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A new locality of Late Cretaceous snakes, mammals and other vertebrates in Africa (western Libya)

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Abstract — *Simoliophis lybicus* sp. nov. (Reptilia, Serpentes, Simoliopheidae) is described from the Upper Cretaceous 'unnamed' beds of the Mizdah Formation (Santonian-Campanian) at Draa Ubari in western Libya. The accompanying fauna consists of an undetermined mammal represented by a caudal vertebra, of hybodontoid, ganopristid and lamnoid sharks, as well as dipnoans, lepisosteids, pycnodonts, enchodontids, turtles, crocodiles and ?dinosaurs. © Elsevier, Paris.

mammalian / vertebra / snake vertebrae / Upper Cretaceous / western Libya

Résumé — Serpents, mammifères et autres vertébrés d'une localité nouvelle du Crétacé supérieur de Libye. Une nouvelle localité de serpents, mammifères et autres vertébrés du Crétacé supérieur en Afrique (Libye occidentale). *Simoliophis libycus* sp. nov. (Reptilia, Serpentes, Simoliopheidae) est décrit dans des grès de la formation Mizdah (Santonien-Campanien), à Draa Ubari en Libye occidentale. Les mêmes couches ont livré une vertèbre caudale de mammifère indéterminé, ainsi que des restes de requins hybodontoïdes, ganopristidés et lamnoïdes, de dipneustes, lépisostéïdes, pycnodontes, enchodontidés, tortues, crocodiles et ? dinosaures. © Elsevier, Paris.

mammifères / vertèbres / serpent / Crétacé supérieur / Libye occidentale

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INTRODUCTION

African terrestrial vertebrate faunas of the Mesozoic are still inadequately known. This is particularly true of mammals. They are represented by abundant and well preserved remains of the morganucodontids *Erythrotherium parringtoni* and *Megazostrodon rudnerae* from the Lower Jurassic of southern Africa [5]; the edentulous dentary of the eupantothere *Brancatherulum tendagurense* from the Upper Jurassic of Tanzania [8], an edentulous dentary fragment and isolated teeth of a cladothere and an indeterminate mammal from the Lower Cretaceous (Aptian) of Cameroon [2, 7, 11], isolated teeth and dentary fragments of triconodonts, multituberculate, symmetrodonts, eupantotheres and tribotherians from the Lower Cretaceous (Berriasian ?) of Morocco [21, 28]. Searches for Cretaceous mammals in several other African regions, such as the Upper Jurassic or Lower Cretaceous Kirkwood Formation in southern Africa [19], the Cenomanian of Sudan [31] and the Coniacian-Santonian In Beceten locality of Niger [1, 31] have so far proved unsuccessful, although tons of matrix were usually screenwashed. However, isolated teeth of gondwanatheres were found in the Upper Cretaceous (Campanian ?) of Madagascar [14]. This state of affairs gives a special value to the discovery of a mammalian tail vertebra among other diverse, mostly marine Cretaceous vertebrate remains from the sandstones ('unnamed' beds) situated between the Thala and Mazuzah Members of the Mizdah Formation, lower part of the Hamada Group (Santonian-Campanian; for stratigraphy see [15]) at Draa Ubari in western Libya (*figure 1*), a discovery made by V. I. Zhegallo during geological prospecting.

DESCRIPTION

1. Mammalian vertebra

The vertebra (ZIN PC 1/31, *figure 2*) lacks the neural arch and haemapophyses but consists of an elongated centrum with weakly developed praezygapophyses. These features are characteristic of a distal tail vertebra. The length of the centrum is 4.8 mm, the anterior width is 1.7 mm, the posterior width is 1.3 mm, the anterior height is 1.8 mm, the posterior height is 1.3 mm. By its dimensions this vertebra is similar to those of the Early Jurassic *Eozostrodon parvus* [12]. The posterior end of the Libyan centrum is relatively narrower than the anterior end of the *Eozostrodon* tail vertebrae. This may indicate that the tail of the Libyan mammal was shorter. Although this single vertebra is not sufficient for taxonomic determination, its discovery extends the geographical range of African Mesozoic Mammalia and indicates a promising new locality.

