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Ranodon cf. *sibiricus* (Amphibia, Caudata) from the Upper Pliocene of Southern Kazakhstan: the first fossil record of the family Hynobiidae

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With 4 figures and 1 table

Kurzfassung: Reste des Froschzahnmolchs *Ranodon* cf. *sibiricus* werden aus dem Ober-Pliozän (Unter-Villafranchium, Säugetier-Zone MN 16) des Zailischen Ala-Tau (Südkasachstan) beschrieben. Wirbel und Knochen der Gliedmaßen dieser Form sind identisch mit den Knochen der rezenten Art *R. sibiricus*. Dies ist der erste fossile Nachweis der Familie Hynobiidae.

Abstract: Remains of a hynobiid salamander *Ranodon* cf. *sibiricus* are reported from the Upper Pliocene (Early Villafranchian, mammal zone MN 16) of the Zaili Alatau Range, southern Kazakhstan. Vertebrae and limb bones of this form do not differ from those of the Recent *R. sibiricus*. This is the first fossil record of a hynobiid salamander.

Introduction

The endemic Asiatic family Hynobiidae was unique among the families of the Caudata, because it lacked a fossil record (Estes 1981; Duellman & Trueb 1985). This may be explained by the very small ranges of most representatives of the family which are restricted now to local areas of the Asian mountains. Only subfossil remains of *Salamandrella keyserlingi*, the most widely distributed species of Hynobiidae, were reported but not described from Holocene deposits of Siberia (Khozatski 1982). Sometimes findings of "fossil" frozen individuals of *S. keyserlingi* are reported from the permafrost in Siberia, which could be reanimated after thawing (Matveev 1957). Without doubt they are Recent individuals which fell down into fissures or hid there for hibernation.

Fossil remains of a hynobiid salamander are described here for the first time. These are 8 vertebrae, femur, and two partial humeri which come from the Upper Pliocene (Middle Akchagylian) Kiikbai Formation in the locality Kiikbai (Figs. 1 and 2), Southern Kazakhstan (Kostenko 1961). These remains were collected by Dr. B. U. Baishashev and the junior author during water screening together with a rich sample of mammals, some bird remains and one bone of a frog. Among the mammals, *Sorex* sp., *Hypolagus brachygnathus, Ochotonoides complicidens, Ochotonoides* n. sp., *Pygerethmus* cf. *pygmaeus, Ellobius primigenius, Allocricetulus eversmanni, Phodopus* n. sp., *Mimomys pliocaenicus, M. antis, Mimomys* sp. were identified by the junior author. Lagomorphs and rodents from this locality were partly described by Lytshev & Savinov (1974). This assemblage indicates an early Villafranchian age of the Kiikbai locality and possibly correlates with the European mammal zone MN 16 (Tjutkova 1990).

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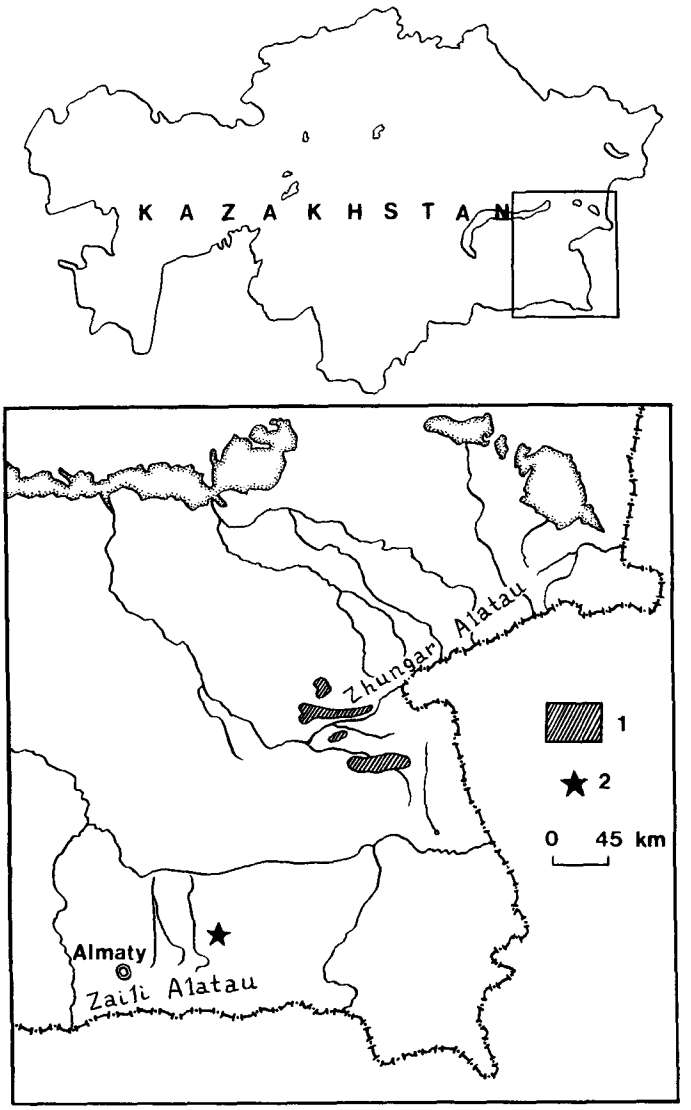

