A, C, D**: lateral views; **B, E**: dorsal views; **F, G**: ventral views; **H**: medial view.*

Family **Ranidae** GRAY, 1825
Genus *Rana* LINNAEUS, 1758

Rana sp.
(Figure 3: C, D)

Material — Osztramos 1/b: 2 frontoparietals, 1 scapula, 1 squamosal, 1 presacral vertebra, 2 sacral vertebrae, 15 ilia (HNHM. No. V.99.12); Osztramos 1/c: 2 presacral vertebrae, 1 scapula, 1 urostyle, 1 premaxilla, 7 ilia (HNHM. No. V.99.13); Osztramos 1/e: 3 premaxillae, 1 squamosal, 3 sacral vertebrae, 2 scapulae, 18 ilia (HNHM. No. V.99.14).

Description and comments — The remains are damaged to various degrees and have belonged to small-sized specimens. Based on the morphology of the ilium we can presume that the majority of the specimens might belonged to *Rana* kl. *esculenta*, and only few of them could belonged to brown frogs (*R. dalmatina* or *R. arvalis*). However, the morphology of the squamosal (Figure 3: C) approaches the condition seen in recent *R. dalmatina*.

Class **Reptilia** LINNAEUS, 1758
Order **Sauria** MCCARTNEY, 1802
Family **Geckonidae** GRAY, 1825

Geckonidae indet.
(Figure 4: A, B)

Material — Osztramos 1/b: 1 dentary (HNHM. No. V.99.15).

Description and comments — The dentary belonged to a small sized individual. The anterior and the posterior tip of the bone are broken off. The Meckel's groove is closed in the posterior area. The dentition is of pleurodont type. The teeth are numerous and bearing monocuspid tips. In the available specimen, 18 tooth positions are preserved. Surprisingly, remains of Geckonidae have never been reported from the territory of Central Europe till now. In Western Europe at least four genera, and also indeterminate geckonids of Eocene – Pliocene ages, have been described (RAGE & AUGE 1993, and references therein).

Family **Lacertidae** BONAPARTE, 1831
Genus *Lacerta* LINNAEUS, 1758

Lacerta sp.
(Figure 4: C–F)

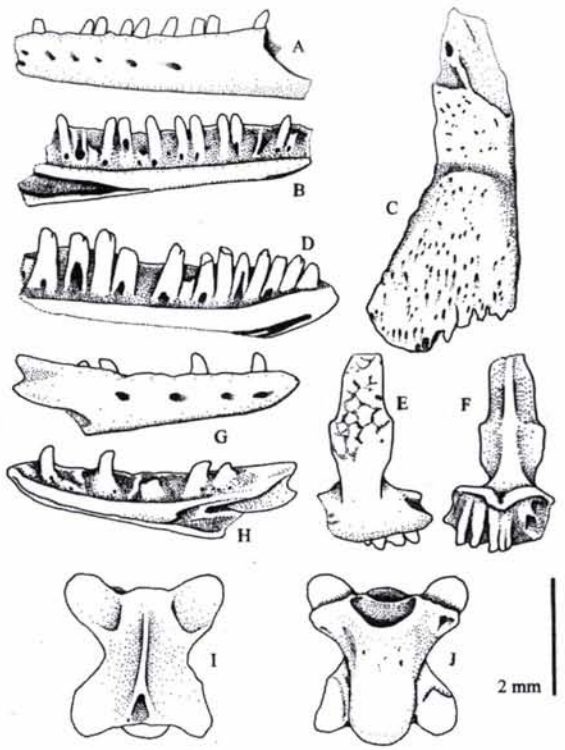


Figure 4 — **Lizards from Osztramos 1.** — **A**, **B**: dentary of Geckonidae indet. (O1B, No.); **C**: frontal of *Lacerta* sp. (O1B, No.); **D**: dentary of *Lacerta* sp. (O1C, No.), **E**, **F**: premaxilla of *Lacerta* sp. (O1B, No.), **G**, **H**: dentary of *Anguis* sp. (O1B, No.), trunk vertebra of *Anguis* sp. (O1C, No.). — ***A***, ***G***: *lateral views;* ***B***, ***D***, ***H***: *medial views;* ***C***, ***E***, ***I***: *dorsal views;* ***F***, ***J***: *ventral views.*

Material — Osztramos 1/b: 1 premaxilla, 1 frontal (HNHM. No. V.99.16); Osztramos 1/c: 1 premaxilla, 1 maxilla, 10 dentaries, 4 vertebrae (HNHM. No. V.99.17); Osztramos 1/e: 1 maxilla (HNHM. No. V.99.41).

