ISSN 1026-2296

RUSSIAN JOURNAL of HERPETOLOGY

FOLIUM PUBLISHING COMPANY VOLUME 17 NUMBER 1 JANUARY–MARCH 2010

Russian Journal of Herpetology

ISSN 1026-2296

RJH is founded in 1993

Founders

- Editorial Council (N. B. Ananjeva, L. J. Borkin, and N. L. Orlov)
- Folium Publishing Company

Subscriptions

One volume per year, in four issues.

Scope

Russian Journal of Herpetology is an international multidisciplinary journal devoted to herpetology. *Russian Journal of Herpetology* accepts original papers on ecology, behavior, conservation, systematics, evolutionary morphology, paleontology, physiology, cytology and genetics of amphibians and reptiles.

Types of Contributions

- original papers
- invited or contributed reviews on specific topics
- short communications on topics of immediate interest, new methods and ideas in progress
- notices of meetings, symposia, and short courses
- book reviews

Copyright

Date of publication of *Russian Journal of Herpetology*, Vol. 17, No. 1 (2010): **March 20, 2010**.

Cover photograph: *Boiga bourreti* Tillack, Ziegler et Quyet, 2004, Kon Du, Mang Canh Village, Konplong District, Kon Tum Province, Vietnam (14°41′25″ N 108°19′31″ E), 1210 m. Photo by Nikolai L. Orlov and Daniel A. Melnikov.

All inquiries about subscriptions should be addressed to

Bibliomania!
P.O. Box 58355
Salt Lake City, UT 84158
USA
Tel./Fax: +1-801-562-2660. E-mail: breck@herplit.com,
http://www.herplit.com/rjh.html

All the necessary information and abstracts are available at
http://rjh.folium.ru

INSTRUCTIONS TO CONTRIBUTORS (http://rjh.folium.ru/instructions.htm)

MANUSCRIPT

Manuscripts that are too descriptive or containing reports of work which appears to contravene accepted principles of conservation or ethical standards may be rejected without external review. Manuscripts should be written in US English and submitted by e-mail or printed to the following Editors, according to the field:

Dr. Natalia B. Ananjeva (general aspects of herpetology and reptiles), **E-mail: azemiops@zin.ru**;

Dr. Igor G. Danilov (evolutionary morphology, paleoherpetology and turtles), **E-mail: turtle@zin.ru**;

Dr. Spartak N. Litvinchuk (amphibians, cytology and genetics), **E-mail: slitvinchuk@yahoo.com**.

Post address (for all Editors): Zoological Institute of the Russian Academy of Sciences, Universitetskaya nab. 1, St. Petersburg, 199034, Russia.

Articles accepted for publication are usually published in order of submission. Exceptions are made for papers of particular scientific significance, and for manuscripts which fully comply with editorial requirements given in the instruction for authors and require only minor changes. **Printed manuscript** must be sent as two double-spaced copies (including figure captions and tables on separate pages) printed on laser or matrix printer should be of near letter quality (NLQ) with typesetting marks entered. Submit file on a diskette or by E-mail (**azemiops@zin.ru**) if possible. **Manuscripts and all the materials included are not normally returned to the author.**

Arrange the parts of the article in the following order:

- Title of the article
- Running header (short title of the article)
- Author(s) of the article
- Full address of the author(s)
- Sending (submitting) date
- Abstract
- Key words
- Main text
- References
- Figure captions
- Tables

ABSTRACT

An abstract not exceeding 200 words should be informative rather than indicative and given on a separate page. All relevant key words should be included in the abstract.

Number all hierarchical headings decimally (e.g., 1. First level heading, 1.1. Second level heading, 1.1.1. Third level heading).

TABLES

Tables should be comprehensible without reference to the text. Avoid long column headings, complicated structure and vertical lines. Plan your tables for column or page width, 40 and 80 letter spaces, respectively.

ILLUSTRATIONS

Illustrations should be numbered consecutively as **Figures** or **Maps**. Line drawings should be made clearly in deep-black ink and submitted as original drawings or photographic prints. Photographs should be submitted as sharp, high contrast prints trimmed at right angles. Half tone and color drawings must be the originals. If dimensions are important a measuring line should be given on the photograph. Parts within composite illustrations should be identified with letters, not numbers. Plan your figures for column (79 mm width) or page (164 × 215 mm) size when printed, but reserve space for the legend.

REFERENCES

References should be listed in alphabetical order under the first author's name and should refer only to publications cited in the text. The followiing are examples of the format to be used for articles from journals, books, and non-serial collective publications, respectively.

Parker E. D., Trueb L., and Cloutier R. (1979), "Phenotypic consequences of *C. tesselatus* to its sexual parental species," *Evolution*, **33**(4), 1167 – 1179.

Deuchar E. M. (1975), *Xenopus*: *the South African Clawed Frog*, Wiley, New York.

Trueb L. and Cloutier R. (1991) "A phylogenetic investigation of the inter- and intrarelationships of the Lissamphibia (Amphibia: Temnospondyli)," in: Schultze H.-P. and Trueb L. (eds.), *Origins of the Higher Groups of Tetrapods: Controversy and Consensus*, Cornell Univ. Press, New York, pp. 175 – 193.

International Code of Zoological Nomenclature (1985), 3rd Edition, Int. Trust Zool. Nomencl., London.

For abbreviations see *Biological Abstracts*.

