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Sinotragus (Bovidae, Mammalia) from Turkey and the Late Miocene Middle Asiatic Province

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With 3 figures and 1 table

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Abstract: The Late Miocene Yatağan Formation near Muğla (Turkey) has yielded several specimens of the Bovid *Sinotragus*, a genus previously known only from Shanxi, China. Among Ungulates, the Rhino *Chilotherium*, the Giraffid *Samotherium* and the ovibovines of the *Plesiaddax-Urmiatherium* group had a similar geographic range. They are undoubtedly open country forms, which attest the extension of such an environment across the whole of Asia around 35° N in Late Miocene times. The discovery of *Sinotragus* in Turkey thus confirms an idea already put forward 50 years ago by B. KURTÉN.

Zusammenfassung: Die obermiozäne Yatağan-Formation bei Muğla (Türkei) hat mehrere Reste des Boviden *Sinotragus* geliefert. Die Gattung war bisher nur aus Shanxi, China, bekannt. Unter den Huftieren hatten das Nashorn *Chilotherium*, die Giraffe *Samotherium* und die Ovibovinen der *Plesiaddax-Urmiatherium*-Gruppe ein ähnliches Verbreitungsgebiet. Sie waren sicherlich Steppenformen, welche die Verbreitung einer entsprechenden Umwelt im Obermiozän durch ganz Asien bis etwa 35° N erweisen. Die Funde von *Sinotragus* in der Türkei bestätigen eine schon vor 50 Jahren vorgebrachte Meinung von B. KURTÉN.

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Introduction

The Late Miocene Mammalian faunas of Turkey, despite their richness, are still rather poorly known. Except for a few localities, such as Kemiklitepe (SEN et al. 1994) and perhaps the Sinap area (OZANSOY 1965; SEN 1991; BOUVRAIN, SEN & THOMAS 1994; KAPPELMAN et al. 1996; GERAADS & GÜLEÇ, 1997, 1999; LUNKKA et al., 1999; other studies in progress), most of the richest fossiliferous sites are known only through faunal lists and short reports, often outdated today, with unreliable identifications. A German team led by O. SICKENBERG conducted important field work in the 70s, but of the taxa that they reported (SICKENBERG et al. 1975), only the Proboscideans (GAZIRY 1976), Carnivores (SCHMIDT-KITTLER 1976), Hipparions (STAESCHE & SONDAAR 1979) and Bovids (KÖHLER 1987) have been described, and this important work remains therefore incomplete. However, various Turkish Institutes house unpublished collections whose study could greatly improve our knowledge of these Late Miocene faunas, both from the biostratigraphic and biogeographic aspects. One of them comes from the Muğla area, in western Turkey. The first fossiliferous localities near the villages of Akgedik and Bayir were found 60 years ago; OZANSOY (1951) published a preliminary faunal list of 10 taxa of large Mammals. Another site there (Eski Bayirköy) was mentioned by BECKER-PLATEN (1970) and SICKENBERG (1976); they gave a longer but rather different faunal list. The most fossiliferous locality, Salihpaşalar (Kemikalan), was first recognised by ATALAY (1980). The lithostratigraphy of the area was first described in detail by BECKER-PLATEN (1970), and then by ATALAY (1980), who formally named the Upper Miocene Yatağan Formation, divided into 3 members, the most fossiliferous of which is the Bayir member, for which he (ATALAY 1980) provided a faunal list. The Bayir member is widely exposed in southwest Anatolia (Fig. 1). It consists of brownish mudstone, claystone, conglomerate, gray limestone and interstratified tuffite. The mammalian fauna occurs in the lenticular masses of brownish claystone. Our (KAYA 1991, 1994; GERAADS & GÜLEÇ 1999, and unpublished) ungulate identifications of the fauna of this member are as follows: *Hipparion mediterraneum, H. matthewi, Ceratotherium neumayri*, cf. *Ancylotherium pentelicum, Orycteropus* sp., *Microstonyx erymanthius*, Giraffid gen et sp. indet. (very large), *Gazella* sp., *Palaeoryx pallasi, Protragelaphus* cf. *skouzesi, Tragoportax* sp. This list reminds of that of Pikermi, and the age of the Bayir member can not be very different from that of the Greek locality, as already suggested by KAYA (1994).

