A new species of *Calamagras* Cope, 1873 (Serpentes, Boidae, Erycinae) from the early Eocene of Kirghizia

Igor G. DANILOV
Zoological Institute of the Russian Academy of Sciences,
Universitetskaya nab. 1, St Petersburg 199034 (Russia)
dig@zisp.spb.su

Alexander O. AVERIANOV
Zoological Institute of the Russian Academy of Sciences,
Universitetskaya nab. 1, St Petersburg 199034 (Russia)
sasha@aa1923.spb.edu

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ABSTRACT
A new erycine snake, *Calamagras turkestanicus* n.sp., known by about fifty trunk vertebrae is described from the early Eocene Andarak 2 locality, Kirghizia. It shows close similarity to *C. gallicus* Rage, 1977 from the early Eocene of France and *C. primus* Hecht, 1959 from the middle Eocene of the United States. New taxon represents the first reliable record of *Calamagras* from the Paleogene of Asia. The presence of Aniliidae, reported previously from the same locality, is not confirmed by new material.

KEY WORDS
Calamagras,
Erycinae,
Boidae,
early Eocene,
Kirghizia.

RÉSUMÉ
Nouvelles espèces de Calamagras *Cope, 1873 (Serpentes, Boidae, Erycinae) de l'Éocène inférieur du Kirghizistan.*
Un nouveau serpent érycine, *Calamagras turkestanicus* n.sp., est décrit. Il provient du gisement d'Andarak 2 du Kirghizistan (Éocène inférieur) et est connu par environ cinquante vertèbres. Il est très proche de *C. gallicus* Rage, 1977 de l'Éocène inférieur de France et de *C. primus* Hecht, 1959 de l'Éocène moyen des États-Unis. Ce nouveau taxon est la première mention de *Calamagras* dans le Paléogène d'Asie. La présence d'Aniliidae, rapportée précédemment du même gisement, n'est pas confirmée par le nouveau matériel.

MOTS CLÉS
Calamagras,
Erycinae,
Boidae,
Éocène inférieur,
Kirghizistan.

INTRODUCTION

The Paleogene snakes of Asia are inadequately known (Rage 1987a). Sea snakes (Palaeophiidae and Nigerophiidae) are better known; they were relatively abundant at that time along the eastern coast of the Tethys Ocean (Nessov 1995; Averianov 1997).

The record of terrestrial snakes is much more scarce. Boinae gen. indet. and Erycinae gen. indet. were described from the early-middle Eocene Kuldana Formation in Pakistan on the basis of four vertebrae (Rage 1987b). Undescribed remains of boid snakes were reported from Paleogene deposits of Zayssan Depression in Kazakhstan (Chkhikvadze *et al.* 1983; Zerova & Chkhikvadze 1984; Chkhikvadze 1985): a primitive small erycine, most probably of the genus *Calamagras*, and a vertebra of a larger erycine from the middle Eocene; a vertebra of a large boid from the upper Eocene; a new genus of erycine snake, a *Calamagras*-like erycine, and a boine from the early Oligocene; an erycine of the genus *Bransateryx* from the middle Oligocene. Aniliidae, Boidae, and a sea snake were mentioned from the early Eocene Andarak 2 locality in Kirghizia (Chkhikvadze 1984; Zerova & Chkhikvadze 1984; Nessov 1995). A sea snake from the Andarak 2 locality was recently described as *Palaeophis ferganicus* Averianov, 1997. Erycine vertebrae from the latter locality are described in this paper.

New materials from Andarak 2 locality, collected by the second author in 1988-1993 and by both authors in 1995, include more than fifty trunk vertebrae which are attributed here to a new species of the erycine genus *Calamagras* Cope, 1873. This extinct genus is represented by a number of species in North America and by one species in Europe. No related snakes have been described until recently from Asia, although *Calamagras*-like remains were reported from Paleogene of Kazakhstan (see above). The presence of Aniliidae in the Andarak 2 locality is not confirmed by our material.

The institutional abbreviation is ZIN PH: Zoological Institute, Russian Academy of Sciences, St Petersburg, Paleoherpetological Collection.