Description and comments — The material belonged probably to two distinct forms. The premaxilla, coming from Osztramos 1/b, seems to have 9 teeth (Figure 4: E, F) and closely resembles that of the Recent *L. agilis* (RAUSCHER 1992: Plate 10: fig. 1). Another specimen from Osztramos 1/c, with a thinner processus nasalis (having its dorsal part broken off), probable belonged to another member of the genus. The morphology of the fragmentary frontal and dentary is similar to the condition observed in *L. viridis*. The Meckel's groove is closed at the level of the first tooth position. The dentition is of pleurodont type; the teeth have bicuspid or tricuspid tips.

Family **Anguidae** GRAY, 1825
Genus *Anguis* LINNAEUS, 1758

Anguis fragilis LINNAEUS, 1758
(Figure 4: G–J)

Material — Osztramos 1/b: 2 osteoderms, 1 dentary, 10 trunk vertebrae (HNHM. No. V.99.18); Osztramos 1/c: 1 dentary, 9 vertebrae (HNHM. No. V.99.19); Osztramos 1/e: 3 vertebrae (HNHM. No. V.99.42).

Description and comments — The dentary preserved 9 or 10 tooth positions. The dentition is of pleurodont type; the monocuspid teeth are recurved posteriorly; the height of the posterior teeth is considerably reduced. The Meckel's groove is narrow, and is closed in the vicinity of the first tooth position.

The vertebrae are of small size. The ventral surface of the centrum is flattened; in ventral view the lateral margins of the centrum are parallel. The dorsal surface of the osteoderms is covered with vermicular shaped tubercles. The remains of *Anguis* are abundant in the Late Neogene European localities.

Genus *Pseudopus* MERREM, 1870

Pseudopus pannonicus (KORMOS, 1911)
(Figure 3: E–H)

Material — Osztramos 1/b: 1 osteoderm, 1 trunk vertebra, 1 dentary (HNHM. No. V.99.20); Osztramos 1/c: 1 frontal, 1 caudal vertebra, 1 osteoderm (HNHM. No. V.99.21).

Description and comments — The morphology of the frontal does not differ significantly from that figured by FEJÉRVÁRY–LÁNGH (1923, Plate 1, Fig. 2a). The teeth in the dentary are conical with their tips broken off; the posterior ones are extremely reduced in height. The few vertebrae preserved are of relatively small size. The centrum is short, the ventral surface is flattened, and somewhat triangle-shaped. The condyle is rather distinct. The posterior part of the outer surface of the osteoderms is covered with vermicular-shaped tubercles, while the anterior part is smooth. During the Late Neogene *Pseudopus pannonicus* was widely distributed in Central Europe, even in northern areas such as Poland (MŁYNARSKI et. al. 1984).