Fig. 1. Recent distribution of *Ranodon sibiricus* (1, compiled after BRUSHKO et al. 1988) and location of the locality Kiikbai (2).

VANGENGEIM & PEVZNER (1991) correlate this locality with the mammal zone MN 17 (Middle Villafranchian).

The specimens described in this paper are housed in the Institute of Zoology, Kazakhstan Academy of Sciences, Almaty, Kazakhstan (IZK).

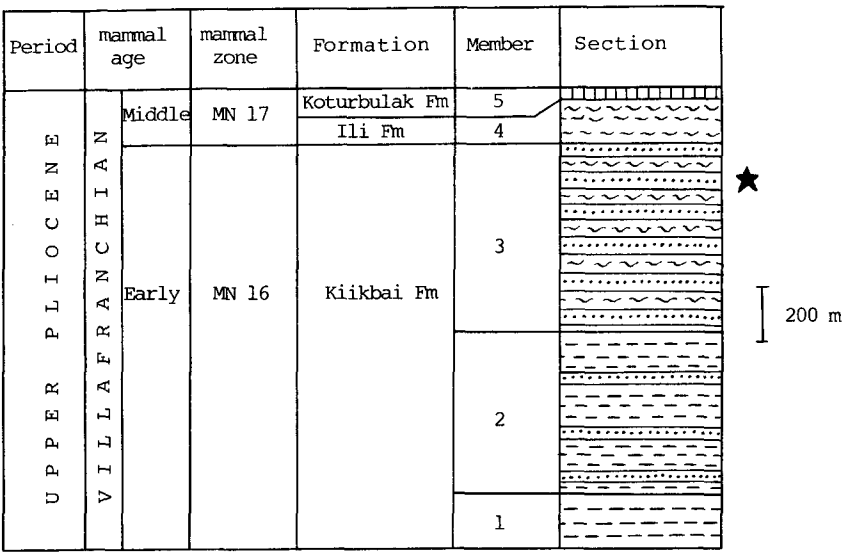

Fig. 2. Simplified geological section of Upper Pliocene deposits near the locality Kiikbai. The level yielding remains of *Ranodon* cf. *sibiricus* is indicated by asterisk. – 1 – red brown clay, 2 – brown clay with layers of sand and conglomerate, 3 – varied coloured clays and sands, 4 – yellow clay, 5 – gravel and loess.

Systematic Paleontology

Class Amphibia Linnaeus 1758
Order Caudata Oppel 1811
Family Hynobiidae Cope 1859
Genus *Ranodon* Kessler 1866
Ranodon cf. *sibiricus* Kessler 1866

Material: Eight partially broken vertebrae (IZK 27/54, 27/55, 27/102–107), one left femur (IZK 27/56) and two incomplete right humeri (IZK 27/100 and 27/101).

Description: The trunk vertebrae are amphicoelous, with circular cotyla corresponding in their morphology to the Recent *R. sibiricus*. The neural arch is relatively low and raised in its caudal part. The neural spine is very low. The zygapophyses are oval in shape.

The large anterior trunk vertebra (IZK 27/54) (Fig. 3.1) has well-developed, but almost not separated rib-bearers. According to its morphology and size it is probably the third vertebra of an adult individual (Tab. 1).

The smaller trunk vertebrae (IZK 27/103 and IZK 27/102) have also well-developed rib-bearers, but their neural arches are relatively shorter. Probably they are posterior "thoracic" vertebrae (Tab. 1) and come from a larval animal.

The specimen with the relatively large rib-bearers with the increased articular facets for the ribs (IZK 27/106) possibly is the sacral vertebra of a larval individual.

