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On some spiral-horned antelopes (Mammalia: Artiodactyla: Bovidae) from the Late Miocene of Turkey, with remarks on their distribution

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With 3 figures

Zusammenfassung: Die Untersuchung von Material aus einigen Aufsammlungen an mehreren türkischen Obermiozän-Lokalitäten ermöglichte erstmals die endgültige Bestimmung und Beschreibung spiral-gehörnter Antilopen dieses Landes: *Palaeoreas lindermayeri*, *Protragelaphus skouzesi*, *Prostrepsiceros zitteli* und *Nisidorcus* sp. Mehrere endemische Arten sind während des tiefen Obermiozäns auf Zentral-Anatolien beschränkt; im höheren Obermiozän treten in stärkerem Maße weitverbreitete Taxa auf. Dieser Wechsel weist auf eine Abnahme des Provinzialismus in diesem Gebiet hin.

Abstract: Examination of some collections from several late Miocene Turkish localities allows us to describe and definitely identify for the first time several species of spiral-horned antelopes in this country: *Palaeoreas lindermayeri*, *Protragelaphus skouzesi*, *Prostrepsiceros zitteli* and *Nisidorcus* sp. During the first part of the late Miocene, several endemic species are restricted to central Anatolia, while more widespread taxa appear in the later part of this period, suggesting a decrease in provinciality of this area.

Introduction

Although a great number of late Miocene localities have been reported from Turkey (OZANSOY 1951, 1957; SENYÜREK 1952, 1953; TEKKAYA 1973, 1974 a, 1974 b, 1975; SICKENBERG et al. 1975; SEN 1994), knowledge of the mammalian faunas of this age is still scrappy, if compared with that of neighbouring countries like Greece. We believe that the main reason is that most of the former excavations in Turkish sites were directed towards collecting of many fossils rather than of good specimens, resulting for instance in an almost complete lack of bovid skulls. However, thanks to their rather distinctive horn-cores, spiral-horned antelopes can be identified with reasonable accuracy. Examination of some previously unpublished material allows us to update the list of their occurrences in Turkey, and to draw some conclusions about their chronological and geographic distribution.

Systematic description

Genus *Palaeoreas* GAUDRY 1861

The genus *Palaeoreas* is chiefly known from the Greek mainland, with *P. lindermayeri*, the type-species (WAGNER 1848; GAUDRY 1862–67; MELENTIS 1968; BOUVRAIN 1980) and *P. zouavei* BOUVRAIN 1980. According to GENTRY (1971), *P. lindermayeri* is also present at Samos, but the frontlet figured by this author (GENTRY 1971: pl. 16, fig. 1) is rather different from the Pikermi specimens.

Palaeoreas sp., cf. *P. lindermayeri* (WAGNER 1848)

A well-preserved frontlet (Fig. 1 F–H) labelled Es5 in the Musée Guimet d'Histoire Naturelle, Lyon, was presented by YALCINLAR in 1949. It comes from Esme, where YALCINLAR excavated in 1946 the sites now known as Kemiklitepe (SEN 1994). They consist of two main fossiliferous layers: Kemiklitepe A–B which has yielded a fauna equivalent in age to the middle Turolian and the stratigraphically lower Kemiklitepe–D (KTD) with a fauna probably contemporaneous with the lower Turolian. The facies of the above-mentioned Es5 frontlet perfectly matches that of the KTD material, and there is little doubt that it belongs to this lower faunal assemblage.