2. Snake vertebrae

Snakes are common in African Cretaceous vertebrate faunas. They are known from the Upper Albian of Algeria [6], the Cenomanian of Algeria and Egypt [9, 18, 34], the Coniacian-Santonian of Niger [1, 31], and the Campanian of Madagascar [10, 20]. Finally, an unexpectedly diverse snake fauna was recently discovered in the Albian-Cenomanian of Sudan [32]. These findings, together with discoveries in South America, indicate that the early evolution and radiation of snakes took place in Gondwana.

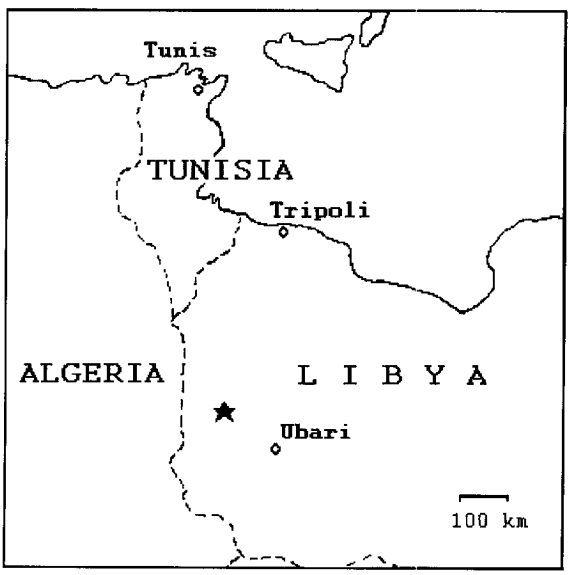

Figure 1. Location map of the Draa Ubari region in western Libya (asterisk).

Figure 1. Situation de la localité fossilière de Draa Ubari (*) en Libye occidentale.

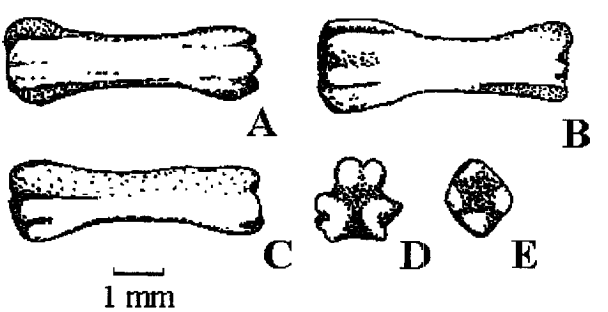

Figure 2. Mammal caudal vertebra (ZIN PC 1/31) from the Santonian-Campanian at Draa Ubari, western Libya. **A**, dorsal, **B**, ventral, **C**, lateral, **D**, anterior, **E**, posterior views.

Figure 2. Vertèbre caudale mammalienne (ZIN PC 1/31) du Campanien-Santonien de Draa Ubari, Libye occidentale. **A**, vue dorsale; **B**, vue ventrale; C, vue latérale; **D**, vue antérieure; **E**, vue postérieure.

The snakes from the Mizdah Formation of Libya are represented by a collection of 16 vertebrae which apparently belong to a new species of the sea snakes *Simoliophis* Sauvage, 1880, described below.

3. Other vertebrate remains

Besides the mammal and the snake, the vertebrates from the 'unnamed' beds of the Mizdah Formation in western Libya are represented by remains of hybodontoid sharks (fragment of fin spine and teeth of *Distobatis* sp.), by the rostral and oral teeth of *Onchopristis* sp. (Ganopristidae), teeth of lamnoid sharks including ? *Carcharoides* sp., tooth plate fragments of the dipnoan *Protopterus* sp. (Lepidosirenidae), scales and vertebrae of lepisosteids, numerous teeth of pycnodonts and enchodontids, vertebrae and scales of indeterminate chondrichthyan and osteichthyan fish, rare turtle shell fragments, sauropod (?) and bone fragments and teeth of theropod (?) dinosaurs and crocodiles.