The three vertebrae with weak rib-bearers and with the relatively narrow neural arches and slender centra probably are anterior caudal vertebrae (IZK 27/105, 27/104 and 27/55) (Fig. 3.2). The first two of these vertebrae have no ventral ridges for hemal arch attachment. Thus, their position is near 19–20 (Tab. 1). The last specimen has such ridges (Fig. 3.2), but the hemal arch was not fused. Possibly it was 19–22 vertebra of a larval individual.

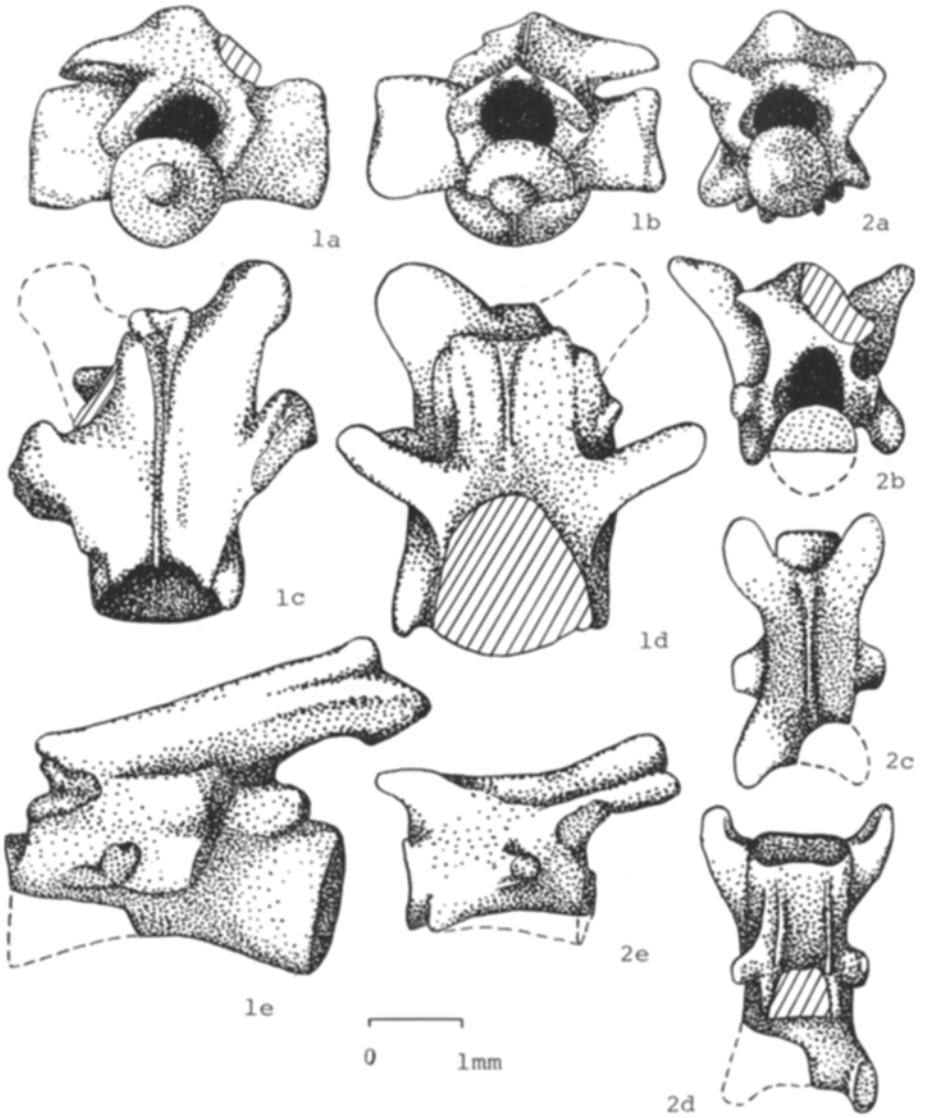

Fig. 3. *Ranodon* cf. *sibiricus*. Southern Kazakhstan, Kiikbai. Upper Pliocene. – 1. Third trunk vertebra (a – anterior, b – posterior, c – dorsal, d – ventral, e – lateral view); IZK 27/54. 2. One of the first caudal vertebrae (a – anterior, b – posterior, c – dorsal, d – ventral, e – lateral view); IZK 27/55.

Table 1. Length (in mm) of the vertebral centra (measured from the ventral side) in Recent *Ranodon sibiricus* and Late Pliocene *Ranodon* cf. *sibiricus*.