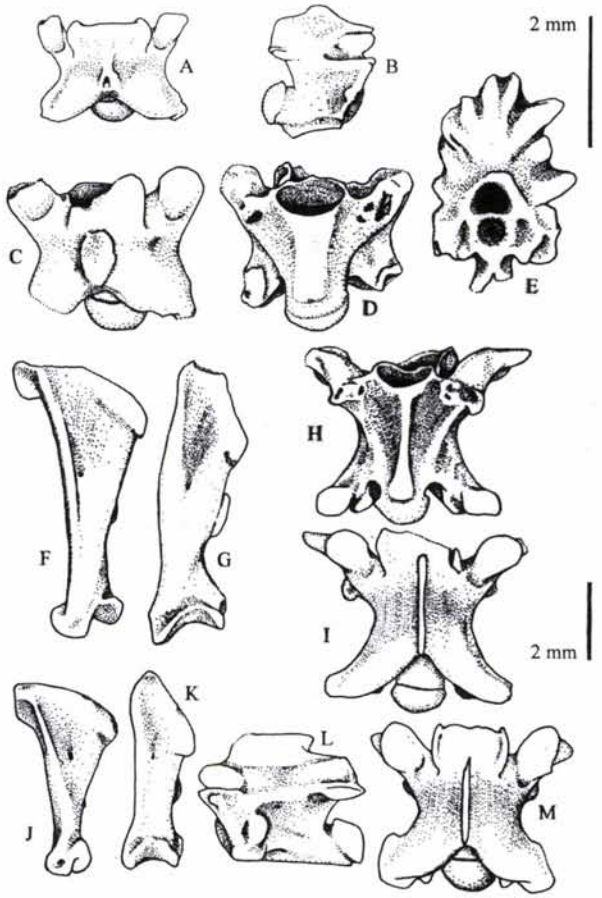


Figure 5 — ***Eryx*** **sp. (A–E),** ***Coluber hungaricus*** **(F–I) and** ***Coronella*** **cf.** ***austriaca*** **(J–M) from Osztramos 1.** — **A, B**: anterior trunk vertebra (O1/e, No.); **C, D**: trunk vertebra (O1/e), **E**: caudal vertebra (O1/e); **F, G**: quadrate (O1/b); **H, I**: trunk vertebra (O1/c); **J, K**: quadrate (O1/b); **L, M**: trunk vertebra (O1/b). — ***A, C, I, M****: dorsal views;* ***B, L****: lateral views;* ***D, H****: ventral views;* ***E****: anterior view;* ***F, J****: posterolateral views;* ***G, K****: posterior views.*

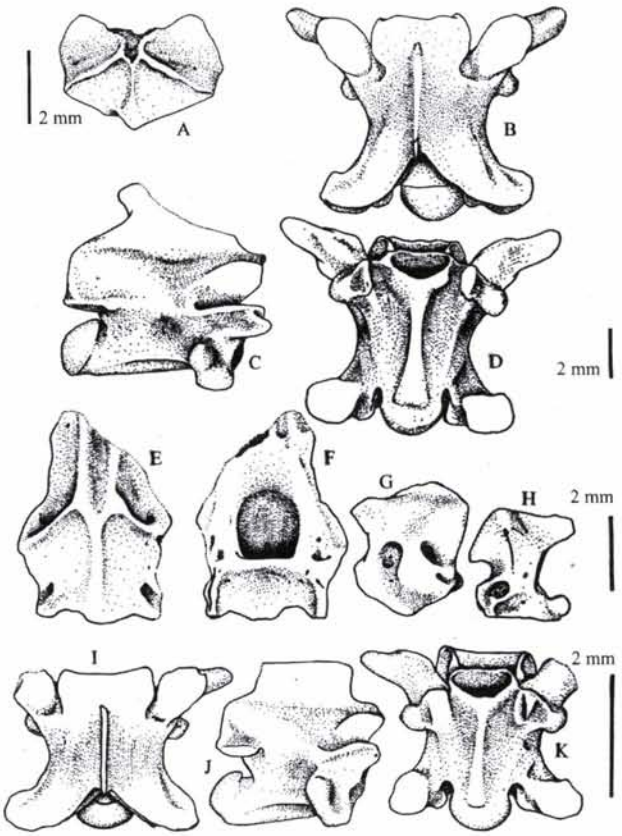


Figure 6 — ***Elaphe kormosi*** **(A–D),** ***Elaphe*** **sp. (E, F) and** ***E. praelongissima*** **(G–K) from Osztramos 1.** — **A**: supraoccipital (O1/c), **B–D**: trunk vertebra (O1/c), **E, F**: basiparasphenoid (O1/e), **G**: prootic (O1/b), **H**: exoccipital (O1/b), **I–K**: trunk vertebra (O1/c). — ***A, B, F, I****: dorsal views;* ***C, G, H, J****: lateral views;* ***D, E, K****: ventral views.*

Order **Serpentes** LINNAEUS, 1758
Family **Boidae** GRAY, 1825
Genus *Eryx* DAUDIN, 1803

Eryx sp.
(Figure 5: A–E)

Material — Osztramos 1/e: 20 trunk vertebrae, 3 caudal vertebrae (HNHM. No. V.99.22).