OFFPRINTS

Ten offprints of each article will be sent to the first-named author free of charge. If you need more than 10 and less then 100 reprints you can do such copies yourself without any additional permission of the publisher. Each author can order more than 50 reprints for additional fee. For details see **http://rjh.folium.ru/offprints.shtml**..

REJECTIONS

In the case of non-observance of any of the above-mentioned instructions the article can be returned for reworking.

CONTENTS

OBITUARY

Russian Journal of Herpetology Vol. 17, No. 1, 2010, pp. 59 – 66

A Review of Tailed Amphibian Remains from Late Cenozoic Sediments of the East European Plain

Viatcheslav Yu. Ratnikov[1]

Submitted October 15, 2008.

This paper presents a review of findings of tailed amphibians from the Late Cenozoic of the East European Plain, including materials from 13 localities. The descriptions of remains of *Mioproteus* sp., *Salamandrella* sp., *Triturus cristatus* aut *dobrogicus*, *Triturus* cf. *karelinii*, and *Lissotriton vulgaris* are given. Geographic and stratigraphic distributions of findings are listed. Determination of two vertebrae from Korotoyak and Vladimirovka as *Triturus* cf. *alpestris* is recognized invalid.

Keywords: tailed amphibians, Late Cenozoic, East European Plain.

INTRODUCTION

The remains of tailed amphibians (Urodela) in the Late Cenozoic continental sediments of the East European plain are rare. In addition to two localities, from which Averianov (2001) described remains of proteid salamanders, only 13 localities are known (Fig. 1), and the remains are, as a rule, represented by single specimens. Only five localities of 13 have produced more than one specimen (Table 1). All these materials are kept in the Geological Museum of the Voronezh State University (VSU). To my thinking, rarity of findings could be explained by small size of bones and, accordingly, the fragility of skeletal elements of tailed amphibians that inhabited East Europe at that time. The overwhelming majority of findings are vertebrae. Other elements of the skeleton are rarely found and represented by the most massive bones: humerus, femur and a few others.

All remains, except for the collection from Mastyuzhenka, have been studied by the author, and main results of these researches have been published (Ratnikov, 1996, 1997a, 1997b, 2002a, 2002b, 2005; Ratnikov and Krokhmal, 2003, 2005). However, in recently newt systematics have been changed. *Salamandrella keyserlingii* Dybowsky, 1870, from south-eastern part of the Russian Far East was distinguished (Berman et al., 2005) as a distinct cryptic species, *Salamandrella schrenckii* (Strauch, 1870). Species formerly included in the genus *Triturus* are distributed now between four genera (Carranza and Amat, 2005; Frost et al., 2006; Litvinchuk et al., 2005): *Lissotriton* Bell, 1839, *Mesotriton* Bolkay, 1927, *Ommatotriton* Gray, 1850, and *Triturus* Rafinesque,

[1] Voronezh State University, Universitetskaya pl. 1, 394006 Voronezh, Russia; E-mail: vratnik@yandex. ru

TABLE 1. List of Localities and Numbers of Specimens Studied (*N*)

Locality	*N*	Locality	*N*
Korotoyak	1	Posevkino	1
Kupino	1	Sergeevka-2	1
Kuznetsovka	4	Veselovka	3
Mastyuzhenka	117	Vladimirovka	3
Musaid	1	Vol'naya Vershina-3	2
Nagornoye-1	1	Zmeevka-1	1
Ozyornoye-1	1		

Fig. 1. Main Late Cenozoic occurrences of tailed amphibians in Eastern Europe: ▲, Pliocene; ●, Lower Neopleistocene; ■, Middle Neopleistocene.

1026-2296/2010/1701-0059 © 2010 Folium Publishing Company

1815. Four subspecies of the former species *Triturus cristatus* have been elevated to the species level (Ananjeva et al., 1998; Kuzmin, 1999): *Triturus carnifex* (Laurenti, 1768), *Triturus cristatus* (Laurenti, 1768), *Triturus dobrogicus* (Kiritzescu, 1903), and *Triturus karelinii* (Strauch, 1870). Species status has also been given to the former subspecies of *Triturus vittatus ophryticus* (Litvinchuk et al., 2005) — *Ommatotriton ophryticus* (Berthold, 1846). Thus, criteria of generic and specific identification of bones have been changed. For this reason, I have decided to revise these materials. It became possible because recent years my comparative osteological collection has been considerably expanded and studied according to modern systematics (Ratnikov and Litvinchuk, 2007).

REVIEW OF THE PLIOCENE AND QUATERNARY LOCALITIES OF TAILED AMPHIBIANS[2]

1. Korotoyak locality. There are several localities of different age near Korotoyak village in Voronezh oblast', Russia. The site with remains of Pliocene caudates is situated on the high bank of Don River near the road between Korotoyak and Pokrovka villages.

Age. Middle Pliocene, MN 16 zone of Main, Urynian faunistic assemblage.

Material and references. VSU No. 530/524, one vertebra of *Triturus* cf. *alpestris* (Laur., 1768) (Ratnikov, 1996, 2002a).

Comments. At that time I had only one comparative specimen of alpine newt, specimens of other species were uncommon and satisfactory descriptions of newt vertebrae were absent. For this reason, it was very difficult to find criteria for specific identification. Besides that, the available vertebra is very badly damaged. Thus, I have regarded as attributes of alpine newt well developed neurapophysis and inclined flat surface of the condylus which was not observed on specimens of other species in my comparative collection.