	Recent*		Fossil, Kiikbai locality	
	Number	Length	Coll. Number	Length
Atlas	1	3.9		
	2	2.9		
	3	3.1	IZK 27/54	3.1
	4	3.2		
	5	3.3		
	6	3.2		
	7	3.3		
	8	3.2		
	9	3.3		
	10	3.4		
	11	3.3		
	12	3.5		
	13	3.6		
	14	3.5	?IZK 27/103	ca. 2.6**
	15	3.7	?IZK 27/102	ca. 2.3**
	16	3.7		
	17	3.8		
Sacral	18	3.3	?IZK 27/106	ca. 2.8**
	19	3.3	?IZK 27/105	3.2
Last rib-bearers for double headed ribs	20	3.3	?IZK 27/104	3.0
First hemal arch	21	2.8		
	22	2.8	?IZK 27/55	2.3**
	23	2.6		
	24	2.2		
	25	2.4		
	26	2.5		
	27	2.6		
	28	2.4	?IZK 27/107	2.4
	29	2.4		
Last rib-bearer	30***	2.3		

* specimen from the Vertebrate Zoology department, St. Petersburg University, adult individual.
** larval specimen.
*** this specimen has at least 48 vertebrae.

The small caudal vertebra (IZK 27/107) with spine-like rib-bearers with the single pointed articular facet for the rib, is one of the middle caudal vertebrae, probably of an adult animal (Tab. 1).

The proximal end of the larger right humerus (IZK 27/ 100) (Fig. 4.1) differs from the Recent one by a more robust shaft and a more prominent crista dorsalis. In size it is close to the Recent adult specimen but may come from an older individual. The humerus of fossil and Recent *Ranodon* differs from this bone in Salamandridae by its relatively low and ridgelike crista dorsalis, which in Salamandridae is much higher and spine-like.

The distal half of the smaller right humerus (IZK 27/101) (Fig. 4.2) apparently belongs to an immature specimen. The width of the distal end here is 2.5 mm, in the Recent specimen it is 3.5 mm.

The completely preserved left femur (IZK 27/56) corresponds in its morpholgy (Fig. 4.3) and size (length 9.8 mm) to our adult specimen of *R. sibiricus* (length 10.0 mm).

Taxonomic remarks: *Ranodon sibiricus* KESSLER 1866 was described originally from