Description and comments — The trunk vertebrae are small-sized and damaged. (Figure 5: C, D). The neural arch is depressed. The neural spine is of low height, relatively short and wide. The prezigapophyseal processes (if preserved) are extremely short. The zygosphenal roof is concave. The cotyle and condyle are slightly depressed dorsoventrally. The haemal keel is wide, but weakly defined in the mid-trunk vertebrae. In the anterior trunk vertebrae the haemal keel is prominent, while the zygosphenal roof is straight (Figure 5: A, B). The lateral and subcentral foramina are distinct, while the paracotylar foramina are lacking. The centrum length of the two largest trunk vertebrae is 1.80 mm; the centrum width is 2.34 mm and 2.38 mm, respectively. The caudal vertebrae are partially damaged. They are coming probably from the anterior caudal region, having a weakly defined zygosphene and zygantrum. (Figure 5: E). The caudal vertebrae are very short and high. The neural spine is slightly bifurcate dorsally. The pleurapophyses and the haemapophyses in all the specimens are broken off. Based on the above discussed characters, the remains undoubtedly can be assigned to the genus *Eryx*. The fossil record from the Pannonian Basin supports the idea that this genus had a larger (circum-Mediterranean) distribution in the Neogene times (SZYNDLAR & SCHLEICH 1994).

Family **Colubridae** OPPEL, 1811
Genus *Coluber* LINNAEUS, 1758

Coluber hungaricus (BOLKAY, 1913)
(Figure 5: F–I)

Material — Osztramos 1/b: 2 exoccipitals, 1 prootic, 2 quadrates (HNHM. No. V.99.23), 10 vertebrae (HNHM. No. V.99.24); Osztramos 1/c: 13 vertebrae (HNHM. No. V.99.25).

Description and comments — The morphology of the cranial bones is similar to those known from Polgárdi, Hungary (BOLKAY 1913; VENCZEL 1994, 1998). The quadrate, having distinctly widened proximal end and sharp quadrate crest, resembles those of Polgárdi 5, Hungary (VENCZEL 1998). The vertebrae are small, the great majority of them are poorly preserved. The neural arch of the trunk vertebrae is moderately vaulted, with relatively long neural spine of low height. The haemal keel is flattened, but more prominent in the posterior trunk vertebrae. The roof of the zygosphene is straight or slightly convex, with a small median lobe; the prezygapophyseal process is relatively short and pointed distally. The length of the parapophyses is equal with that of the diapophyses. The centrum length of seven vertebrae from Osztramos 1/c ranged between 3.18–4.51 mm, while the centrum width between 2.32–3.52 mm. The centrum length / centrum width ratio is between 1.22–1.42 (mean = 1.3). Up to now *Coluber hungaricus* was only known from the Upper Miocene (MN 13) localities of Polgárdi, Hungary.

Genus *Coronella* LAURENTI, 1768

Coronella cf. ***austriaca*** LAURENTI, 1768
(Figure 5: J–M)

Material — Osztramos 1/b: 2 exoccipitals, 1 quadrate (HNHM. No. V.99.26), 4 vertebrae (HNHM. No. V.99.27); Osztramos 1/c: 8 vertebrae (HNHM. No. V.99.28); Osztramos 1/e: 9 vertebrae (HNHM. No. V.99.29).

Description and comments — The vertebrae closely resemble those of recent *C. austriaca*. They are small-sized: the centrum length of the largest vertebra from Osztramos 1/b is 3.08 mm, while its width is 2.67 mm. The neural arch is flattened, with extremely low and long neural spine. The haemal keel is flattened, while the parapophyses are about two times longer than the diapophyses. The zygosphene is straight or crenate, and the prezygapophyseal processes are extremely short distally. Two exoccipitals and a quadrate resembling the homologous bones of recent *C. austriaca* were assigned with some doubt to this form, too. *C. miocaenica,* an extinct member of the genus, has been described from the Upper Miocene (MN 13) of Polgárdi 4, Hungary (VENCZEL 1998).