The horn-cores diverge by an angle of about 35°. They are tightly twisted on their axis (about 4/3 of revolution), without any opening of the spiral. A strong postero-external keel starts above the post-orbital bar, but does not continue onto the pedicle. The anterior keel is also strong, prominent and rounded at the base, but becomes acute higher up. These strong keels are responsible for the apparent transverse compression of the section. The post-cornual fossa is small and deep; the pedicle is short, but the frontals are raised above the orbits. The supra-orbital



Fig. 1. – **A-C:** Bovidae gen. et sp. indet., aff. '*Palaeoreas elegans*', frontlet from Çorak Yerler, DTCF, Ankara. A: anterior view; B: medial view of right horn-core; C: lateral view of left horn-core. **D-E:** *Nisidorcas planicornis* (PILGRIM 1939)?, left horn core from Çoban Pinar, MTA Museum, Ankara, n° 1261. D: medial view; E: anterior view. **F-H:** *Palaeoreas* cf. *lindermayeri* (WAGNER 1848), frontlet Es5, most probably from Kemiklitepe-D, Musée Guimet, Lyon. F: posterior view; G: anterior view; H: lateral view. – All specimens 0.5 natural size.

pits are small, and they open in wide depressions close to the midline. The area of the inter-frontal suture is raised, but the suture itself is not visible. One cannot tell whether the frontal bone was hollowed or not. Some measurements are (in mm):

basal index: 44.5×37.5

width over external side of pedicles: 86.5

distance between centres of supra-orbital pits: 31.5.

Most of the above-mentioned characters of this frontlet match those of *P. lindermayeri*, except perhaps the shortness of the pedicles, the frontals being more bent and the horn-cores farther away from the orbits and from the supra-orbital foramen at Pikermi. In any case, the Es5 frontlet is quite different from the ? *Palaeoreas* cf. *elegans* that BOUVRAIN (1994) described from KTD; it is therefore a new addition to the KTD faunal list, which increases the similarity of this fauna to that of the middle Turolian of Pikermi, although the KTD frontlet looks more primitive. The anterior keel is also stronger than in most Pikermi specimens in the Paris Museum, where this keel is usually rather weak near the base. *P. asiaticus* KÖHLER 1987, from Garkin, considered as probably identical with *P. lindermayeri* by GENTRY & HEIZMANN (1996) is perhaps more similar to the KTD frontlet but smaller. All these forms are undoubtedly closely related.

'*Palaeoreas*' *elegans* OZANSOY 1965

From the Sinap Formation of Turkey, OZANSOY (1957, 1965) and TEKKAYA (1975) described *P. elegans* and *P. brachyceras*. Both names (which remained nomina nuda until 1965) are almost certainly synonymous and TEKKAYA himself (1975: figs. 1-6) confused them. Unfortunately, only horn-cores and frontals are known. BOUVRAIN (1980, 1994) raised doubts about the belonging of this species to *Palaeoreas*. GENTRY & HEIZMANN (1996) noticed the similarities of its horn-cores with those of *Prostrepsiceros zitteli*. Besides Sinap, *Palaeoreas elegans* was described by KÖHLER (1987) from Çorak Yerler, and BOUVRAIN (1994) called ?*Palaeoreas* cf. *elegans* the material from Kemiklitepe-D. Ongoing excavations at Çorak Yerler, directed by one of us (E.G.) have already provided some more material of this species, which confirms the specific heterogeneity of the populations from these 3 localities, first suggested by BOUVRAIN (1994). After comparing them, she reached the conclusion that the Çorak Yerler and KTD populations

are probably co-specific but distinct from the Sinap species. To the list of similarities between the two former populations, we may add the greater divergence of the horn-cores, as shown by a well-preserved frontlet from Çorak Yerler (Fig. 1A-C), suggesting that the one figured by KÖHLER (1987: fig. 93) may have been crushed. However, the Çorak Yerler '*Palaeoreas*' differs from the KTD one by its weaker torsion, weaker spirallisation and smaller supra-orbital pits which are farther away from the orbits, and they must also be of two different species, whose belonging to the genus *Palaeoreas* is poorly supported. As to the Sinap horn-cores, their characters may be considered as primitive, as suggested by BOUVRAIN (1994), but none of them implies any relationship with *Palaeoreas*.