We describe here a fifth Bovid from the same area; it was found in Akgedik-Bayir, at Salihpaşalar (Kemikalan), and perhaps at Örucebağ near Ankara. No name has ever been published for it, but some of the specimens are labelled *Sinotragus wimani* in the Maden Tetkik ve Arama (MTA) Museum, Ankara.

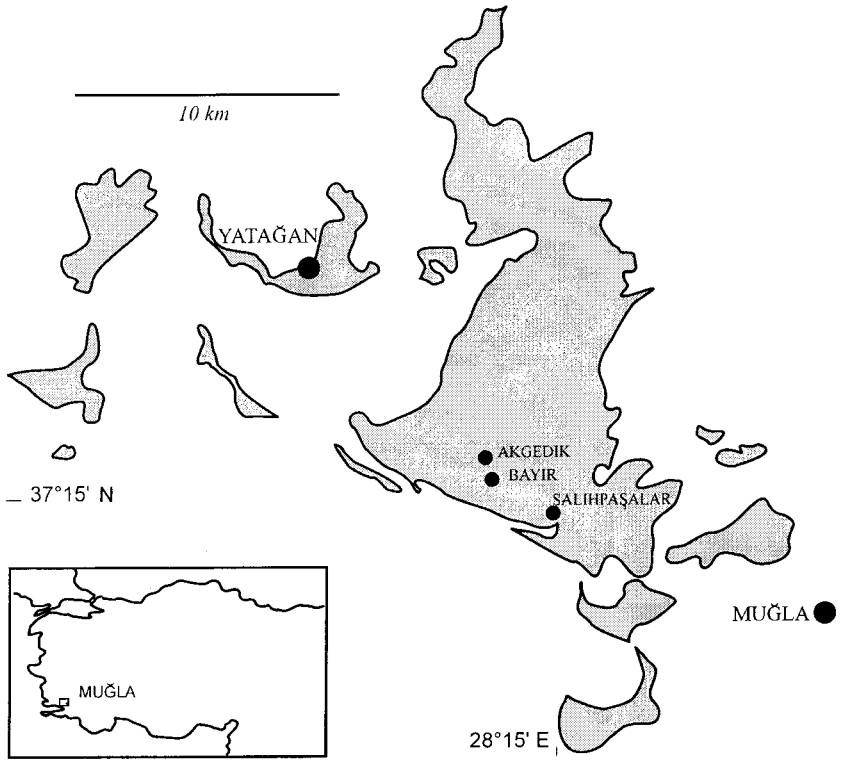

Fig. 1. Map of the Muğla - Yatağan area of Western Turkey, with the extension of the Bayir member of the Yatağan Formation, according to ATALAY (1980).

Systematic description

Genus *Sinotragus* BOHLIN, 1935

= *Prosinotragus* BOHLIN, 1935 ?

Type-species: *Sinotragus wimani* BOHLIN, 1935: 133.

Original diagnosis: „Grosse Antilopen mit sehr kurzen, dicken, homonym gedrehten Hörnern. Der Schädel ist plump mit verdickten Knochen. Die Hörner

können als abnorm entwickelte *Prosinotragus*-Hörner aufgefasst werden", (BOHLIN 1935: 133).

Sinotragus occidentalis n. sp.

Holotype: a relatively complete skull, lacking the anterior part of the muzzle, most of the teeth, and with a poorly preserved cranial base. N° 1894 in the MTA Museum, Ankara.

Type-locality: Yatağan Formation, Bayir member, Akgedik-Bayir area (Muğla). Precise locality unknown.

Derivatio nominis: the species was found almost 8000 km west of the type species.

Diagnosis: a *Sinotragus* about the size of *S. wimani* and *S.? tenuicornis*, but with a narrower skull. Long brain-case. Fronto-parietal suture extremely complicated. Differs from *S. wimani* by its smaller and less expanded horn-cores, with a strong postero-lateral keel, longer cranial basis, shorter temporal fossa, occipital more rounded. The lachrymal is more expanded on the face, the jugal less so. Differs from *S. tenuicornis* by its horn-cores which are more like those of *S. wimani*.