Genus *Elaphe* FITZINGER, 1833

Elaphe kormosi (BOLKAY, 1913)
(Figure 6: A–D)

Material — Osztramos 1/c: 1 supraoccipital, 10 vertebrae (HNHM. No. V.99.30).

Description and comments — The supraocccipital is assigned with some doubt to this form. The occipital crests are well developed, and slightly inclined posteromedially. The sagittal crest is relatively long and of low height. The hypapophysis of a cervical vertebra is directed ventrally. The trunk vertebrae are large-sized and closely resemble those described from Polgárdi 2 (e.g. flattened haemal keel, moderately long and obtuse prezygapophyseal processes, straight zygosphene) (VENCZEL 1994). The centrum length in five trunk vertebrae is between 4.61–6.58 mm, while the centrum width is between 3.43–4.88 mm. The centrum length / centrum width ratio ranged between 1.22–1.41 (mean = 1.32).

Elaphe praelongissima VENCZEL, 1994
Figure 6: G–K)

Material — Osztramos 1/b: 1 prootic, 1 axis, 2 vertebrae (HNHM. No. V.99.31); Osztramos 1/c: 1 exoccipital, 1 basioccipital, 16 vertebrae (HNHM. No. V.99.32).

Description and comments — The morphology of the exoccipital, and in a lesser degree the prootic, resembles those described from Polgárdi 4 (VENCZEL 1994). A well-preserved basioccipital, which belonged to a small-sized specimen, having weakly defined basioccipital crests and basioccipital tubercles, was assigned to this species, too. The vertebrae are small-sized and poorly preserved. The neural arch is vaulted, provided with a relatively high neural spine. The zygosphene is concave (in few specimens it is crenate), and the prezygapophyseal processes are shorter than the prezygapophyseal articular facets, and obtused distally. The paradiapophyses are slightly divided into parapophyses and diapophyses, the former being distinctly longer than the latter one. The haemal keel is prominent and spatula-shaped (but in a few specimens it is weakly defined). In four vertebrae from Osztramos 1/c the centrum length ranges from 3.21 to 4.12 mm, while the centrum width is between 2.73–3.53 mm. The centrum length/centrum width ratio is between 1.13–1.23.

Elaphe sp.
(Figure 6: E–F)

Material — Osztramos 1/c: 2 vertebrae (HNHM. No. V.99.33); Osztramos 1/e: 1 basiparasphenoid, 1 exoccipital, 1 frontal, 1 compound bone, 60 vertebrae (HNHM. No. V.99.34).

Description and comments — The material belonged to two different forms. Two vertebrae coming from Osztramos 1/c are small-sized (the centrum length is 3.64 and 3.68 mm respectively), with extremely low centrum length/centrum width ratio (1.01). The neural arch is depressed, with a low neural spine. The zygosphene is nearly straight with an indistinct median lobe. The haemal keel is flattened and wide. The prezygapophyseal processes in both specimens are broken off. The above described characters somewhat resemble those observed in *E. szyndlari*. A fragmentary basiparasphenoid (Figure 6: E, F) is comparable to that of *Elaphe praelongissima* (e.g. the disposition of the foramina), but it differs from the latter by having larger basipterygoid processes, suborbital flanges, and a concave posterolateral margin. The vertebrae coming from Osztramos 1/e are small-sized. In seven trunk vertebrae the centrum length ranged between 2.82–3.12 mm, while the centrum width between 2.76–3.02 mm. The centrum length/centrum with ratio is between 1.01–1.03 (mean = 1.02). The neural arch is moderately vaulted, the haemal keel is flattened and spatulate-shaped. The zygosphene is usually crenate (but a few cases it is concave or straight). The prezygapophyseal processes are moderately long and obtuse. Some of these characters similar to those of the Recent *E. situla* (SZYNDLAR 1991a), but the material in hand is unsuitable to demonstrate the identity.

Genus *Natrix* LAURENTI, 1768

Natrix longivertebrata SZYNDLAR, 1984
(Figure 7: A–E)

Material — Osztramos 1/b: 2 basiparasphenoids, 2 supraoccipitals, 4 frontals, 2 prootics, 1 prootic, 1 ectopterygoid, 2 compound bones, 14 vertebrae (HNHM. No. V.99.35); Osztramos 1/c: 1 frontal, 2 exoccipitals, 1 baziparasphenoid, 8 vertebrae (HNHM. No. V.99.43) Osztramos 1/e: 1 basioccipital, 2 exocci-

pitals, 2 compound bones, 1 quadrate, 27 vertebrae (HNHM. No. V.99.36).

