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Denis Geraads, Nikolai Spassov, Dimitar Kovachev. A new *Sporadotragus* (Bovidae, Mammalia) from the late Miocene of Bulgaria. *Rivista Italiana di Paleontologia e Stratigrafia*, 2006, 112 (3), pp.473-479. halshs-00157494

HAL Id: halshs-00157494

<https://shs.hal.science/halshs-00157494>

Submitted on 26 Jun 2007

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A new Sporadotragus (Bovidae, Mammalia) from the late Miocene of Bulgaria

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Key-words: Mammalia, Bovidae, systematics, late Miocene, Turolian, Bulgaria, Balkano-Iranian province

Riassunto:

Abstract: We provide a systematic revision of the late Miocene caprine genus *Sporadotragus* Kretzoi, 1968, the type-species of which was described from Samos under the specific epithet *schafferi*. It is distinct from the poorly known *Pseudotragus*. Some specimens from Samos are rather distinctive, but the whole morphological variation there encompasses that of *Palaeoryx parvidens* from Pikermi, and we follow earlier authors in considering the two names as synonymous. New material from two late Miocene localities of south-western Bulgaria, Kalimantsi and Strumyani, is referred to a new species, *S. vasilii*, which is more primitive than the Greek one in some skull features, but not in the horn-core morphology.

Introduction

Around the village Kalimantsi in south-western Bulgaria, in the lower valley of the Struma River, several localities have yielded rich late Miocene faunas of Turolian age, which have been partly re-studied under the direction of one of us (N.S.). The main fossiliferous sites, except Kalimantsi-1 (perhaps of early Turolian age), are roughly contemporaneous with Pikermi in Greece. The bovid fauna includes *Tragoportax* cf. *amalthea*, *Miotragocerus* (*Pikermicerus*) *gaudryi* cf. *gaudryi*, *Gazella* sp., *Palaeoreas lindermayeri*, *Prostrepsiceros* cf. *houtumshindleri* and *Oioceros* sp. (Geraads et al. 2003; Spassov et al., 2004; Spassov et al., in press, and our unpubl. observations). More to the North, in the same valley, the locality Strumyani (with two sub-contemporaneous fossiliferous sites) was recently found and excavated by us, but its fauna is not yet fully studied. From these two localities, we here describe another bovid species, which belongs to a genus previously known from a few Turolian sites of the Eastern Mediterranean, but the systematics of which was not clear.

Abbreviations: BMNH = Natural History Museum, London; MCGL = Musée cantonal de Géologie, Lausanne; MNHN = Muséum National d'Histoire Naturelle, Paris; NHMW = Naturhistorisches Museum Wien; NMNHS = National Museum of Natural History, Sofia; NMNHA = Paleontological Museum - Assenovgrad, division of the National Museum of Natural History, Sofia; PIUM = Geologisch-Palaeontologisches Institut und Museum, Universität Münster; SMF = Senckenberg Museum, Frankfurt. L = length; W = width.

Systematic paleontology

Order **Artiodactyla** Owen, 1848

Sub order Ruminantia Scopoli, 1777

Family Bovidae Gray, 1821

Genus *Sporadotragus* Kretzoi, 1968

= *Microtragus* Andree, 1926: 150 [non *Microtragus* White, 1846 (Coleoptera)]

Type-species. *Microtragus schafferi* Andree, 1926: 150.

Diagnosis (partly from Solounias 1981). A caprine of rather small size; supra-orbital pits small; ethmoidal fissure absent or vestigial; pre-orbital fossa small, mostly restricted to the lachrymal bone. Choanae far behind M3. Braincase long, its upper profile rounded, basioccipital rather square, with broad but not very prominent anterior tuberosities; bulla medio-laterally compressed. Horn-cores long, moderately divergent, curved backwards, without torsion, not very compressed transversely, with flattened medial surfaces and sometimes an incipient antero-medial keel and often with a flattened anterior surface almost in the same plane as the frontals. Teeth less caprine-like than in *Pachytragus*, metacone of upper molars convex, metastyle of M3 expanded.

Sporadotragus parvidens Gaudry, 1861

Palaeoryx parvidens Gaudry, 1861: 241.

Microtragus schafferi Andree, 1926: 150.

Sporadotragus parvidens (Gaudry): Solounias 1981.

Holotype. Incompletely preserved skull, lacking the distal part of the horn-cores, and transversely compressed. MNHN-PIK-2453.

Type-locality. Pikermi.

Other localities. Samos, Molayan ?