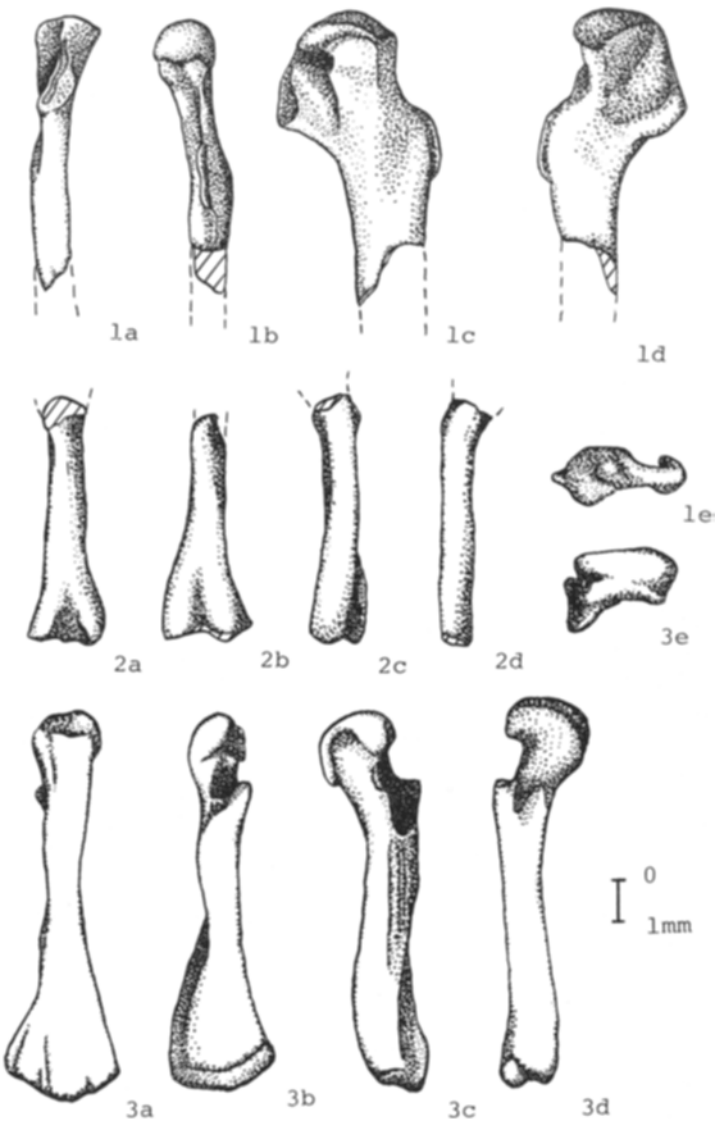

Fig. 4. *Ranodon* cf. *sibiricus*. Southern Kazakhstan, Kiikbai. Upper Pliocene. 1. Proximal end of right humerus (a – ventral, b – dorsal, c – medial, d – lateral, e – proximal view); IZK 27/100. 2. Fragment of right humerus (a – ventral, b – dorsal, c – medial, d – lateral view); IZK 27/101. 3. Left femur (a – ventral, b – dorsal, c – medial, d – lateral, e – proximal view); IZK 27/56.

one specimen from the Semipalatinsk area (Eastern Kazakhstan). As was noted by SCHNITNIKOV (1913) and NIKOLSKY (1918), in the Semipalatinsk area there are no living conditions for *R. sibiricus*, so this location was mistakenly indicated. The Recent distribution of *R. sibiricus* is restricted to the Zhungar Alatau Range where this salamander inhabits high altitude mountain cold water streams (NIKOLSKY 1918; BANNIKOV 1958; BRUSHKO et al. 1988).

Ranodon kozhevnikovi NIKOLSKY 1918 was based on a single specimen from Tashkent (Uzbekistan), an area without any conditions that would be suitable for this hynobiid salamander. But Tashkent, like Semipalatinsk, is a large trade center. Hence the type specimens of both species could only have been bought on a local market in these towns and may have come from quite distant areas. This is quite probable, because these animals are widely used in the national medicine by local Kazakh and Chinese people (PARASKIV 1953). The systematic position of *R. kozhevnikovi* is uncertain, possibly it is conspecific with *R. sibiricus*.

The type specimen of *R. kessleri* BALLION 1868 comes from the Zhungar Alatau Range. Undoubtedly it is a junior synonym of *R. sibiricus*.

The fourth described *Ranodon* species, *R. wushanensis* LIU et al. 1960 from Sechuan, China, proves to be a junior synonym of *Hynobius shihi* LIU 1950 (RISCH & THORN 1982) and recently was distinguished as the new genus *Liua* ZHAO & HU 1983.

The last *Ranodon* species, *R. tsinpaensis* LIU & HU 1967 is still valid now (DUELLMAN & TRUEB 1985). It is distributed in the Chinese part of the Zhungar Alatau Range.

Osteological differences between *R. sibiricus* and *R. tsinpaensis* are not fully described in the literature. We have no specimens of the latter available for comparison. Hence we cannot determine exactly what species of *Ranodon* is represented in the Upper Pliocene of Kiikbai locality. Thus we ascribe the reported remains, which do not show any sufficient morphological difference from our Recent specimen of *R. sibiricus*, to *Ranodon* cf. *sibiricus*.

Discussion: Specimens of *Ranodon* cf. *sibiricus* from the Upper Pliocene Kiikbai locality reported here are the first findings of a hynobiid salamander in the fossil record. The new record clearly extends the geographic range of the genus.

Recent specimens of *R. sibiricus* from the Zaili Alatau Range were reported by SEWERTZOW (1873). Usually nobody has believed this (PARASKIV 1953). The finding of the fossil *Ranodon* cf. *sibiricus* in the Zaili Alatau Range gives some support to SEWERTZOW's data that this area was inhabited by this animal at least in the last century.

The majority of Hynobiidae species have very small ranges of one or two mountain ridges. There are representatives of the genera *Batrachupterus* BOULENGER 1878 (7 species from Western China, Afghanistan and Iran), *Hynobius* TSCHUDI 1838 (18 species from Eastern Asia), *Liua* ZHAO & HU 1983 (1 species from North-Central China), *Onychodactylus* TSCHUDI 1838 (2 species from Eastern Asia), *Pachyhynobius* FEI et al. 1985 (1 species from North-Eastern China), *Pachipalminus* THOMPSON 1912 (1 species from Japan) and *Paradactylodon* RISCH 1984 (1 species from Iran) (DUELLMAN & TRUEB 1985).

A diverse fauna of hynobiid salamanders with many endemic and quite divergent forms indicates a long and complex history of the family, which is still virtually unkown. In order to understand this history it is necessary to carry out a special search for hynobiid remains in Cretaceous and Cenozoic deposits of the mountain depressions in Central Asia.

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