Description and comments — From the remains, the supraoccipital (Figure 7: A), the compound bones (Figure 7: E) and the quadrate resemble homologous bones of recent *N. natrix*. The fragmentary basiparasphenoid (Figure C) is similar to that coming from Polgárdi 2 (VENCZEL 1994: fig. 8: f, g), having separate foramina for the anterior opening of the Vidian canal and for the re-exit of the constrictor internus dorsalis (= cid) nerve. The pterygoid processes cover the posterior orifices of common foramina. In the prootic the V2 and the V4 foramina exit separately. The characters observed in the basiparasphenoid and prootic are of diagnostic value for *N. longivertebrata* (SZYNDLAR 1991b, 1991c). The precaudal vertebrae are less elongated (in six vertebrae coming from Osztramos 1/b the centrum length/centrum width ratio ranges between 1.62–2) when compared to those coming from the type locality (SZYNDLAR 1984).

Genus *Neonatrix* HOLMAN, 1973

cf. ***Neonatrix*** sp.
(Figure 7: F–J)

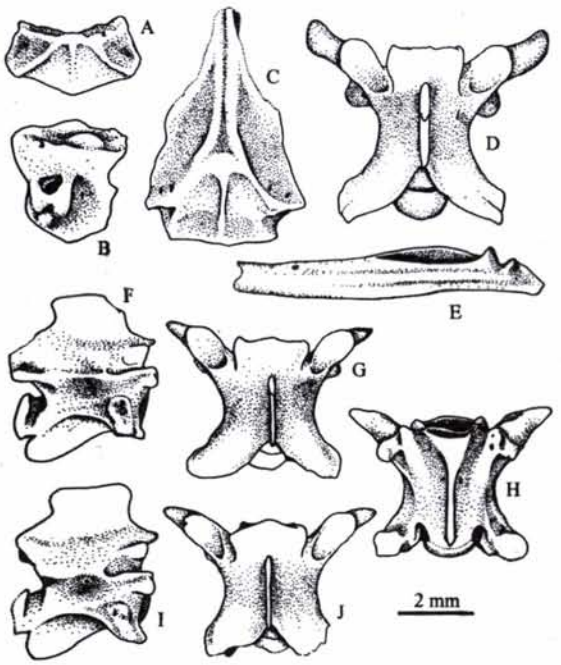


Figure 7 — ***Natrix longivertebrata*** **(A–E) and** ***Neonatrix*** **sp. (F–J) from Osztramos 1.** — **A**: supraoccipital (O1/b), **B**: prootic (O1/b), **C**: basiparasphenoid (O1/b), **D**: presacral vertebra (O1/c), **E**: compound bone (O1/b), **F–J**: precaudal vertebrae (O1/e). — ***A, D, G, J****: dorsal views;* ***B, E, F, I****: lateral views;* ***C, H****: ventral views.*

Material — Osztramos 1/e: 20 presacral vertebrae (HNHM. No. V.99.37).

Description and comments — The vertebrae belonged to a small-sized snake. The vertebrae have sigmoid shaped hypapophyses, never reaching the base of the condyle. The neural spine is relatively high, overhanging both anteriorly and posteriorly. The zygosphene is crenate, while the prezygapophyseal processes are relatively short and pointed distally. The paradiapophyses are damaged in all the specimens; the parapophyseal processes are relatively short. The interzygapohyseal ridges are quite well-developed. In ten vertebrae the centrum length ranges between 3.11–3.65 mm, while the centrum width between 2.37–2.92 mm. The centrum length/centrum width ratio is between 1.22–1.45. Remains of *Neonatrix* from Europe were described by RAGE & HOLMAN (1984), SZYNDLAR (1987, 1991b) and SZYNDLAR & SCHLEICH (1993). According to the latter authors the generic assignment of *Neonatrix* remains is uncertain: they could belong to a recent Asiatic natricine genus.