After recent study of newt vertebrae on the basis of new comparative material and systematics (Ratnikov and Litvinchuk, 2007), taxonomic attribution of this vertebra is changed to *Triturus* cf. *karelinii* (see below).

2. Kupino locality. This locality is situated in a sand quarry in the right bank of Strizhkov Log ravine near the road to Nezhegol village, Shebekino rayon, Belgorod oblast', Russia.

Age. Lower Neopleistocene, Muchkap horizon, Tiraspol faunistic assemblage.

Material and references. VSU No. 504/17, one vertebra of *Salamandrella* cf. *keyserlingii* (Ratnikov, 1989, 2002a, 2002b).

Comments. The new determination for this specimen is *Salamandrella* sp.

3. Kuznetsovka locality. This locality is situated in the left board of Podgornyi Buerak ravine near Kuznetsovka village of Uvarovo rayon, Tambov oblast', Russia.

Age. Lower Neopleistocene, Muchkap horizon, Tiraspol faunistic assemblage.

Material and references. VSU Nos. 503/377 and 503/378, two humeri of *Salamandrella* cf. *keyserlingii*; VSU Nos. 503/376 and 503/706, vertebrae of *Triturus vulgaris* (L., 1758) and *Triturus* sp., respectively (Ratnikov, 1997a, 2002a).

Comments. According to new systematics, these bones are determined as *Salamandrella* sp., *Lissotriton vulgaris*, and Salamandridae indet., respectively.

4. Mastyuzhenka locality. This locality is situated in the left board of Mastyuzhenka ravine, 5 km W from Srednii Ikorets village of Liski rayon, Voronezh oblast', Russia.

Age. Formerly, the age of this fauna was considered to be Middle Neopleistocene, Lichvin horizon (Ratnikov, 2002). However, study of small mammals from this locality collected in 2007 suggests older (Lower Neopleistocene) age (A. K. Agadzhanyan, personal communication). It seems that this fauna corresponds to a new warm interval after Muchkap (Iosifova et al., 2006), but this question is in the stage of discussion. Herein, I designate the age of this fauna as the Lower Neopleistocene, Muchkap horizone.

Material and references. VSU No. 537/1-104, 104 vertebrae; VSU No. 537/105-108, four humeri; VSU No. 537/109-112, four femori; and VSU No. 537/113-114, two ilia of *Salamandrella* sp.

5. Musaid locality. This locality is situated on the right bank of Big Salcha River, in the ravine in front of Musaid village, Vulkaneshty Region, Moldova.

Age. Lower Pliocene, MN 15 zone of Main, Moldavian faunistic assemblage.

Material and references. VSU No. 620/2, one vertebra of *Mioproteus* sp. (Ratnikov, 2002a).

6. Nagornoye-1 locality. This locality is situated on the east shore of Kagul Lake near Nagornoye village in Reni District, Odessa Region, Ukraine.

Age. Lower Neopleistocene, Muchkap horizon, Tiraspol faunistic assemblage.

Material and references. VSU No. 629-1/62, one vertebra of *Triturus cristatus* (Ratnikov and Krokhmal, 2005).

[2] In this review, species names are given according to original publications.

Comments. According to new systematics, this vertebra is determined as *Triturus cristatus* aut *dobrogicus*.

7. Ozyornoye-1 locality. This locality is situated on the east bank of Yalpug Lake near Ozernoe village, Odessa Region, Ukraine.

Age. Middle Neopleistocene. More detailed age of this locality is disputable: Singil or Hazar faunistic assemblage.

Material and references. VSU No. 610 – 1/61, one vertebra of *Triturus* cf. *cristatus* (Ratnikov and Krokhmal, 2003).

Comments. According to new systematics, this vertebra is determined as *Triturus cristatus* aut *dobrogicus*.

8. Posevkino locality. This locality is situated on the bank of Vorona River near Posevkino village of Uvarovo rayon, Tambov oblast', Russia.

Age. Lower Neopleistocene, Muchkap horizon, Tiraspol faunistic assemblage.

Material and references. VSU No. 515/85, Hynobiidae indet. (Ratnikov, 2002a, 2002b).

9. Sergeevka-2 locality. This locality is situated within 13.0 – 16.0 m depth interval of the well No. 218 near Sergeevka village, Roslavl' rayon, Smolensk oblast', Russia.

Age. Lower Neopleistocene, Muchkap horizone, Tiraspol faunistic complex.

Material and references. VSU No. 599/1, one vertebra of *Salamandrella keyserlingii* (Ratnikov, 2002a, 2002b).

Comments. The new determination for this vertebra is *Salamandrella* sp.

10. Veselovka locality. This locality is situated near Veselovka village on the Taman' Peninsula, Krasnodar kray, Russia.

Age. Middle Pliocene, MN 16 zone of Main, Urykian faunistic assemblage.

Material and references. VSU No. 619/15-17, three vertebrae of *Mioproteus* sp. (Ratnikov, 2002a).

11. Vladimirovka locality. This locality is situated on the left bank of Don River, 1.4 km NE from the south-eastern outskirts of Vladimirovka village, Pavlovsk rayon, Voronezh oblast', Russia.

Age. Middle Neopleistocene, Lichvin horizon, Singil faunistic assemblage.

Material and references. VSU No. 589/217, one vertebra of *Triturus* cf. *cristatus*; VSU No. 589/218, one vertebra of *Triturus vulgaris*; and VSU No. 589/219, one vertebra of *Triturus* cf. *alpestris* (Ratnikov, 1997b, 2002a, 2005).