Hypodigm: From the type-locality, there are also the posterior part of a skull with an incomplete horn-core, N°1762 in the MTA Museum, and a frontlet in the Izmir Museum. Two frontlets from Salihpaşalar (Kemikalan) are also in the MTA Museum (N° MYK-75-573 and 580). As there is no doubt that these specimens belong to the same species, they will be described with the type. A few more specimens, of less secure identification, will be described separately.

Descriptions and comparisons: The anterior part of the muzzle is missing in all specimens. An ethmoidal fissure is present, as well as a preorbital depression with a ridge-like upper border. The lachrymal is longer than in *S. wimani*, as it expands farther anteriorly than the jugal, which lacks an upward extension along the orbit (Fig. 2A), in contrast to *S. wimani* (BOHLIN 1935, fig. 108). The orbit is perhaps relatively larger and more circular than

Fig. 2. *Sinotragus occidentalis* n. sp. from Akgedik - Bayir. **A-C:** holotype, MTA 1894. **A:** left lateral view; **B:** antero-superior view; **C:** detail of the fronto-parietal area. **D-E:** MTA 1762. **D:** upper view of the brain-case and base of right horn-core; **E:** occipital view. Scale = 6 cm for A-B, 4 cm for C-E.

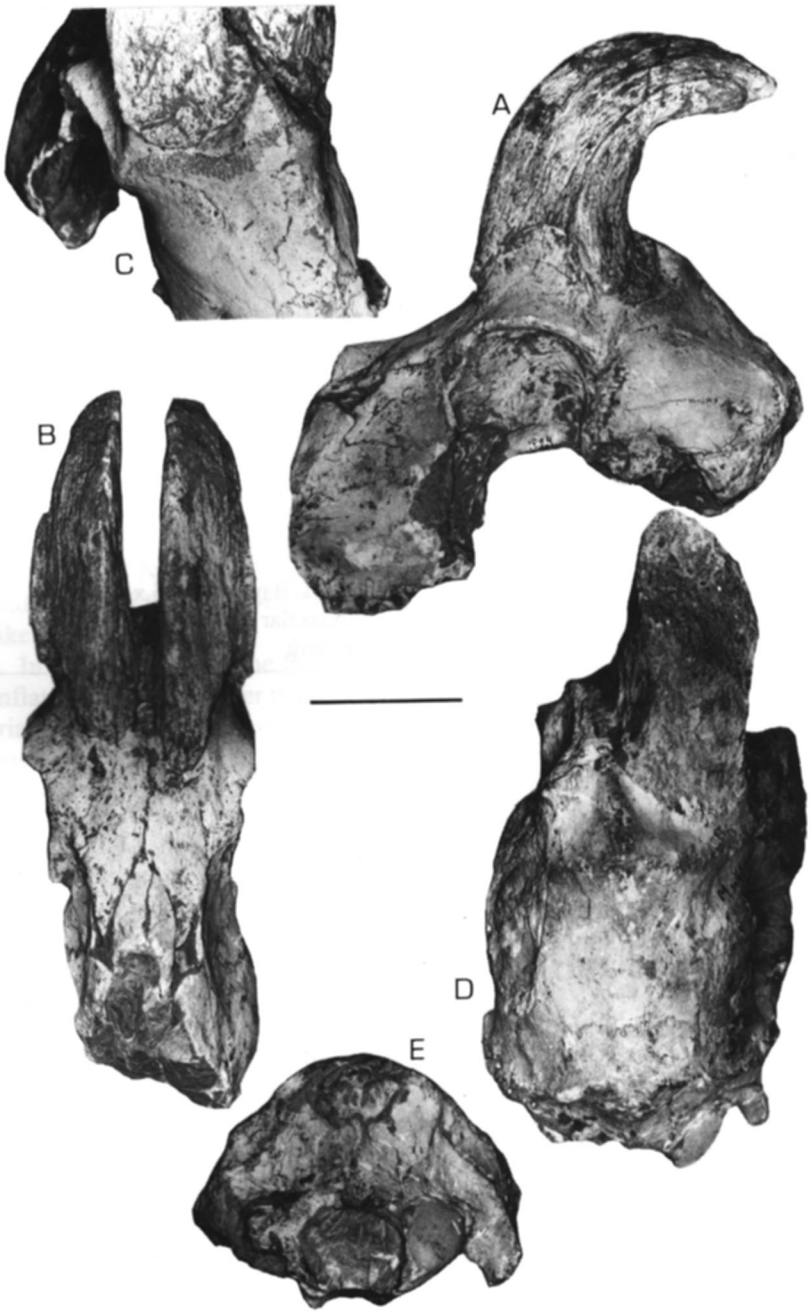

Fig. 2 (Legend see p. 480)

Table 1. Skull measurements of *Sinotragus occidentalis* n.sp.

Number	**1894**	**1762**	**573**	**580**
Length of Frontal (straight line)	107	-		
Length of Parietal (")	50	46		
Length from basion to M3/	≈ 113	89		
Height, from basioccipital to Fronto-Parietal suture	86-	83		
Max. occipital width	-	86.5		
Bi-condylar width	-	≈ 52		
Distance between temporal lines	-	34		
Horn-cores:				
Basal index	72 x 38	-	59 x 48	62 x 43
Pedicle index	55.5 x 31	- x 33.4	51 x 43	48 x 40
Length (straight line)	136	-	134 +	≈ 140
Length (along anterior curve)	165	-	160 +	≈ 175
Max. width over pedicles	71 +	2 x 42	87.5	≈ 87
Min. distance between horn-cores	5.5	7	7	≈ 10

Basal indexes of the ? female specimens:		
	Akgedik-Bayir	48.5 x 31
	Salihpaşalar	41.7 x 29
	Örücebağ	40.3 x 25.9