SYSTEMATIC PALEONTOLOGY

Superfamily Booidea Gray, 1825
Family Boidae Gray, 1825
Subfamily Erycinae Bonaparte, 1831
Genus *Calamagras* Cope, 1873

Calamagras turkestanicus n.sp.
(Figs 1-3)

Holotype. — ZIN PH 1/2, an anterior/middle trunk vertebra.

Type locality. — Andarak 2, Fergana Valley, Kirghizia; Alay beds, lower Eocene (late Ypresian).

Etymology. — From the Turkestan Range in Middle Asia.

Referred material. — About fifty more or less weathered trunk vertebrae from the same locality.

Diagnosis. — The neural arch is depressed; the anterior edge of the zygosphene is slightly concave, or forms three protruding lobes; the neural spine is thin, short, occupying less than half the length of the neural arch, low and without knob; the haemal keel of the trunk vertebrae is comparatively wide.

Comparison. — The new species most closely resembles *Calamagras gallicus* Rage, 1977 from the lower Eocene of France and *C. primus* Hecht, 1959 from the middle Eocene of the United States. However, the vertebrae of the Asiatic species differ from both species by a wider haemal keel, variable shape of the anterior border of the zygosphene, slightly more slanting prezygapophyses, and from the latter species by more reduced neural spine without knob.
The new taxon can be distinguished from the Oligocene and Miocene species of *Calamagras* (Rage 1984) by its thin and short neural spine without knob.

Description

The holotype ZIN PH 1/2 (Fig. 1) is an anterior/middle trunk vertebra with a relatively short and anteriorly broadened centrum. The ventral surface of the centrum is concave on the sagittal section. The haemal keel is narrow and becomes wider posteriorly. The subcentral ridges are blunt and not distinct. The condylus is well-rounded, larger than the neural canal, and projects posteriorly. The cotylus is almost pentagonal in shape, with one of the angles directed ventrally.