Comments. Ventral part and haemal arch of caudal vertebra identified as *Triturus* cf. *alpestris* (Fig. 2) are destroyed. The identification was based on the same criteria, which were used for identification of the Korotoyak specimen. After our recent study of newt vertebrae (Ratnikov and Litvinchuk, 2007), a new determination of this vertebra can be given. It differs from vertebrae of *Salamandra salamandra* (L., 1758), *Lissotriton vulgaris*, *L. montandoni* (Boulenger, 1880), *Mesotriton alpestris* (Laur., 1768), and *Ommatotriton ophryticus* by undeveloped zygapophyseal crests. Such crests are not developed in *Mertensiella caucasica* (Waga, 1876) and representatives of the genus *Triturus*, but neurapophyses in the Caucasian salamander are not so high and begin much further posteriorly. I did not manage to find diagnostic differences in caudal vertebrae of different *Triturus* species and the fossil vertebra, and therefore I determine this specimen as *Triturus* sp.

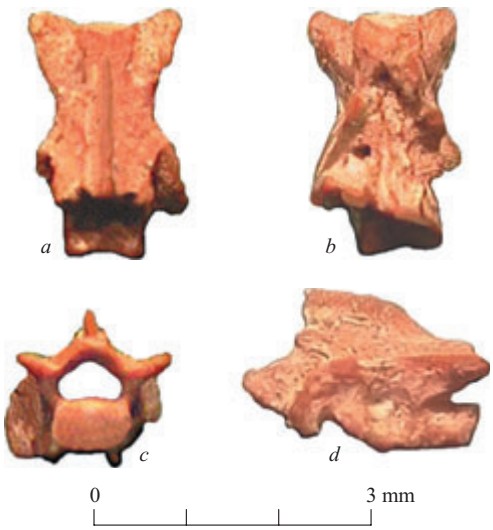

Fig. 2. "*Triturus* cf. *alpestris*," Vladimirovka, caudal vertebra, VSU No. 589/219: *a*, dorsal view; *b*, ventral view; *c*, anterior view; *d*, lateral view.

The other two vertebrae are determined as *Triturus cristatus* aut *dobrogicus* and *Lissotriton vulgaris*.

12. Vol'naya Vershina-3 locality. This locality is situated in Volny ravine, 4 km SE from Vol'naya Vershina village of Muchkap rayon, Tambov oblast', Russia.

Age. Lower Neopleistocene, Muchkap horizon, Tiraspol faunistic assemblage.

Material and references. VSU No. 501-3/91, 92, two vertebrae of *Salamandrella keyserlingii* (Ratnikov, 2002c).

Comments. The new determination for these specimens is *Salamandrella* sp.

13. Zmeevka-1 locality. This locality is situated in a sand quarry on the left bank of Gryaznaya Potudan' River, NE from Zmeevka village, Staryy Oskol rayon, Belgorod oblast', Russia.

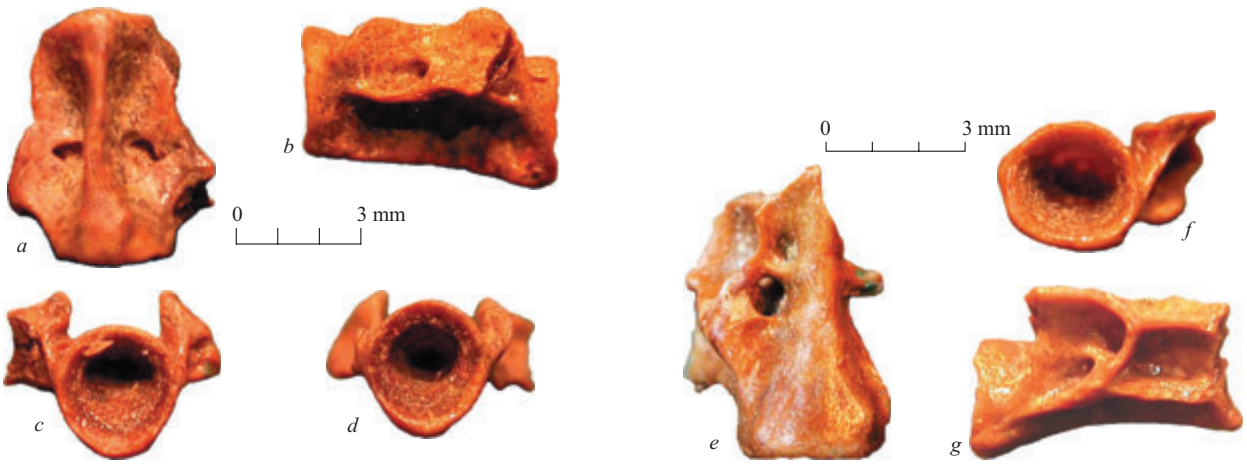

Fig. 3. Vertebrae fragments of *Mioproteus* sp. Veselovka, VSU No. 619/15: *a*, ventral view; *b*, lateral view; *c*, posterior view; *d*, anterior view. Musaid, VSU No. 620/2: *e*, ventral view; *f*, posterior view; *g*, lateral view.

Age. Lower Neopleistocene, Il'inka horizon, Tiraspol faunistic assemblage.