Genus *Protragelaphus* DAMES 1883

This genus is mainly known through *P. skouzesi* DAMES 1883, a species with a wide geographic range, since it is known in Pikermi, Samos and Maragheh (WEITHOFER 1888; DE MECQUENEM 1924; ANDREE 1926; GENTRY 1971). However, its only previous mention in Turkey, where its occurrence might be expected, is at Ilhan near Ankara, where THENIUS (1949) mentioned it without figure or description. In any case, the occurrence of this species, or of a closely related one, in Turkey, is demonstrated by several specimens in the MTA (Maden Tetkik ve Arama) Museum, Ankara. These are a horn-core n° 1538 from Bayir near Mugla, several horn-core fragments from Gülpınar (but we could not find the horn-core figured by TEKKAYA in 1973 as *Palaeoreas lindermayeri*), and some others from Serefköy, also near Mugla.

The horn-cores are slightly compressed transversely, mainly because of the strong postero-lateral keel, but there is no anterior keel. Torsion is strong but the horn-cores have an almost straight axis, without open spiralling, as in *Protragelaphus* and *Ouzocerus* BOUVRAIN & DE BONIS 1986. These isolated horn-cores cannot be distinguished from those of *P. skouzesi*, except perhaps by their slightly smaller size, and we refer them confidently to this species.

Basal dimensions of the most complete specimens are (in mm):

1538 Bayir	38 × 38 (Fig. 2F-G)
ÇAG-818 Gülpınar	38 × 30.5 (Fig. 2C)
MYS Serefköy	40.7 × 34
Mean of 5 <i>P. skouzesi</i>	45.4 × 37.1 (Maragheh, Pikermi; GENTRY 1971).

There is also a horn-core with part of the frontal n° 1923 from Manisa (Fig. 2D-E; precise locality unknown); its basal dimensions are 47×39.5 . The supra-orbital foramen and postcornual fossa are unfortunately missing. This partial frontlet has little divergent horn-cores (about 35°) which are twisted on their axis, but without any spiralling; the frontals are hollowed, the sagittal suture is raised but not fused, and the pedicle is short, with the