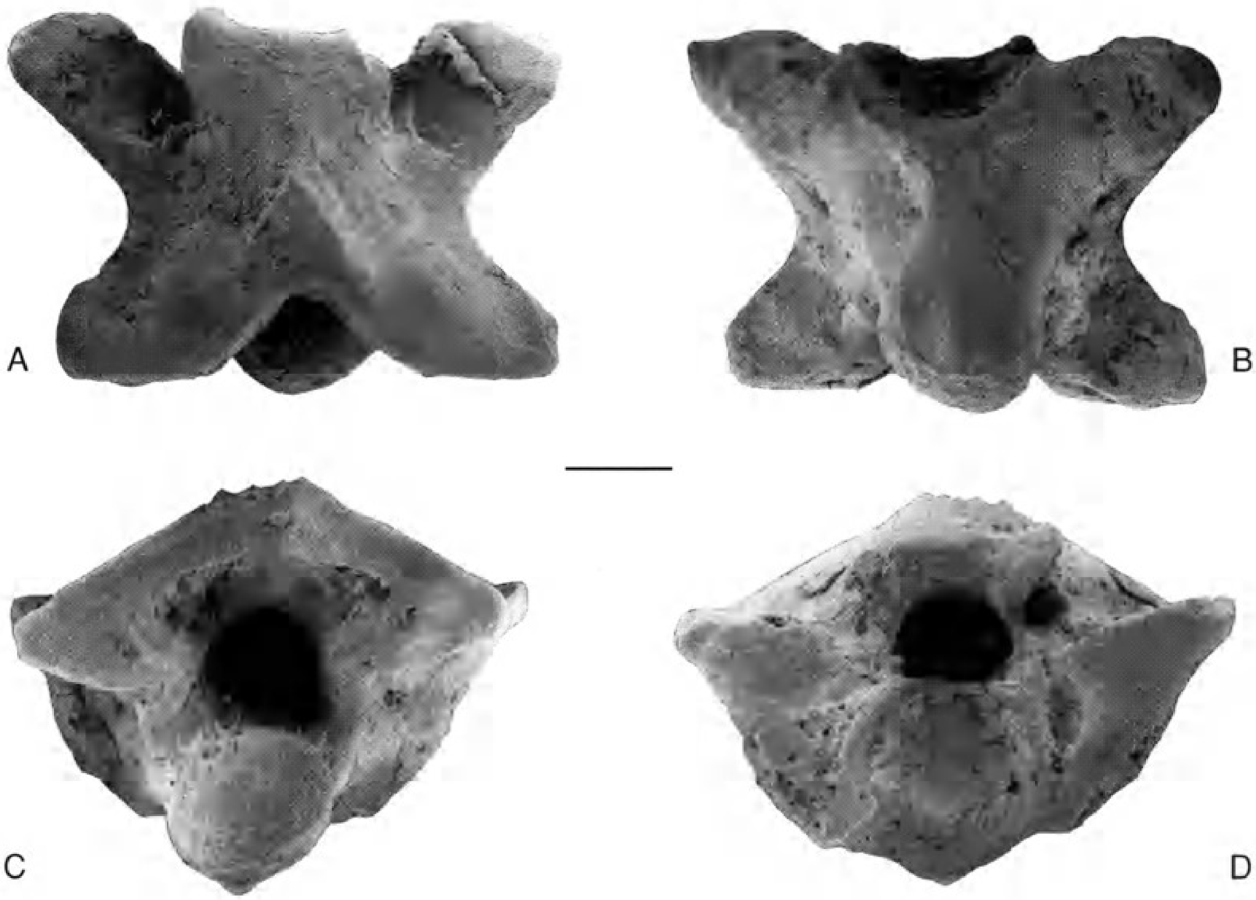

FIG. 1. — *Calamagras turkestanicus* n.sp., an anterior/middle trunk vertebra (ZIN PH 1/2); **A**, dorsal view; **B**, ventral view; **C**, posterior view; **D**, anterior view. Scale bar: 1 mm.

The articular surfaces of the prezygapophyses are elongated, set at an angle of about 150°. The weak prezygopophyseal processes are present. The synapophyses are not separated from the centrum, their ventral border is situated above the ventral border of the centrum. The diapophyseal part of the synapophyses is wider than the parapophyseal one. There is a pair of lateral foramina. The neural arch is dorso-ventrally flattened, and the notch in the posterior neural arch border is well-developed. The neural spine is broken; its basis stretches from the basis of the zygosphene to the posterior border of the neural arch. The anterior border of the zygosphene is slightly concave. The width of the zygosphene is equal to the width of the cotylus.

ZIN PH 51/2 (Fig. 2) is an anterior trunk vertebra with a narrow haemal keel which forms a weak, short hypapophysis posteriorly. The neural spine occupies about one third of the length of the neural arch. The notch in the posterior neural arch border is weaker than in the holotype.

ZIN PH 17/2 is a fragment of an anterior/middle trunk vertebra with a complete neural spine which slightly overhangs the notch in the posterior neural arch border.

ZIN PH 2/2 is a posterior trunk vertebra of a large specimen. The haemal keel is well-developed, low and wide; the groves on either side of the haemal keel are deeper than in the anterior vertebrae. The subcentral ridges are blunt but distinct. The synapophyses are separated from the centrum; their ventral border is at the same level as the ventral border of the centrum. The cotylus is more depressed dorso-ventrally, oval in shape. The neural canal is wider than on the holotype, trapezoid in shape when viewed anteriorly. The anterior border of the zygosphene forms three protruding lobes. The zygosphene is slightly wider than the cotylus.