Material and references. VSU No. 523/11, one vertebra of *Triturus* cf. *cristatus* (Ratnikov, 2002a).

Comments. According to new systematics, this vertebra is determined as *Triturus cristatus* aut *dobrogicus*.

SYSTEMATIC PALEONTOLOGY

Family Proteidae
Genus *Mioproteus* Estes et Darevsky, 1977
Mioproteus sp.

Remains of an extinct form attributed to the genus *Mioproteus* are found in two localities (Veselovka and Musaid). The material is represented exclusively by fragments of vertebrae with damaged neural arches. The length of the best preserved fragment is about 6 mm. Amphicoelous centra (Fig. 3) have an "hour-glass" shape from below due to deep lateral excavations in the medial portion and show some features of the genus *Mioproteus*, pointed by Estes and Darevsky (1977). These are presence of the posterior basapophyses and flattened ventral surface of the centrum, co-extensive with the basapophyses. Large subcentral foramina are observed on their ventral surface, and the remains of horizontal and inclined laminae are visible laterally at the base of the neural arch. A well developed ventromedial keel is present in the specimen from Veselovka. The described specimens are morphologically similar to the corresponding vertebral parts of *Mioproteus caucasicus* (Estes and Darevsky, 1977), but they can not be determined to the species level due to destroyed neural arches.

Family Hynobiidae
Genus *Salamandrella* Dybowski, 1870
Salamandrella sp.

Vertebrae of representatives of the family Hynobiidae are found in five localities: Vol'naya Vershina-3, Kupino, Mastyuzhenka, Posevkino, and Sergeevka-2. Previously, almost all specimens were determined as *Salamandrella keyserlingii* or *Salamandrella* cf. *keyserlingii*. Their morphology corresponds to modern specimens of this species (Ratnikov and Litvinchuk, 2007) and is characterized by the following features: amphicoelous centra, low and sufficiently flat laminae of neural arch, low or absent neurapophysis, lacking zygapophyseal and ventral crests (Fig. 4*a* – *e*). However, allocation of the cryptic species *Salamandrella schrenckii* (Berman et al., 2005), which has the same vertebral features, does not allow specific determination of these specimens. Therefore, here I redeterminate them as *Salamandrella* sp. Vertebrae from Posevkino were determined as Hynobiidae indet. (Ratnikov, 2002), because of a damaged neural arch, although, most probably, they belong to *Salamandrella*, as no other hynobiid is known in this area.

The humeral bones from Kuznetsovka and Mastyuzhenka have a low and ridge-like crista dorsalis (Fig. 4*f* – *g*), while in Salamandridae this crista is much higher and spine-like. The probability that these bones belong to *Ranodon* Kessler, 1866 or *Onychodactylus* Tschudi, 1838 is very small, and from this reason I determine them as *Salamandrella*. Four femoral bones and two ilia from Mastyuzhenka were also assigned to *Salamandrella*, because of their morphological similarity with the corresponding bones of this genus. Besides that,

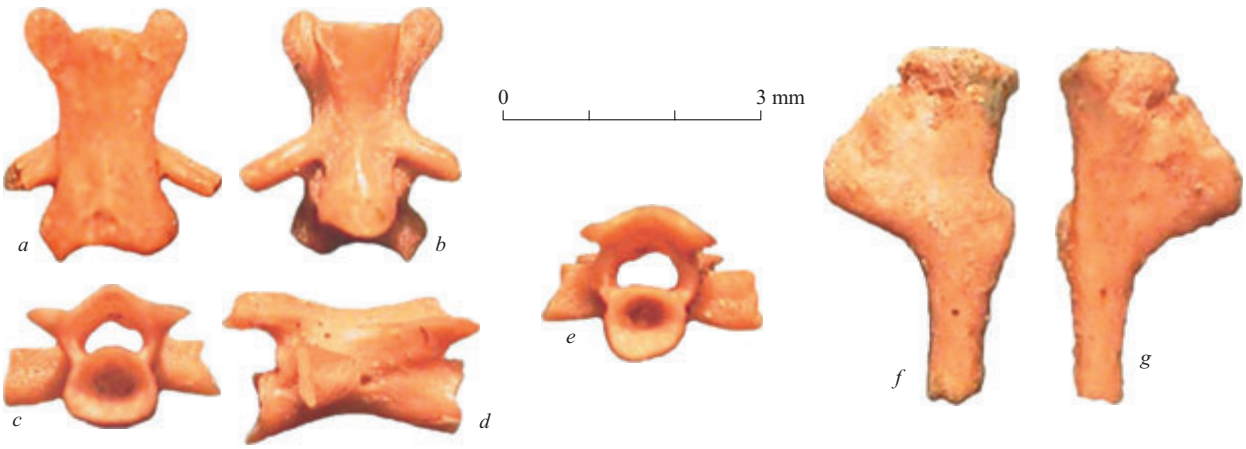

Fig. 4. *Salamandrella* sp. Vol'naya Vershina-3, trunk vertebra, VSU No. 501-3/91: *a*, dorsal view; *b*, ventral view; *c*, anterior view; *d*, lateral view; *e*, posterior view. Kuznetsovka, humerus, VSU No. 503/377: *f*, lateral view; *g*, medial view.

all remaining caudate specimens (more than 100 isolated bones) from this locality are assigned to *Salamandrella*.