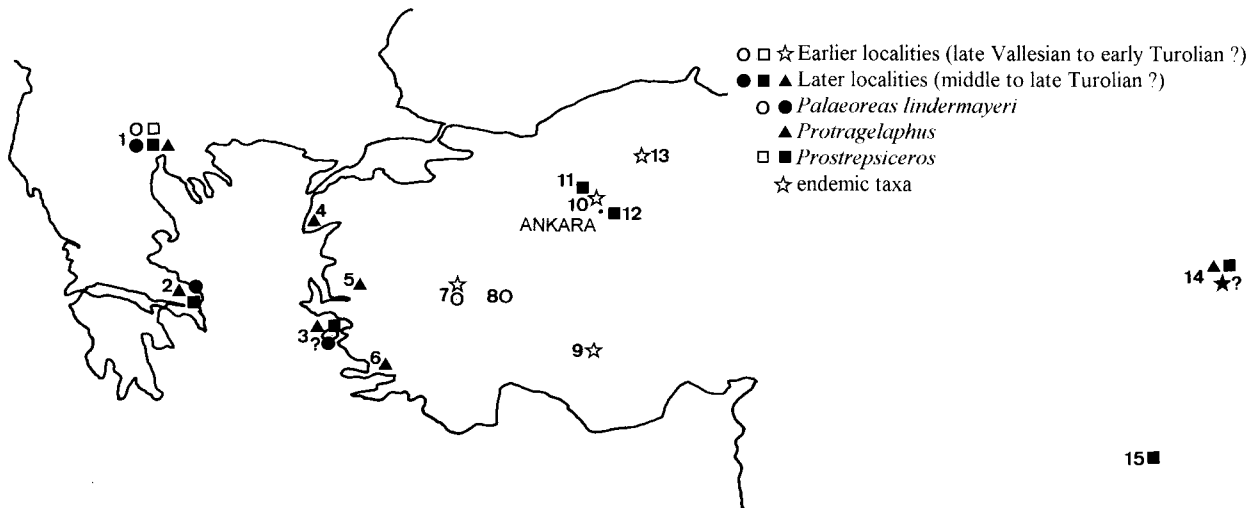


Fig. 3. Distribution of the taxa discussed in the text, in Turkey and neighbouring areas. – 1 = Thessaloniki; 2 = Pikermi; 3 = Samos; 4 = Gülpınar; 5 = Manisa; 6 = Muğla; 7 = Kemiklitepe; 8 = Garkın; 9 = Kayadibi; 10 = Sinap tepe; 11 = Kavakdere, Çoban Pınar; 12 = Gökdere; 13 = Çorak Yerler; 14 = Maragheh; 15 = Jebel Hamrin.

horn-core close to the orbit. The smaller divergence of the horn-cores, and their less posterior insertion, are differences from *P. skouzesi*, but similarities with *Ouzocerus* from Greek Macedonia and perhaps Maragheh (BOUVRAIN & DE BONIS 1986: 664). However, both species of this genus, *O. gracilis* BOUVRAIN & DE BONIS and *O. pentalophosi* BOUVRAIN 1997, are smaller, their frontals are not hollowed, and their horn-cores often have an anterior keel. The frontlet from Manisa could be of a species different from *P. skouzesi*.

Genus *Prostrepsiceros* MAJOR 1891

The genus is well known from Greece to Iran, but it has seldom been mentioned in Turkey. SENYÜREK (1952) figured two horn-cores from Gökdere (Elmadag) as *P. rotundicornis*; although we have not seen his material, his identification looks correct; some more horn-cores from Elmadag in the Dil ve Tarih Coğrafya Fakültesi (DTCF), Ankara, although poorly preserved, are probably also of this species.

Prostrepsiceros zitteli (SCHLOSSER 1904)

KAPPELMAN et al. (1996) cite *P. zitteli* at Kavakdere, but without providing details on the material upon which this identification is based. Whatever it may be, the MTA

Museum displays a well-preserved frontlet, n° 2370 (Fig. 2A-B), which establishes beyond doubt the occurrence of *P. zitteli* at this locality.

The horn-cores, inserted directly above the orbits, diverge by about 40°. Spiralling is more open than in *Palaeoreas* or *Protragelaphus*, but less so than in most *Prostrepsiceros*, the axis of revolution remaining inside the horn-core. Horn-cores are strongly twisted (about 3/2 revolutions) and rather short. Their cross-section is slightly compressed near the base, without any posterior or postero-lateral keel, but with a strong antero-medial one. Only a part of the frontal is preserved, but it seems that it was bent along the sagittal line. Supra-orbital foramina are large, and open directly into the orbit, suggesting that there was no frontal sinus, and there is no postcornual fossa either. Some dimensions are (in mm):

basal index: 31.5 × 28
width over external side of pedicles: 88
distance between centres of supra-orbital pits: 40.

These characters agree quite well with those of the *Prostrepsiceros* frontlet from Samos upon which SCHLOSSER (1904: pl. 3, fig. 5) founded the species *Protragelaphus zitteli*. *Prostrepsiceros woodwardi* PILGRIM & HOPWOOD 1928, known by a skull, also from Samos, has similar horn-cores, and this name is probably a junior synonym of *P. zitteli*. Both taxa were included in *P. houtumschindleri* by GENTRY (1971) and SOLOUNIAS (1981) as a distinct 'variety', but *P. zitteli* was considered worth a specific distinction by BOUVRAIN (1982, 1992) and by GENTRY & HEIZMANN (1996). BOUVRAIN also described *P. zitteli* from several localities near Thessaloniki, especially from the early Turolian of Ravin des Zouaves-5 (BOUVRAIN 1982: figs. 4-5). This latter form has very slender, openly spiralled horn-cores, and the skull is little bent, in contrast to *P. woodwardi* (PIL-

Fig. 2. – A-B: *Prostrepsiceros zitteli* (SCHLOSSER 1904), frontlet from Kavakdere, n° 2370. A: anterior view; B: antero-lateral view. C: *Protragelaphus* cf. *skouzesi* DAMES 1883, incomplete horn-core from Gülpınar, n° ÇAG-818. D-E: *Protragelaphus* sp., horn-core from Manisa, n° 1923. F-G: *Protragelaphus* cf. *skouzesi* DAMES 1883, horn-core from Bayir, n° 1538. – All specimens in the MTA Museum, Ankara; 0.5 natural size.