Family **Viperidae** OPPEL, 1811
Genus *Vipera* LAURENTI, 1768

Vipera cf. ***ammodytes*** (LINNAEUS, 1758)
(Figure 8; Figure 9: A–C)

Material — Osztramos 1/b: 2 exoccipitals, 3 prootics, 2 frontals, 2 prefrontals, 3 ectopterygoids, 1 maxilla, 17 vertebrae (HNHM. No. V.99.38); Osztramos 1/c: 10 vertebrae (HNHM. No. V.99.39).

Description and comments — The morphology of the cranial bones is similar to those observed in homologous elements of recent *V. ammodytes*. A small foramen is situated postero-dorsally to the lacrimal foramen of the prefrontal (Figure 8: D). The latter one, in recent *V. ammodytes*, is situated dorsally to the lacrimal foramen. Some variation is observed in the morphology of the prootic: in two specimens the V2 and V3 foramina are situated in a common recess, while in another specimen they are distinctly separated (Figure 8: B). The shape of maxilla (Figure 8: E, F) and the ectopterygoid (Figure 8: G, Figure 9: A) is similar to

recent *V. ammodytes*. The ascending process of the maxilla is relatively high and thick, its distal part being curved medially. There is a weakly defined bony ridge on its anteromedial side. The latter structure, in the members of *Macrovipera*, is always strongly developed (SZYNDLAR 1991b; VENCZEL 1998). The hypapophyses of the anterior presacral vertebrae are relatively long and straight, while those coming from the posterior region are short, but never hooking backward, as observed in *V. berus* (see below). In ten vertebrae from Osztramos 1/b, the centrum length ranges between 4.33–6 mm, while the centrum width between 3.1–4.4 mm. The centrum length/centrum width ratio is between 1.36–1.59 (mean = 1.46). The oldest members of the '*V. aspis* complex' were present in Europe since the beginning of the Miocene (SZYNDLAR & RAGE 1999).

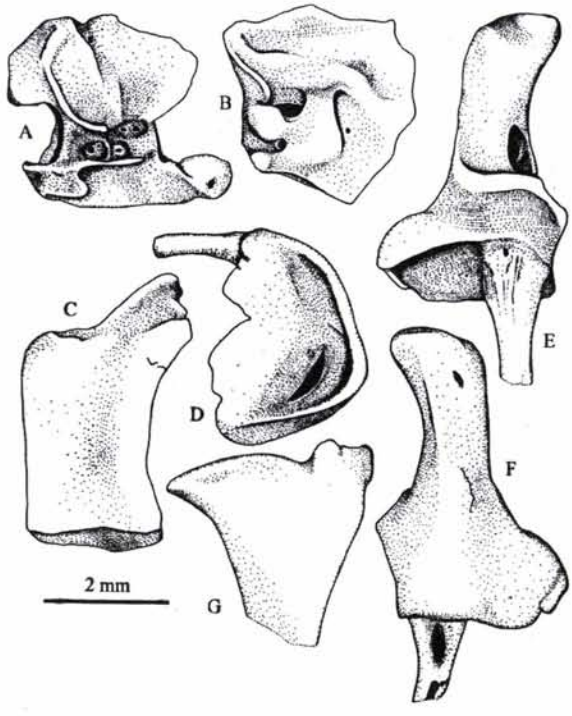


Figure 8 — ***Vipera* cf. *ammodytes* from Osztramos 1/b.** — **A**: exoccipital, **B**: prootic, **C**: frontal, **D**: prefrontal, **E, F**: maxilla, **G**: ectopterygoid. — ***A, B**: lateral views; **C, G**: dorsal views; **D**: posteroventrolateral view, **E**: posteromedial view, **F**: anterior view.*