in *S. wimani*, with a projecting rim. Only two much worn molars remain on the type; they had weak or absent basal pillars, and they cannot be distinguished from those of *S. wimani*, which are rather variable (BOHLIN 1935: 148).

The supra-orbital foramina are small, and almost roofed over by an anterior expansion of the horn-core. The frontal bone is thick, but there is a single large sinus at the base of the horn pedicle. The inter-frontal suture is clearly visible, and the area just anterior to the parietal is raised and pinched transversely so as to produce a characteristic hump just behind the horn-cores (Fig. 2C). BOHLIN (1935) mentioned a similar feature in *S. wimani*. There is no post-cornual fossa. The fronto-parietal suture is extremely complicated, especially laterally (Fig. 2C), perhaps more so than in any other Bovid. According to BOHLIN (1935), the fronto-parietal suture

of *S. wimani* is "fast gerade" (not curved). Furthermore, the lateral part of the suture was probably overlapped by the basal horn-core expansion in *S. wimani*.

The braincase is strongly inclined in respect to the facial axis. The temporal lines are weak. The occipital is more regularly rounded than that of *S. wimani* and the mastoid exposure is not so broad (Fig. 2E). The basioccipital has almost no anterior tuberosities, being transversely convex at this level. The tuberosities are stronger in *S. wimani*, with a central groove. The temporal fossa is extremely short, being broader than long on N° 1762, which is not deformed.

The horns are inserted uprightly and close together (Fig. 2B). On N° 1762, which we interpret as juvenile, there is a distinct pedicle, but on N° 1894, which is old (as shown by the teeth), the external rugose part of the horn-core has grown downwards, tending to cover the supra-orbital foramina, and to spread out on the posterior part of the frontal (Fig. 2C). The horn-cores are less massive at the base than those of *S. wimani* and they do not taper so quickly, but they have a similar course, being almost parallel and strongly curved backwards. Torsion is absent on the holotype and on N° 75-573, not detectable on N° 1762 which is incomplete, and weak, of the *Oioceros* type, on N° 75-580, which is the most *wimani*-like.