Diagnosis. Face short, strongly angled on basicranium, front of orbit above M3, sutures complex, mid-frontal suture elevated. Braincase making an obtuse angle with the occipital, occipital often low and broad. Horn cores large relative to skull size and with smooth surface.

***Sporadotragus vasili* n. sp.**

Pl.1, Figs.1-3

Holotype. Incomplete skull K-5146.

Repository. NMNHA (Pl.1, Fig.3).

Type-locality. Kalimantsi, south-western Bulgaria.

Age. Late Miocene (Turolian Mammalian age).

Referred material. About 10 specimens (list: table 2), the best of which are K-55612 (Pl.1, Fig.1 and Pl.2, Fig.2) and K-5147 (Pl.1, Fig.2), from the upper Kalimantsi horizons, probably of middle Turolian age, all kept in NMNHA; FM-2026 from Strumyani-1 (perhaps early Turolian age; Spassov et al., in press), housed in NMNHS.

Derivatio nominis. Dedicated to Vasil Ashminov our host and friend in Kalimantsi.

Diagnosis. Braincase less angled on the face than in *S. parvidens*; face longer and dorsal profile less concave. Mid-frontal and parieto-frontal sutures fused in adults. Horn-cores smaller, less curved, with strong longitudinal grooves, with a flattened anterior surface, and an incipient antero-medial keel.

Description of the material from Kalimantsi and Strumyani

K-5146 (Pl.1, Fig.3) is an incomplete skull, without premaxilla and braincase. Only the posterior tips of the nasal bones are preserved. They form an acute point. The frontal bones are large. They are inflated in the supra-orbital area, and were probably hollowed by sinuses. They are intimately fused along the sagittal line, and the suture is no longer traceable. The supra-orbital pits are small and moderately wide apart. The poorly delimited ante-orbital fossa is restricted to the upper part of the face. The horn-cores are moderately curved backwards, but almost straight in anterior view; they diverge at an angle of about 25°, which slightly decreases towards the tip. Their most characteristic feature is the cross-section: it is not very compressed transversally, has a flat medial surface, a broad anterior surface that is only slightly convex, and an antero-medial keel between them. Measurements are given in Tables 1 and 2.

We refer to the same species an almost complete skull with the base of the right horn-core preserved, but nothing of the left one, K-55612 (Pl.1, Fig.1). The face, frontal, and cross-section of the horn-core match those of the former specimen. The well-worn molars are the only preserved teeth. The protocone is angular and the labial face of the metacone is convex; the metastyle of M3 is somewhat expanded. Compared to the size of the face, the neurocranium is broad and long; its upper profile is convex, and makes an angle of about 100° with the occipital, which is semi-circular. The braincase is not much angled on the face, but the skull may have suffered some dorso-ventral compression. The basi-occipital is short and broad, with widely spaced but low anterior tuberosities. In ventral view, the bulla is kidney-shaped, strongly compressed transversally.

K-5147 (Pl.1, Fig.2) is a frontlet from Kalimantsi-Prehvarloka, with the same features.

FM-2026 from Strumyani-1 (Pl.2, Fig.1) is again a frontlet with the bases of the horn-cores; the face is strongly inclined on the braincase, but less so than in *S. parvidens*. The preserved parts of the horn cores indicate a slight backward curvature. They have a fully flattened anterior surface and strong longitudinal relief of alternating ridges and grooves as well as a clear antero-medial keel.

Comparisons

The contents and even the validity of the late Miocene genus *Sporadotragus* have been disputed, so that it is useful to re-state the main features of the well-preserved type-specimen of *Microtragus schafferi*, type-species of *Sporadotragus*, from an unknown quarry in Samos, 1911-V-1 in NHMW. These are:

- the small size, compared to the members of the *Protoryx* – *Pachytragus* group;
- the cross-section of the horn-cores, which is very characteristic, and quite unlike that of other late Miocene Mediterranean bovids. There is a flat medial surface, and a poorly convex broad anterior surface, with a keel between them; this is a clear similarity with some modern caprines, such as *Capra ibex*. The main axis of the cross-section, from the keel to the postero-lateral angle, is thus strongly angled with respect to the sagittal plane;
- the smooth surface of the horn-cores;
- the broad frontals with small supra-orbital pits and an elevated mid-frontal suture;
- the curved dorsal profile of the braincase, continuing almost without angulation into the occipital. Andree's figure (1926, pl.14, fig.6) is quite incorrect in this regard, as it shows a straight brain-case profile markedly angled on the occipital;
- the very low and broad occipital;
- the broad but low anterior tuberosities of the basioccipital;
- the upper teeth with rather prominent styles, especially the metastyle of M3, but labial walls less flattened, and premolars less shortened (Pl.2, Figs.2-4, and Table 3), than in *Pachytragus*.