Family Salamandridae
Genus *Triturus*
Triturus cristatus aut *dobrogicus*

Four opisthocoelous vertebrae come from four localities: Zmeevka-1, Vladimirovka, Ozyornoye-1, and Nagornoye-1. These specimens demonstrate features of the genus *Triturus* (Ratnikov and Litvinchuk, 2007) and formerly were determined as *Triturus cristatus*. According to the modern systematics, they are redeterminated as *Triturus cristatus* aut *dobrogicus*, because they can belong to one of two species, morphological distinctions between which are unknown. These specimen differ from vertebrae of the third species of the genus, *Triturus karelinii*, by a low neurapophysis (Fig. 5).

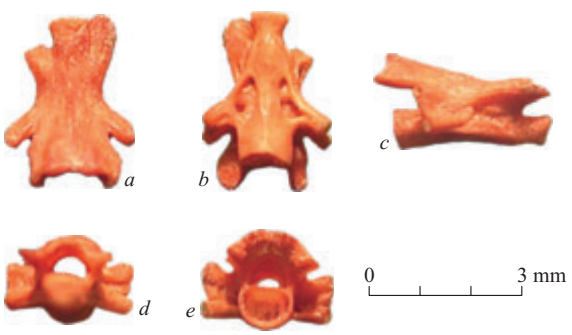

Fig. 5. *Triturus cristatus* aut *dobrogicus*, Nagornoye-1, trunk vertebra, VSU No. 629-1/62: *a*, dorsal view; *b*, ventral view; *c*, lateral view; *d*, anterior view; *e*, posterior view.

Triturus cf. *karelinii*

One poorly preserved vertebra lacking posterior part comes from Korotoyak locality (Fig. 6). In this vertebra, the condylus is bigger than in modern species *Lissotriton montandoni*, *L. vulgaris*, and *Mesotriton alpestris*. Besides that, the anterior margin of its neural arch being at the level of the middle of prezygapophyseal articular facets, whereas in the three mentioned species the anterior margin of the neural arch is closer to the anterior margin of prezygapophyseal articular facets. Presence of the neurapophysis excludes attribution of the Korotoyak vertebra to *Triturus cristatus* or *T. dobrogicus*. The Korotoyak vertebra does not belong to *Ommatotriton ophryticus*, because the anterior margin of its neurapophysis rises gradually, whereas it rises abruptly in the latter species. Thus, the Korotoyak vertebra is most similar to *Triturus karelinii*. However, breakage of many diagnostic elements allows identification only to *Triturus* cf. *karelinii*.

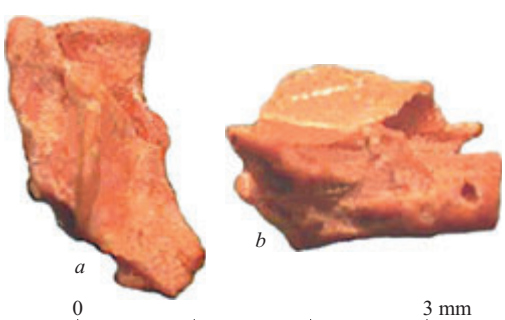

Fig. 6. *Triturus* cf. *karelinii*, Korotoyak, trunk vertebra VSU No. 530/524: *a*, dorsal view; *b*, lateral view.

Fig. 7. Late Cenozoic occurrences of tailed amphibians in Eastern Europe. *a*, *Mioproteus*. *b*, *Salamandrella* sp.: vertical hatching, modern area of *Salamandrella keyserlingii* (after Kuzmin, 1999). *c*, *Triturus*: horizontal hatching, modern area of *Triturus cristatus*; vertical hatching, modern area of *Triturus karelinii*; specks, modern area of *Triturus dobrogicus* (after Kuzmin, 1999). *d*, *Lissotriton vulgaris*: horizontal hatching, modern area of *Lissotriton vulgaris* (after Kuzmin, 1999). ▲, Pliocene; ●, Lower Neopleistocene; ■, Middle Neopleistocene.

Genus *Lissotriton*
Lissotriton vulgaris

Two very small vertebrae were found in two localities (Kuznetsovka and Vladimirovka). Their morphology corresponds to the vertebral morphology of *Lissotriton vulgaris* (Ratnikov and Litvinchuk, 2007).

STRATIGRAPHIC AND GEOGRAPHIC DISTRIBUTION OF LATE CENOZOIC TAILED AMPHIBIANS OF EASTERN EUROPE

Occurrences of the genus *Mioproteus* remains studied are shown in Fig. 7*a*. Both localities are of the Pliocene age. In general, the geographical distribution of this genus is rather extensive: it is known from a number of Neogene localities in Moldova, Ukraine, Germany, Poland, Russia and Kazakhstan (Averianov, 2001; Bakradze and Chkhikvadze, 1988; Estes, 1981; Estes and Darevsky, 1977, Malakhov, 2003; Młynarski et al., 1984). However, no findings younger than the Eopleistocene are known.