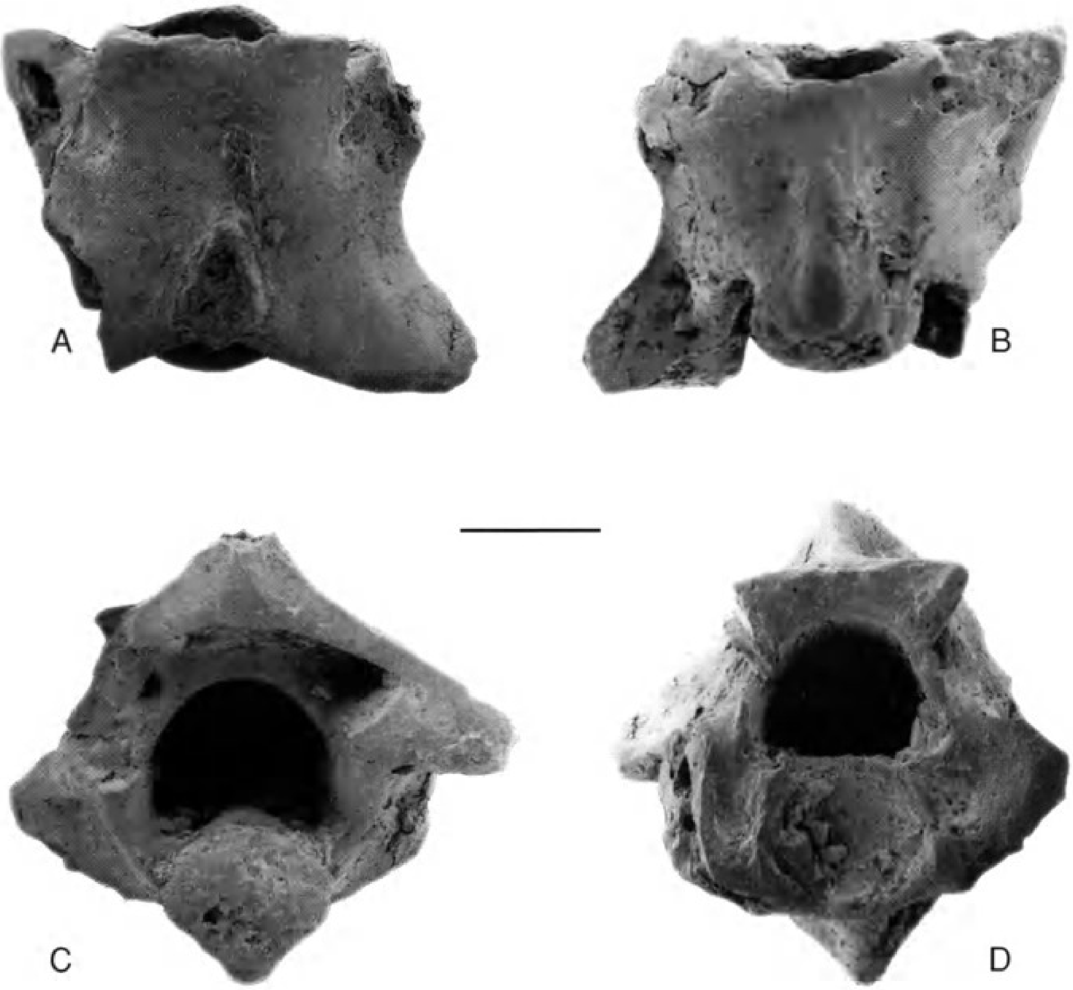

FIG. 2. — *Calamagras turkestanicus* n.sp., an anterior trunk vertebra (ZIN PH 51/2); **A**, dorsal view; **B**, ventral view; **C**, posterior view; **D**, anterior view. Scale bar: 1 mm.

ZIN PH 3/2 (Fig. 3) is a more posterior trunk vertebra. The haemal keel is wide but slightly higher than in the mid trunk vertebrae. The grooves on either side of the haemal keel are very deep and the subcentral ridges are very distinct. The synapophyses are well separated from the centrum. Condylus and cotylus are slightly compressed. The neural arch is more flattened than on the anterior vertebrae.

REMARKS

Our material includes small vertebrae (about 2 mm) and comparatively large ones (about 5 mm). Most of the small vertebrae are strongly weathered and many of their morphological traits are not as distinct as in the large ones, nevertheless, they seem to have a similar morphology. Probably, the small vertebrae from the Andarak 2 locality are those which were previously assigned to the Aniliidae (Chkhikvadze 1984; Zerova & Chkhikvadze 1984). However, they could not belong to the Aniliidae because they possess a less depressed neural arch, a well-developed neural spine and a more strongly developed notch in the posterior border of the neural arch.

DISCUSSION

The assignment of the vertebrae described above to the Boidae is supported by their short and wide centra, which are anteriorly broadened, and by the absence of projected prezygapophyseal processes.