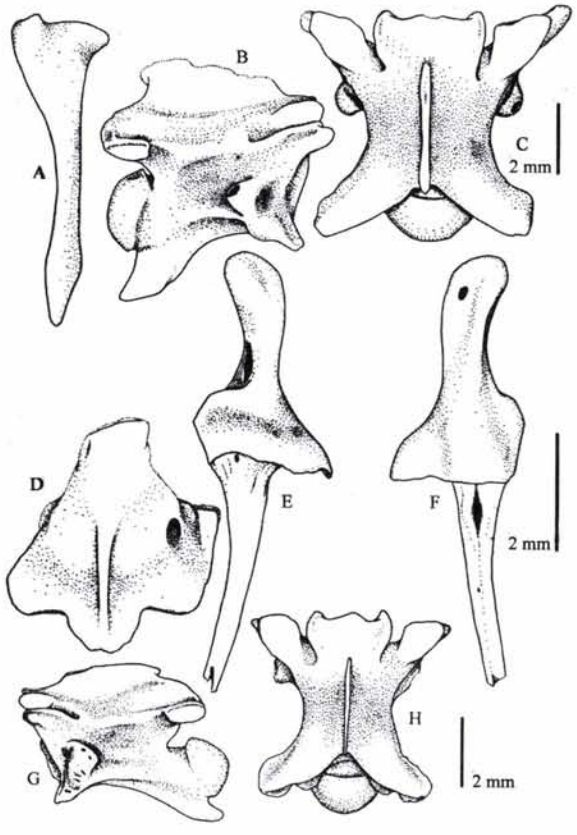


Figure 9 — ***Vipera* cf. *ammodytes* (A–C) and *V.* cf. *berus* (D–H) from Osztramos 1/b.** — **A**: ectopterygoid, **B, C**: trunk vertebra, **D**: basiparasphenoid, **E, F**: maxilla, **G, H**: trunk vertebra.— ***A, C, H**: dorsal views; **B, G**: lateral views; **D**: ventral view; **E**: posteromedial view; **F**: anterior view.*

Vipera* cf. *berus (LINNAEUS, 1758)
(Figure 9: D–H)

Material — Osztramos 1/b: 1 basiparasphenoid, 1 maxilla, 11 presacral vertebrae (HNHM. No. V.99.40).

Description and comments — Only a posterior part of the basiparasphenoid is preserved (Figure 9: D). Its basisphenoid crest is short and of low height, ending in a relatively wide projection. The cerebral foramen is distinctly separated off from the posterior orifice of the Vidian canal, and a crest does not covers them. The ascending process of the maxilla is high and slender, with its distal part curved medially. The neural arch of the presacral vertebrae is depressed, provided with a long neural spine of low height. The centrum is elongated; the hypapohysis is short and strongly hooked posteriorly (especially in the posterior presacral vertebrae). The zygosphene is crenate, and the prezygapophyseal processes are extremely short. All the above mentioned characters are consistent with those observed in recent *Vipera berus*. In seven vertebrae from Osztramos 1/b the centrum length ranges between 3.74–4.76 mm, while the centrum width between 2.19–3.02 mm. The centrum length/centrum width ratio is between 1.57–1.83 (mean = 1.71). The members of the '*Vipera berus* complex' appeared later in Europe than those of the '*Vipera aspis* complex' (SZYNDLAR & RAGE 1999). Thus it is quit surprising that in Osztramos 1/b locality both members of the genus occurred sympatrically.

Conclusion

Osztramos 1 locality produced a more complex herpetofauna than the stratigraphically older Polgárdi localities (VENCZEL 1994, 1997, 1998). Its composition suggests mild and wet climate and a diversified paleoenvironment, with forests and a water source in the area. However, the differences observed in the fossil record of Osztramos 1/b, 1/c and 1/e locality may be linked to the rapid change of paleoecological conditions during the accumulation of the sediments. Some taxa are recorded for the first time in the Hungarian Neogene (*Eopelobates* sp., Geckonidae indet., *Eryx* sp., cf. *Neonatrix* sp., as well as *Vipera* cf. *ammodytes* and *V.* cf. *berus*), suggesting that this period favored their rapid spread in the Carpathian Basin. On the other hand a number of forms still inhabiting the area in the Late Miocene (e.g. *Macrovipera*), were replaced by newcomers from the East. The joint record of '*aspis* group' and '*berus* group' of the genus *Vipera* in Osztramos 1 locality indicates that the appearance of the latter group in Central Europe took place more earlier (at least during Lower Pliocene times) than considered SZYNDLAR & RAGE 1999).

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