Occurrences of *Salamandrella* sp. in the Eastern Europe are shown in Fig. 7*b*. At present, this species occupies an extensive area with its western border situated slightly to the East from the region shown on the map (Engelmann et al., 1985; Kuzmin, 1999). All our fossil

TABLE 2. Stratigraphic Distribution of Localities of Tailed Amphibians

Divisions of West Europe		Divisions of East Europe		Horizons, superhorizons and zones of Mein	*Mioproteus* sp.	*Salamandrella* sp.	*Triturus* cf. *karelinii*	*Triturus cristatus* aut *dobrogicus*	*Lissotriton vulgaris*
Holocene									
Pleistocene	Late	Neopleistocene	Late	Valdai					
				Mikulino					
	Middle		Middle	Middle Russia					
				Lichvin				Vladimirovka, Ozyornoye-1	Vladimirovka
			Early	Oka					
				Muchkap		Vol'naya Vershina-3, Kuznetsovka, Kupino, Mastyuzhenka, Posevkino, Sergeevka-2		Nagornoye-1	Kuznetsovka
				Don					
				Il'inka				Zmeevka-1	
				Pokrov					
				Petropavlovsk					
	Early	Eoplei-stocene	Late						
			Early						
Pliocene				MN 17					
				MN 16	Veselovka		Korotoyak		
				MN 15	Musaid				

findings occur from the Muchkapian (Lower Neopleistocene) sediments. It is obvious, that at that time, the range of the species strongly differed from its present range. Other findings of representatives of the family Hynobiidae are known from the Neogene of Kazakhstan (*Ranodon* cf. *sibiricus* Kessler, 1866) (Averianov and Tjutkova, 1995) and from the Neogene and Lower Pleistocene of Central Europe, where two new species of a new genus are known (Venczel, 1999).

Occurrences of the genus *Triturus* are shown in Fig. 7*c*. The Early-Middle Neopleistocene vertebrae are determined as *Triturus cristatus* aut *dobrogicus* because of difficulty to give a more exact determination. However, the Lower Neopleistocene Nagornoye-1 and Middle Neopleistocene Ozyornoye-1 localities are situated within the modern range of *Triturus dobrogicus*, whereas the Lower Neopleistocene Zmeevka-1 and the Middle Neopleistocene Vladimirovka locality are situated within the modern range of *Triturus cristatus*. At the Pliocene Korotoyak locality, a vertebra comparable to *Triturus karelinii* is far outside the modern range of this species (Kuzmin, 1999).

Occurrences of *Lissotriton vulgaris* are shown in Fig. 7*d*. Both localities are situated within the modern range of this species.

It is necessary to note that our findings of newts are not the oldest known. Remains of "*Triturus cristatus*" and "*Triturus vulgaris*" are known from the Pliocene deposits of Central Europe (Estes, 1981; Hodrova, 1984, 1985), whereas findings comparable to other modern European species of newts are known from the Miocene deposits (Estes, 1981).

As was demonstrated above, information about the geographic and stratigraphic distribution of fossil tailed amphibians until now has been highly fragmentary. However, it is also obvious that the ranges of some forms changed seriously during the Late Cenozoic. First of all, the range of *Salamandrella* in the Early Neopleistocene covered at least central part of the East European Plain. Unfortunately, the absence of fossils from the Asian part of *Salamandrella* present range prevents judgment about its last form and size.

Data on the stratigraphic distribution of tailed amphibians are presented in Table 2.

The remains of tailed amphibians are still not found in the Upper Neopleistocene and Holocene sediments from the East European Plain, and all known findings occur only in warm stratigraphic intervals.

Acknowledgments. The author thanks Drs. Chris Gleed-Owen (CGO Ecology Limited, Bournemouth, Dorset, United Kingdom) and Igor Danilov (Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia) for checking the English in the manuscript and Igor Danilov and Pavel Sku-

tschas (St. Petersburg State University, St. Petersburg, Russia) for reviewing the manuscript and useful comments. This study was supported by grant of the Russian Foundation for Basic Research (No. 07-04-00694).

REFERENCES

Ananjeva N. B., Borkin L. Y., Darevsky I. S., and Orlov N. L. (1998), *Amphibians and Reptiles. Encyclopedia of the Russian Nature* [*Zemnovodnye i Presmykayushchiesya. Éntsiklopediya Prirody Rossii*], Moscow [in Russian].

Averianov A. O. (2001), "New Records of Proteid Salamanders (Amphibia, Caudata) from the Pliocene of Ukraine and Lower Pleistocene of Moldavia," *Vestnik Zool.*, **35**(1), 43 – 46.

Averianov A. O. and Tjutkova L. A. (1995), "*Ranodon* cf. *sibiricus* (Amphibia, Caudata) from the Upper Pliocene of Southern Kazakhstan: the first fossil record of the family Hynobiidae," *Paläont. Z.*, **69**(1/2), 257 – 264.

Bakradze M. A. and Chkhikvadze V. M. (1988), "Materials to tertiary history of herpetofauna of Caucasus and adjacent regions," *Vestnik Gos. Muz. Gruzii*, **34-A**, 176 – 193 [in Russian].

Berman D. I., Derenko M. V., Malyarchuk B. A., Grzybowski T., Kryukov A. P., and Miścicka-Śliwka D. (2005), "Intraspecific genetic differentiation of Siberian newt (*Salamandrella keyserlingii*, Amphibia, Caudata) and cryptic species *S. schrenkii* from the Russian south-east," *Zool. Zh.*, **84**(11), 1374 – 1388 [in Russian].

Carranza S. and Amat F. (2005), "Taxonomy, biogeography and evolution of *Euproctus* (Amphibia: Salamandridae), with the resurrection of the genus *Calotriton* and the description of a new endemic species from the Iberian Peninsula," *Zool. J. Linn. Soc.*, **145**, 555 – 582.

Engelmann W.-E., Fritzsche J., Günther R., and Obst F. J. (1985), *Lurche und Kriechtiere Europas*, Neumann Verlag, Leipzig.