The recently described elasmobranchian genera *Distobatis* and *Aegyptobatis* from the Late Cenomanian of Egypt were attributed to the family Distobatidae of the order Myliobatoidea and considered as 'archaic' elements of the Cenomanian elasmobranchian fauna [29, 30]. Real myliobatiforms are not known prior to the Campanian [3]. The teeth of Distobatidae differ from those of Myliobatoidea by having a root not divided by numerous grooves: the root morphology of the Distobatidae is typical of the Hybodontoidea. The flat sculptured crown of the crushing type teeth of Distobatidae is very similar to that of the hybodontoid *Asiadontus,* from the Aptian of Mongolia and Kyrgyzstan[16]. Here we consider Distobatidae as a family of Hybodontoidea. The same conclusion was reached previously by Cappetta [3].

DISCUSSION

In general aspect the Santonian-Campanian vertebrate fauna from western Libya is similar to the vertebrate assemblages from the Coniacian-Santonian In Beceten locality of Niger [1, 31] and the Campanian of Madagascar [20], and to a lesser extent to the Campanian assemblage from the Duwi Formation of Egypt [4]. The latter is essentially more marine and differs by the presence of plesiosaurs and mosasaurs and by more diverse chondrichthyans.

The vertebrate remains described above are housed in the Zoological Institute, Russian Academy of Sciences, Saint Petersburg (ZIN PC).

SYSTEMATICS

Order SERPENTES

Suborder **ALETHINOPHIDIA**

Superfamily ***Simoliopheoidea***

Family SIMOLIOPHEIDAE

Genus ***Simoliophis*** Sauvage, 1880

Simoliophis libycus sp. nov.

Holotype: ZIN PC 2/31, mid-trunk vertebra (*plate I, 2a-e*).

Locus typicus: Draa Ubari at the southern border of the Hamada Al-Khamra, southeast of the Gadames Oasis in western Libya. 'Unnamed' beds between the Thala and Mazuzah Members of the Mizdah Formation, Upper Cretaceous, Santonian-Campanian.

Paratypes: ZIN PC 3/31, anterior trunk vertebrae (*plate I, 1a-e*) and 4/31, posterior trunk vertebrae (*plate II, a-e*). Locality as for the holotype.

Etymology: From the country Libya

Distribution: Santonian-Campanian of Libya

Diagnosis: Differs from the only previously known species of the genus, *S. rocherbrunei* Sauvage, 1880 ([17], Taf.1; [13], pl.7, figures 1–4) by more narrow centrum and lower neural spine on anterior trunk vertebrae, shorter (antero-posteriorly) neural spine, confined to the posterior part of neural arch, less developed synapophysis.

Description: The vertebrae pachyostotic. The anterior trunk vertebrae have a curved centrum, usually more elongated than in the mid-trunk vertebrae, with a distinct but relatively low ridge-like hypapophysis developed as an elevation of the haemal keel. The mid trunk vertebrae have a relatively low neural spine and no hypapophysis. The posterior trunk vertebrae usually have a shortened centrum and a very high neural spine; sometimes they have a small tubercle-like hypapophysis which is not clearly connected to the haemal keel.

Some vertebrae have undercut cotylar lips (signifying incompletely ossified vertebrae from juvenile individuals ?), others have two well developed ridges on either side of the haemal keel converging posteriorly at the lip of the condyle.

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Plate I

Vertebrae of *Simoliophis libycus* sp. nov. from the Santonian-Campanian at Draa Ubari, western Libya. **1a-e**, paratype, ZIN PC 3/31, anterior trunk vertebra from anterior (**a**), posterior (b), ventral (**c**), dorsal (**d**) and lateral (**e**) views; **2a-e**, holotype, ZIN PC 2/31, mid trunk vertebra from anterior (**a**), posterior (**b**), ventral (**c**), dorsal (**d**) and lateral (**e**). Stereopairs views.