In N° 75-580 only, the front part of the base of the horn-core is somewhat inflated and pitted rather than grooved. The section at the base is more or less triangular, sometimes very clearly so, with a medial face which is slightly posterior and becomes more so upwards, an antero-lateral surface which becomes more anterior (topographically, superior) and a posterolateral one which becomes more lateral (topographically, infero-lateral). The anterior keel is not distinct basally, but becomes sharp upwards, as in *S. wimani* (BOHLIN 1935, fig. 118). The postero-lateral keel is stronger, and even ridge-like on the type and on N° 75-573; on these specimens, it is even expanded as a lateral flange in the basal part of the horn-core. There is no postero-lateral keel in *S. wimani*.

Female specimens ?

A few other specimens are doubtfully referred to *S. occidentalis*. They are much different from the specimens described above, and if they are really of this species, they must be juvenile, or more probably female. There is a frontlet from Akgedik-Bayir, N° 67 in the Fen Fakültesi, Ankara, a horn-core N° 13 from Salihpaşalar in the Izmir Museum, and a horn-core from Örücebag in the Dil ve Tarih Coğrafya Fakültesi, Ankara, N°ÖB-48. Nothing of the skull is visible. The horn-cores are smaller than those

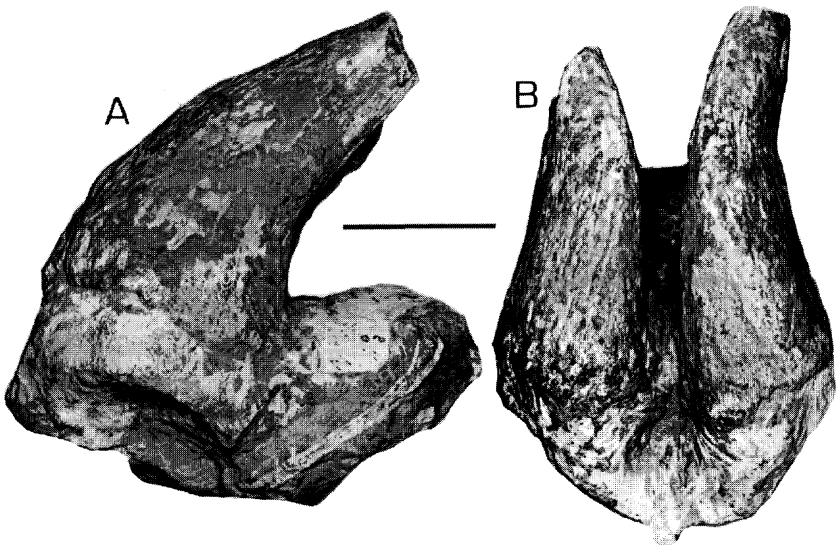

Fig. 3. *Sinotragus occidentalis*?, female specimen ? from Akgedik-Bayir. Science Faculty, Ankara. A: left lateral view; B: anterior view. Scale = 3 cm.

described above, stout at the base, but taper quickly upwards, much as in *S. wimani*. They have an oval cross-section, without keels, are transversely compressed, and more convex laterally than medially. They are much curved backwards, and also outwards, and perhaps more clearly twisted. The horn-core from Salihpaşalar has an anterior pitted swelling, like the specimen N° 75-580 above.

These horn-cores come from the same strata as those of *S. occidentalis*. They share only a few features with them, but these features are unusual among Late Miocene Bovids, and they cannot be referred to any other known genus. Their cross-section, by which they differ from *S. wimani* and from (the males of ?) *S. occidentalis*, is rather similar to that of *Prosinotragus tenuicornis*, a poorly known species from Loc. 116 of Qansu, China, whose horn-cores are less stout than those of the other species, and which has a semi-circular occipital, like that of *S. occidentalis*. The possibility that *S. tenuicornis* is indeed the female of *S. wimani* could also be considered, since there are only two identifiable specimens of the latter species at Loc. 30, and one of the former at Loc. 116.