Other specimens from Samos, also of unknown stratigraphic origin, display some differences from the type. The most conspicuous ones are the shape and proportions of the occipital, and the shape of the horn-cores cross-section. On skull SMF-M1975, the horn-cores suffered some deformation, but they were certainly only slightly flattened anteriorly, and there is no antero-medial keel. The occipital is even lower and wider than in the type (Pl.1, Fig.4b); there are two large ligament scars on the nuchal crest, on either side of the midline; the mastoid exposure is quite small, and the paroccipital processes are short and stout,

separated from the condyles by shallow depressions (Pl.1, Fig.4a). On this well-preserved specimen, the ventral borders of the pterygoids look almost straight, from the lateral border of the choanae to the medial side of the bulla. The latter is transversally compressed, almost with a ventral keel.

A brain-case with horn-cores, PIUM-130, mentioned by Andree (1926, p.150), also has a very broad and low occipital. On the frontlet SMF-M1971, the horn-cores are clearly flattened anteriorly, and there is a hint of an antero-medial keel. On skull SMF-M1977, the pterygoid wings probably had a straight ventral edge, and the paroccipital processes are stout, as in SMF-M1975, but the occipital is less low and wide. The horn cores are somewhat distorted, but some anterior flattening certainly occurred.

Another braincase from Samos, S1098 in MCGL, is somewhat crushed postero-dorsally to antero-ventrally. It is of slightly larger size, and has a very low and broad occipital, strongly inclined on the fronto-parietal plane. Only the bases of the horn-cores are preserved. The main axis of the cross-section is more oblique than in *Pachytragus*, bringing the antero-lateral surface to an almost anterior orientation, but there is no antero-medial keel. It may not belong to *Sporadotragus*.

While acknowledging that they had not seen its holotype, Pilgrim & Hopwood (1928) included *Palaeoryx parvidens* Gaudry, 1861, from Pikermi, in the same genus as *Microtragus schafferi*. The material from Pikermi is less well preserved than that from Samos.

On the holotype skull (MNHN PIK-2453) of *P. parvidens*, the horn-cores are incomplete, and the skull is transversely crushed, so that several features cannot be reliably ascertained. The horn-cores are not very compressed; they lack an antero-medial keel, but there is some tendency towards flattening of the anterior and medial surfaces. The crushed occipital now looks triangular; it might be distorted but was certainly not very low and broad. The large size of the horn-cores, especially relative to the size of the teeth, is a resemblance to the Samos specimens.

Four more or less complete skulls and a frontlet from Pikermi in the BMNH certainly belong to Gaudry's species. Crushing precludes detailed comparison of the cross-sections, but although the horn-cores lack an antero-medial keel, they have a flattened medial surface and a broadened anterior face, in the same plane as the inter-orbital part of the frontal. On the whole, this frontal part of the skull recalls that of the Samos form, and we take this as a major distinctive feature of *Sporadotragus*. However, none of the Pikermi specimens has the extremely broad and low occipital of some of the Samos skulls (compare Pl.1, Fig.4b and 5b). This is not linked to sexual dimorphism, because (besides the fact that, in this case, all

Pikermi specimens would be female) there is no relation between the shape of the occipital and the size or shape of the horn-cores. Solounias (1981) considered the hornless skull of *Oioceros ? proaries* Schlosser, 1904 to be the female of *S. parvidens*, but this is doubtful because it has a long face, in contrast to *S. parvidens*. Alternatively, one might refer the Samos form to *Sporadotragus schafferi*, and the Pikermi one to *S. parvidens*, but the distinction between both groups is far from being clear-cut, and we prefer to include them in the same species.

The Bulgarian form has horn-cores more like those of the Samos type of *S. schafferi*, but several other features make it clearly distinct. The cranio-facial angle is more obtuse (although FM-2026 from Strumyani is not very different), the inter-frontal suture is closed (not a result of greater ontogenic age, as the type of *S. schafferi* is old), the only known occipital is not very broad (compare Pl.1, Fig. 1d, to Pl.1 Figs.4b-5b), the anterior tuberosities of the basi-occipital are weaker (compare Pl.1, Fig. 1c, to Pl.1 Figs.4a-5a), the posterior end of the nasal bones tapers gently instead of being short and broad, and the horns from Kalimantsi and Strumyani are shorter, less curved, and more deeply grooved. The Bulgarian and Aegean forms share the features that we have taken as characteristic of the genus, the unusual outline of the horn-core cross-section being the most convincing synapomorphy, but the Kalimantsi form is definitely more primitive in its weaker cranio-facial flexion.