Planche I

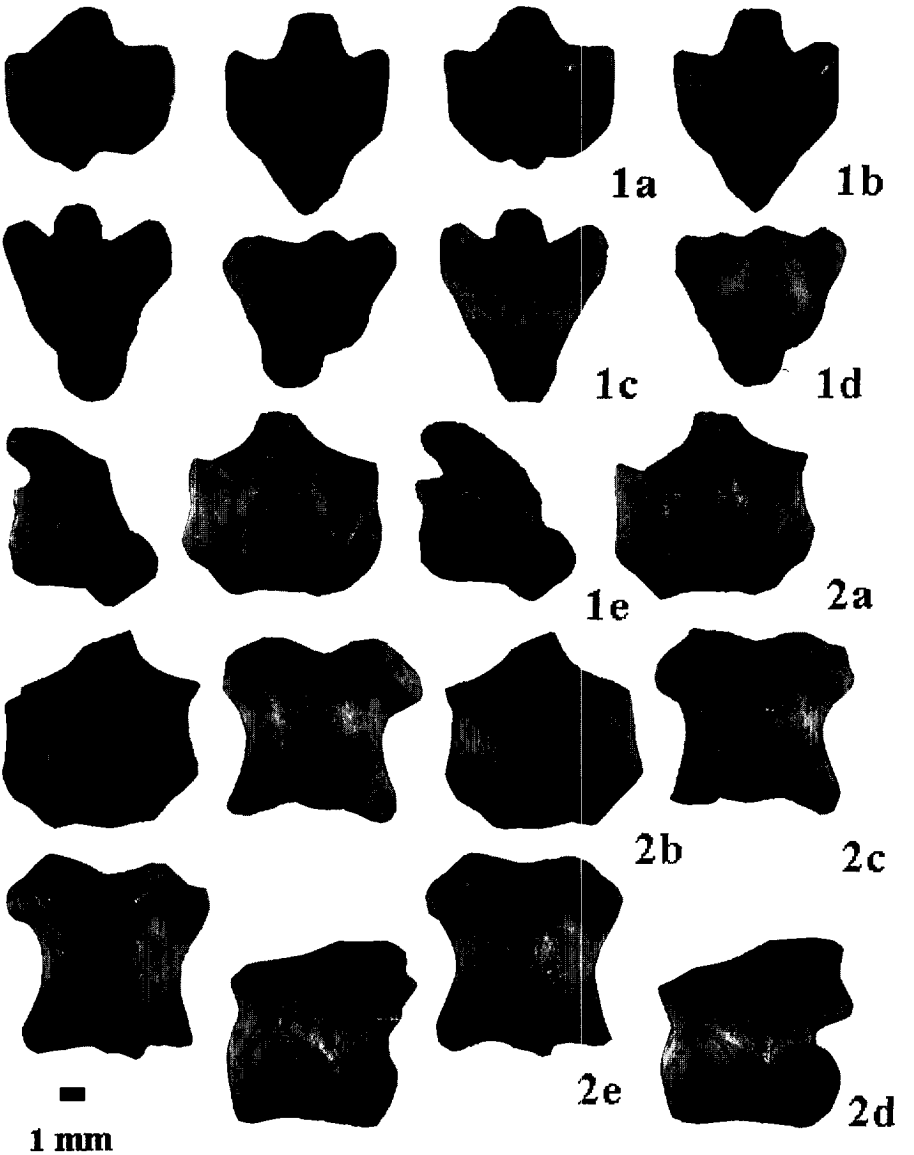
Stéréophotographies des vertèbres de *Simoliophis libycus* sp. nov., du Santonien-Campanien de Draa Ubari, Libye occidentale. **1a-e**, paratype, ZIN PC 3/31, vertèbre dorsale antérieure, en vues antérieure (**a**), postérieure (**b**), ventrale (**c**), dorsale (**d**) et latérale (**e**) ; **2a-e**, holotype, ZIN PC 2/31, vertèbre de la région dorsale moyenne, en vues antérieure (**a**), postérieure (**b**), ventrale (**c**), dorsale (**d**) et latérale (**e**).

Plate II

Posterior trunk vertebra of *Simoliophis libycus* sp. nov. from the Santonian-Campanian at Draa Ubari, western Libya, paratype, ZIN PC 4/31 from anterior (**a**), posterior (**b**), ventral (**c**), dorsal (**d**) and lateral (**e**) views. Stereopairs views.