A flattened, low neural arch, a comparatively low

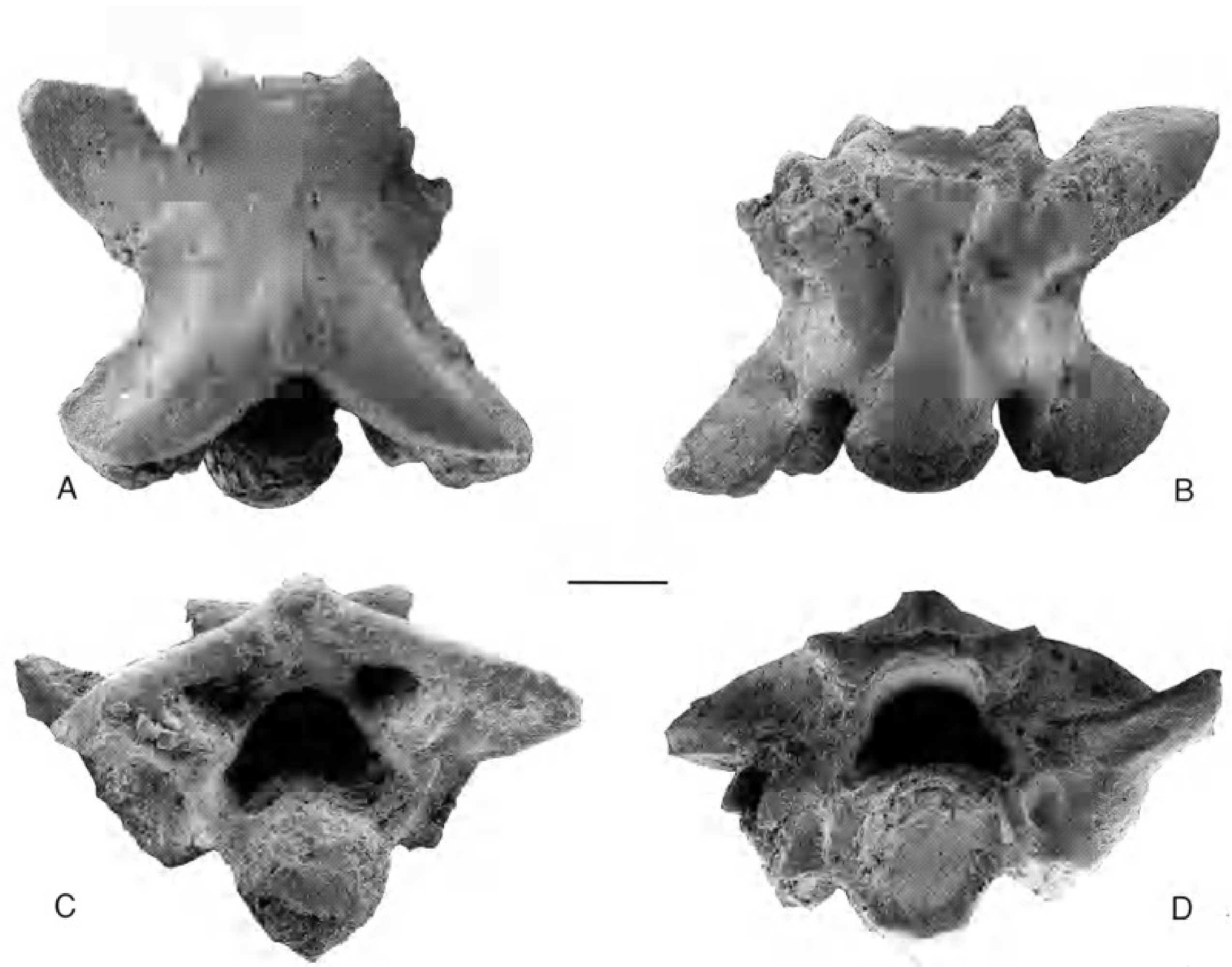

FIG. 3. — *Calamagras turkestanicus* n.sp., a posterior trunk vertebra (ZIN PH 3/2); **A**, dorsal view; **B**, ventral view; **C**, posterior view; **D**, anterior view. Scale bar: 1 mm.

neural spine, and also the small size of the vertebrae are traits of the Erycinae. The most important distinguishing feature of erycines is the structure of their caudal vertebrae, which are shortened and have additional complex processes (Hoffstetter & Gasc 1969, 1972; Rage 1984). Unfortunately caudal vertebrae are absent from our material, but the traits listed above certainly prove the assignment.