Conclusion : contents of the genus *Sporadotragus*

The genus was recognised as distinct by Gentry (1971) and Solounias (1981) who both placed it into the Caprini. Later, the species *parvidens* and *schafferi* were transferred by Köhler (1987) to *Pseudotragus*, a genus erected by Schlosser (1904) for his new species *P. capricornis* from Samos. The lectotype (Pilgrim & Hopwood 1928, p.39; BMNH-M4193), figured by Schlosser (1904, pl.10, fig.7) has elliptical horn-cores, much larger and more compressed (basal index 62 x 38; the cross-section was illustrated by Bohlin 1936, fig.4a) than in *Sporadotragus*, and the basicranial angle is much less bent. We can see no reason for including *parvidens* in the same genus as *capricornis*, the type-specimen of which is so poorly preserved that the name *Pseudotragus* should not, in our opinion, be used for any other specimen.

Köhler (1987) referred some fragmentary specimens from Turkey to "*Pseudotragus*" *parvidens*, but the upper molars have a flat metacone, in contrast to those of *Sporadotragus* (Pl.2, Figs.2-4), and the identification is therefore doubtful. Bouvrain (1994) assigned a few horn-cores from Kemiklitepe-D (Turkey) to the same species but, in contrast to the Aegean

material, the horn-cores are rather small compared to skull size, as inferred from the frontal, which is also less bent (meaning a larger cranio-facial angle). These are both similarities with *S. vasilii*, but the material is too fragmentary for definite identification. Kemiklitepe-D is probably earlier than Kalimantsi, but perhaps closer to Strumyani. The relative chronological placement of all these localities is not known with enough precision to decide whether both species were contemporaneous.

Protoryx tadjikistanica Dmitrieva, 1977, from the Turolian of Sor, shows some resemblances to *Sporadotragus* in the size, strong cranial flexure, short face, and course of the horn-cores. The horn-cores are slightly more compressed, and the illustration (Dmitrieva 1977, fig. 15b) shows lateral flattening and posterior position of the maximum transverse diameter, but the description mentions a flat anterior face. We have not seen the material, but if *P. tadjikistanica* does belong to *Sporadotragus*, it may be closer to the Pikermi variety. *Sporadotragus* is also present in the Turolian of Molayan, Afghanistan; the material is under study by G. Bouvrain.

Paraprotoryx minor Bohlin, 1935 from the Turolian of Baode, China, has horn-cores that are similar in cross-section to those of *Sporadotragus*, but the only known partial skull is larger, the facial angle is significantly more open, the notch between condyle and paroccipital process is deeper, and the bulla is less compressed; still, *Paraprotoryx* might be related to *Sporadotragus*.

Thus, although *Sporadotragus* is a typical component of the Balkano-Afghan province, there are several signs of the occurrence of related forms outside this area, and as far as China. Thus, its distribution is similar to that of a few other late Miocene large mammals, such as the rhino *Chilotherium*, the giraffid *Samotherium* and, among bovids, *Sinotragus* and the *Plesiaddax-Urmiatherium* group (Geraads et al. 2002). All of them are open-country forms, unknown West of Macedonia.

Acknowledgements

We are grateful to those people who gave us access to collections in their care: M. Bertling (Paläontologisches Institut Universität Münster), R. Brocke and J. Oelkers-Schaeffer (Senckenberg Museum, Frankfurt), A. Currant (Natural History Museum, London), G. Daxner-Höck (Naturhistorisches Museum Wien), R. Marchant (Musée Cantonal de Géologie, Lausanne), C. Sagne and P. Tassy (Muséum National d'Histoire Naturelle, Paris), and to M. Böhme, A. Ilg and N. Solounias for their help. Thanks also to D. Kostopoulos and L. Werdelin for helpful comments on the manuscript. The cooperation between the senior

authors is supported by an exchange program between the Bulgarian Academy of Sciences and the CNRS, Direction des Relations Internationales. Survey and excavations were partly funded by the Leakey Foundation for Anthropological Research.

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Caption to plate 1

Fig. 1. *Sporadotragus vasili*, skull K-55612 (formerly labelled K-5145) from Kalimantsi, a: dorsal view of the braincase; b: lateral view; c: ventral view of the cranial base; d: occipital view.

Fig. 2. *S. vasili*, K-5147 from Kalimantsi, anterior view of frontlet.