Planche II

Stéréophotographies de la vertèbre dorsale postérieure de *Simoliophis libycus* sp. nov., du Santonien-Campanien de Draa Ubari, Libye occidentale, paratype, ZIN PC 4/31, en vues antérieure (**a**), postérieure (**b**), ventrale (**c**), dorsale (**d**) et latérale (**e**).



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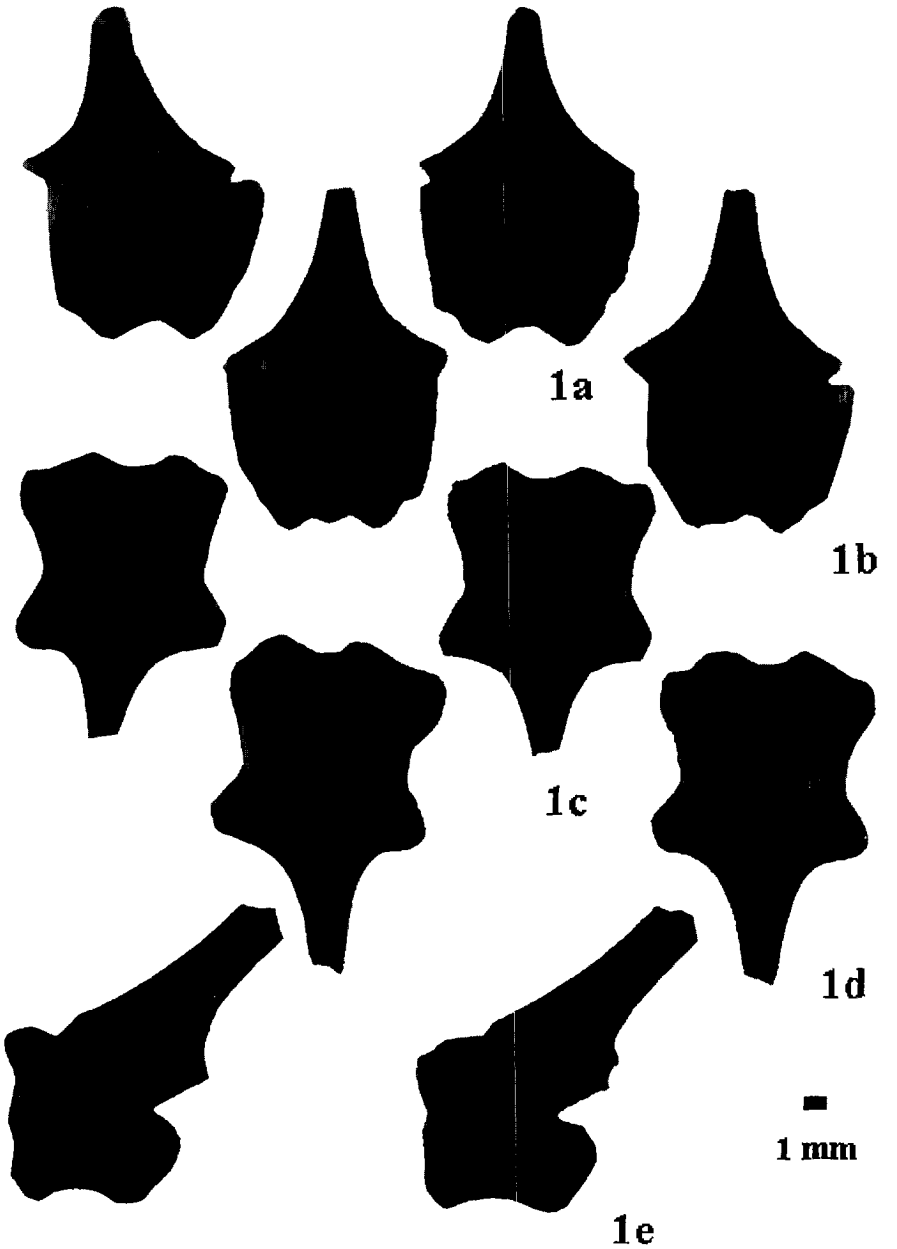

Plate II