Estes R. (1981), *Encyclopedia of Paleoherpetology. Part 2. Gymnophiona*, *Caudata*, Gustav Fisher, Stuttgart – New York.

Estes R. and Darevsky I. (1977), "Fossil amphibians from the miocene of the North Caucasus, USSR," *J. Paleontol. Soc. India*, **20**, 164 – 169.

Frost D. R., Grant T., Faivovitch J. N., Bain R. H., Haas A., Haddad C. L. F. B., de Sa R. O., Channing A., Wilkinson M., Donnellan S. C., Raxworthy C. J., Cambell J. A., Blotto B. L., Moler P., Drewes R. C., Nussbaum R. A., Lynch J. D., Green D. M., and Wheeler W. C. (2006), "The amphibian tree of life," *Bull. Am. Mus. Nat. Hist.*, **297**, 1 – 370.

Hodrova M. (1984), "Salamandridae of the Upper Pliocene Ivanovce locality (Czechoslovakia)," *Acta Univ. Carol. Geol.*, No. 4, 331 – 352.

Hodrova M. (1985), "Amphibia of Pliocene and Pleistocene Včelar localities (Slovakia)," *Čas. pro miner. a geol.*, **30**(2), 145 – 161.

Iosifova Yu. I., Agadzhanyan A. K., Pisareva V. V., Semenov V. V. (2006), "The Upper Don basin as stratoregion of the Middle Pleistocene of the Russian plain," in: *Reconstructions from Palynology*, *Climatostratigraphy*, *and Geoecology* [*Palinologicheskiye*, *klimatostratigraphicheskiye i geoékologicheskiye rekonstruktsii*], St. Petersburg, pp. 41 – 84 [in Russian].

Kuzmin S. L. (1999), *Amphibians of the Former USSR*, KMK, Moscow [in Russian].

Litvinchuk S. N., Zuiderwijk A., Borkin L. J., and Rosanov J. M. (2005), "Taxonomic status of *Triturus vittatus* (Amphibia: Salamandridae) in western Turkey: trunk vertebrae count, genome size and allozyme data," *Amphibia–Reptilia*, **26**(3), 305 – 323.

Malakhov D. V. (2003), "The earliest known record of *Miproteus* (Caudata; Proteidae) from the Middle Miocene of Central Kazakhstan," *Biota*, **4**(1 – 2), 67 – 72.

Młynarski M., Szyndlar Z., Estes R., and Sanchiz B. (1984), "Amphibians and reptiles from the Pliocene locality of Węze II near Działoszyn (Poland)," *Acta Palaeontol. Polonica*, **29**(3 – 4), 209 – 226.

Ratnikov V. Yu. (1989), "Some notes about herpetofauna findings in quaternary sediments of East Europe," in: *Problems of Herpetology. Abstrs. if the VII All-Union Herpetol. Conf.*, Kiev, 208 – 209 [in Russian].

Ratnikov V. Yu. (1996), "The Late Pliocene herpetofauna of the Korotoyak site the Voronezh region and the contemporary landscape," in: *The Down of the Quaternary. Abstrs. of the INQUA-SEQS Symp.*, *16 – 21 June 1996*, *Kerkrade*, *The Netherlands*, p. 79.

Ratnikov V. Yu. (1997a), "New data on the herpetofauna of Kuznetsovka locality in Tambov region," *Izv. Vuzov. Geol. Razvedka*, No. 1, 26 – 32 [in Russian].

Ratnikov V. Yu. (1997b), "Middle Pleistocene herpetofauna of Vladimirovka locality in Voronezh region," *Vestnik VGU. Ser. Geol.*, **3**, 88 – 91 [in Russian].

Ratnikov V. Yu. (2002a), "Late Cenozoic amphibians and reptiles of the East-European plain," in: *Trudy NII Geol. VGU*, p. 10 [in Russian].

Ratnikov V. Yu. (2002b), "Muchkapian (Early Neopleistocene) amphibians and reptiles of the East-European plain," *Russ. J. Herpetol.*, **9**(3), 229 – 236.

Ratnikov V. Yu. (2002c), "New findings of amphibians and reptiles in the base muchkapian localities of Upper Don Basin" *Vestnik VGU. Ser. Geol.*, No. 1, 73 – 79 [in Russian].

Ratnikov V. Yu. (2005), "Likhvinian (Middle Neopleistocene) amphibians and reptiles of the East-European Plain," *Russ. J. Herpetol.*, **12**(1), 7 – 12.

Ratnikov V. Yu. and Krokhmal A. I. (2003), "Middle Neopleistocene herpetofauna of Ozernoe-1 locality," *Geol. Zh.*, No. 3, 127 – 131 [in Russian].

Ratnikov V. Yu. and Krokhmal A. I. (2005), "Middle Pleistocene small terrestrial vertebrates of Nagornoe-1 and Nagornoe-2 sections," *Geol. Zh.* (4), 97 – 105 [in Russian].

Ratnikov V. Yu. and Litvinchuk S. N. (2007), "Comparative morphology of trunk and sacral vertebrae of tailed amphibians of Russia and adjacent countries," *Russ. J. Herpetol.*, **14**(3), 177 – 190.

Venczel M. (1999), "Land salamanders of the family Hynobiidae from the Neogene and Quaternary of Europe," *Amphibia–Reptilia*, **20**, 401 – 412.