A short neural spine (occupying less than half the length of the neural arch), though considered as a feature of doubtful value (Rage 1977), is a character of the genus *Calamagras*. Representatives of the latter are known in Europe in the early Eocene, and in North America in the middle Eocene and from the early Oligocene to the early Miocene (Rage 1984). The new taxon represents the first reliable record of *Calamagras* in Asia and the second well-established finding of the Erycinae in the Paleogene of Asia (Rage 1987a). Erycine vertebrae described from the early-middle Eocene Kuldana Formation in Pakistan (Rage 1987b) have a narrow haemal keel, a short neural spine, and formally may belong to the genus *Calamagras*. They differ from the new species by their strongly flattened neural arch (Rage 1987b, fig. 2A-E).

The oldest representative of the Erycinae – *Helagras prisciformis* Cope, 1883 from the early Paleocene of the United States – is based on two articulated vertebrae, which may belong to the posterior trunk region of *Calamagras* or *Ogmophis* (Rage 1984). The latter genus differs from *Calamagras* by its longer neural spine occupying more than half the length of the neural arch.

According to Rage (1977), erycine snakes, which probably originated in North America, reached

TABLE 1. — Measurements (in mm) of vertebrae of *Calamagras turkestanicus* n.sp. from the early Eocene of Kirghizia. *, the holotype; **CL**, centrum length; **CTH**, cotyle height; **CTW**, cotyle width; **PO-PO**, width between the outer edges of postzygapophyseal articular surfaces; **PR-PO**, length from the anterior edge of the prezygapophyseal articular surface to the posterior edge of the postzygapophyseal articular surface; **PR-PR**, width between the outer edges of prezygapophyseal articular surfaces.

ZIN PH	CL	CTH	CTW	PO-PO	PR-PO	PR-PR
Anterior trunk vertebrae						
6/2	2.7					
51/2	2.4	1.2	1.3			
55/2	2.0	1.2	1.4	3.3	3.1	
56/2	2.4	1.5	1.5			
Anterior/middle trunk vertebrae						
1/2*	3.0	2.0	2.3	5.0	3.7	5.3
9/2	2.4	1.4	2.0			
15/2		1.3	2.0			
20/2	2.1	1.1	1.6			
25/2	1.6	1.0	1.4			
28/2	2.6	1.3	1.7	4.0	3.5	4.7
36/2	2.8	1.5	1.7			
38/2	2.2	1.3	1.7			
42/2	3.1	1.8	1.9			
43/2	2.4	1.5	1.9			
45/2	3.4	1.7	2.2			5.0
Middle trunk vertebrae						
4/2	2.8	1.3	1.8			
7/2		1.2	1.5			3.8
11/2	3.4	2.1	2.4			
12/2	2.2	1.3	1.5			
18/2	1.4	0.6	1.1			
26/2	2.6	1.6	2.0			
31/2	2.6	1.6	2.3			
32/2	3.2	1.6	2.2			5.8
40/2	2.2	1.2	1.6			
44/2	2.2	1.2	1.5			4.4
46/2		1.1	1.7			
50/2	2.6	1.8	2.0			4.5
52/2	2.7	2.0				
Posterior trunk vertebrae						
2/2	5.5	2.1	2.6		5.3	
3/2	3.2	1.7	1.8	5.1	4.0	
8/2	3.4	1.4				
19/2	2.8	1.4				
23/2	3.7	1.8	2.3			
27/2		1.5	1.7			
35/2		2.0	2.2			
39/2		1.3	1.4		3.2	4.2

Europe during the early Eocene. After this time, Europe, which was separated from Asia by the Turgai Strait, became isolated from North America by the opening of the North Atlantic. New findings of erycine snakes in the Paleogene of Asia (Rage 1987b; this study) show that by the early Eocene erycine snakes were more widely distributed as was previously thought, and had already invaded Asia.

Eocene representatives of *Calamagras* (*C. primus* in North America, *C. gallicus* in Europe and *C. turkestanicus* in Asia) may belong to an ancient group of species (? distinct genus), which differs from Oligocene-Miocene *Calamagras* by shorter and thinner neural spines without knob or with an incipient one (*C. primus*).

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