Phylogenetic relationships of *Sinotragus*

SOLOUNIAS (1981) referred *Samotragus crassicornis* SICKENBERG, 1936 from Samos to *Sinotragus*, thereby sinking the former genus into the latter. Both taxa share a face strongly inclined on the cranial axis, a raised mid-frontal suture, and the direction of horn spiralling, but the latter is only incipient in *Sinotragus*, while it is very strong in *S. crassicornis* as in the *Oioceros-Samotragus* complex. The cross-section is also much different, with a flattened medial side in *Sinotragus* from China and Muğla, instead of a more rounded cross-section with a flattened antero-lateral side in *S. crassicornis*. In our opinion, these genera are only distantly related.

BOHLIN (1935) considered that *Sinotragus* was related to *Protoryx*, and this opinion was also held by GENTRY (1971: 243). The main characters shared by the two groups are:

- large size;
- strong cranio-facial flexure;
- horns almost parallel at the base, curved backwards;
- sinus in the pedicle;
- complicated fronto-parietal suture.

BOHLIN also noticed that the rectangular lachrymal bone of *S. wimani* is similar to that of his ? *Protoryx planifrons*.

However, the lachrymal of *S. occidentalis*, as well as those of other *Protoryx* species, are different. The other above-mentioned features are not exclusive of these groups; thus, they are not very convincing to establish a close relationship.

Unfortunately, other hypotheses of relationships are perhaps still less satisfactory:

- the triangular cross-section of the horn-cores (especially on the holotype of *S. occidentalis*) and some other minor characters suggest affinities with the Bovinae, but the rest of the skull is so different that this relationship is very unlikely;

- the narrow skull, strong cranio-facial flexure, and short stout horns are like the Ovibovines, but it now appears that this group might well be polyphyletic, if not a waste-basket (GENTRY & HEIZMANN 1996; GENTRY et al. 1998). In any case, the teeth of *Sinotragus* are rather different from those of the Upper Miocene so-called Ovibovines, and its horn-cores are made of compact bone, while those of the Ovibovines are usually cancellous.

The Middle Asiatic province

It should perhaps first be mentioned that SOLOUNIAS (1981) referred to *Prosinotragus* "a minute horn-core" from the Vallesian of Tunisia, probably the one illustrated by ROBINSON (1986, fig. 10). The specimen is, however, undiagnostic.

In China, *Prosinotragus* and *Sinotragus* are known only from Loc. 116 (Qansu) and Loc. 30 (Shanxi). Both localities have yielded faunas of open character, that KURTÉN (1952) called the "dorcadoides"-fauna, from the specific name of its dominant gazelle. According to this author, this open environment extended, in the Late Miocene, as far as Turkey and the Black Sea, while Europe and the south-western part of China were more forested. Even though this model has been refined, it remains basically correct. BERNOR (1984) called the Sub-Paratethyan province an area extending from Northern China to Turkey, including also the Balkans. However, in the Balkans the few characteristic large Mammal taxa of this province are quite rare or absent.

One of them is the Rhino *Chilotherium*. There are a few records outside this area, but almost always without description; since fragmentary remains could easily be confused with other Rhinos, these few records can be taken as dubious, at best. The only one worth to be considered is that of *Ch. intermedium* from the Dhok Pathan of Pakistan (HEISSIG 1972), but this species is very different from typical species of the genus by its narrow mandibular symphysis and it certainly had a different ecology.

A second one is the Giraffid *Samotherium*, whose African records (ARAMBOURG 1959; CHURCHER 1974) are probably erroneous. Among Bovids, the only previous markers of this province were the Ovibovines *Plesiaddax-Urmiatherium*, known from Baode (Loc. 30) as well as from Turkey (KÖHLER 1987), Maragheh in Iran (MECQUENEM 1924) and Injana in Iraq (BOUVRAIN et al. 1995). *Sinotragus* can now be added to this list of taxa with a wide Asiatic range, but which are probably absent from the southern part of this continent, and from Europe and Africa.

It should be noted that hominoid primates are absent from the sites which have yielded this typical association. It may be because all of them post-date the extinction of hominoid primates in the area, but ecological differences between contemporary faunas cannot be dismissed.

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