GRIM & HOPWOOD 1928: pl. 7, fig. 1; also GENTRY 1971: pl. 5, fig. 3), and it is perhaps hard to include it in the same species as *P. zitteli* / *P. woodwardi* if these names are really synonymous. BOUVRAIN & THOMAS (1992), mainly using the Ravin des Zouaves-5 material as reference, also included in *P. zitteli* a skull from Jebel Hamrin, Iraq. Again, the slightly bent skull, slender and openly spiralled horns with increasing divergence at the base, are rather different from the Samos material, but more like the Maragheh one. We believe that Kavakdere provides the strongest evidence of *P. zitteli* outside Samos and probably Veles in Macedonia (CIRIC 1957).

Genus *Nisidorcas* BOUVRAIN 1979

This genus was founded by BOUVRAIN (1979) upon *Antilope planicornis* PILGRIM 1939 from Perim island in India. She also referred to it good materials from Vathylakkos-2 and Ravin des Zouaves-5 near Thessaloniki, plus the Kayadibi frontlet (Ka4-1895 in MTA Museum) upon which TEKKAYA (1969) had founded the species *Antilospora incarinatus*. More material from the latter locality was also included in ? *Nisidorcas planicornis* by KÖHLER (1987). There are indeed a number of similarities between the Macedonian and Kayadibi horn-cores, but the latter are less widely separated at the base, they are more openly spiralled instead of being twisted on their axis, the supra-orbital foramina are of medium size on TEKKAYA's type, and "recht gross" on KÖHLER's material instead of "très petit" in Greece. Thus, we prefer to retain *Nisidorcas* ? *incarinata* as a distinct species.

The only Turkish specimen that could, in our opinion, belong to PILGRIM's species is a left horn-core from Çoban Pinar (n° 1261 in MTA Museum; Fig. 1D-E). It is slender, almost straight, very weakly twisted, with a slightly compressed cross-section, and weak postero-lateral keel and grooves. It is probably the basis of OZANSOY's (1965) mention of *Palaeoreas lindermayeri* at this site.

Conclusions

The specimens described above are certainly too few to draw general conclusions. It seems, however, that two main groups of localities can be distinguished, both on geographic and chronological grounds. Earliest localities, probably contemporaneous with the late Vallesian and early Turolian of Europe, include the lowest localities of Middle Sinap, and probably Çorak Yerler, Kayadibi, Garkin and Kemiklitepe-D. They are all located in the Anatolian highlands (Fig. 3), and have several species of endemic spiral-horned antelopes: '*Palaeoreas*' *elegans* and its relative from Çorak Yerler, *Antilospora* ? *incarinata*, *Sinapodorcas* (BOUVRAIN, SEN & THOMAS 1994). Only to the West (KTD, Garkin) occurs a species related to *Palaeoreas lindermayeri* of Greece. Later localities have a different bovid fauna. Those along the western coast have yielded *Protra-*

gelaphus, well known in Greece and also in Maragheh, but still absent from Central Turkey. However, two species of *Prostrepsiceros* are shared between central Anatolia and neighbouring areas. In the latest part of the Miocene, several species have a wide range, and there is no longer any evidence of endemic species of spiral horned antelopes in Turkey.

It seems, therefore, that, at least in Central Anatolia, a decrease of provinciality took place during the 'Turolian'. Further studies will have to confirm it, or to extend it to other groups of bovids and mammals.

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