Fig. 3. *S. vasili*, holotype skull, K-5146 from Kalimantsi, a: cross-section of the right horn-core (reversed); the arrow points anteromedially; b: anterior view; c: lateral view.

Fig. 4. *S. parvidens*, skull SMF-M-1975 from Samos, a: ventral view of the cranial base; b: occipital view.

Fig. 5. *S. parvidens*, skull BMNH-M-10833 from Pikermi, a: ventral view of the cranial base; b: occipital view.

Scale bar = 15 cm for Figs. 2, 3b, and 3c, 10 cm for all others.

Caption to plate 2

Fig 1. *Sporadotragus vasili*, frontlet FM-2026 from Strumyani, a: anterior view; b: left lateral view.

Fig. 2. *Sporadotragus vasili*, upper molar row of skull K-55612 from Kalimantsi.

Fig. 3. *Sporadotragus parvidens*, upper tooth-row of skull SMF-M-1975 from Samos.

Fig. 4. *Sporadotragus parvidens*, upper tooth-row of skull MNHN-PIK-2453 (holotype) from Pikermi.

Scale bar = 10 cm for Fig. 1, 5 cm for Figs. 2-4.

Table 1. Skull measurements of *Sporadotragus parvidens* and *Sporadotragus vasili* n. sp.

| | Bulgaria | | | | Samos | | | | | Pikermi | | | | |
|--|------------|------------|-------------------|----------------|-------------------------|-------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|----------------------|
| | K- 5146 | K- 5147 | K- 55612 ** | Strum. 2026 | NHMW 1911- V-1*** | PIUM 133 | SMF M1975 | SMF M1977 | MCGL 1098 | BMNH 10833 | BMNH 11417 | BMNH 11428 | BMNH 13067 | MNHN 2453 **** |
| L of horn-core along anterior curve | 220 ? | - | - | - | 310 ? | 260 ? | 300? | - | - | - | - | - | - | - |
| Horn-core antero-posterior diameter | 38.5 | 38 | - | 40 | 47 | 52 | 46.8* | 45.3* | 50.5 | 47.3 | 50 | 48.8 | 47.3 | 43.6 |
| Horn-core transverse diameter | 30.5 | 33.2 | - | 30.3 | 38 | 37.5 | 38.6* | 36.8* | 40.5 | 39.4 | 41.7 | 37.2 | 37 | 37 |
| Width over pedicles | 88 | 86.5 | - | 83.5 | 84 | 88 | 95 | - | 98.5 | 100 | - | 91 | 90.2 | - |
| Width over middle of supra-orbital pits | 36 | 33 ? | 37.5 | 36.5 | 40.5 | 40 | 48.3 | - | 45 | 40.6 | 44.4 | 42.5 | 44.5 | - |
| Minimum braincase width | - | - | 66.5 | - | - | 66.5 | 70 | - | 75.5 | - | - | - | - | - |
| Occipital width | - | - | 80 | - | 72.5 | 72.5+ | 78.2 | 75.3 | 88 | 72.5+ | - | 74 | - | 85? |
| Occipital height, from top of fo. magnum | - | - | 37 | - | 30 | 27.5 | 26.3 | 30 | 33 | 34.5 | - | - | - | 36.5 |
| Length from condyle to M3 | - | - | 105 | - | 96 | - | 101 | 96 | - | 92 | - | - | - | - |
| L from front of pedicles to nuchal crest | - | - | 100 | - | ca.133 | 120 | - | 119 | 120 | 108 | - | 107 | - | 114 |
| W over ant. tuberosities of basioccipital | - | - | - | - | 27 | 28 | 33.8 | - | 26.5 | 25.5 | - | - | - | 22+ |
| W over post. tuberosities of basioccipital | - | - | 32.5 | - | 28 | 28 | 30 | - | 29.5 | 32 | - | - | - | - |

* mean of left and right HCs. ** type of *S. vasili* ***type of *S. "schafferi"* **** type of *S. parvidens*

Table 2. Measurements of frontlets and horn-cores of *Sporadotragus vasili* n.sp.

| | K 1129 | K 1133 | K 5148 | K 5149 | K 49182 | K 49187 | K 55614 |
|---------------------------------|-----------|-----------|-----------|-----------|------------|------------|------------|
| A-P-diameter | 36 | - | 40.5 | 36 | 40.5 | 46.5 | - |
| Transverse diameter | 28 | - | 33 | 28.5 | 33 | 35 | - |
| Width over pedicels | - | - | - | - | - | - | 84.5 |
| Width across supra-orbital pits | - | 32 | - | - | - | - | 33 |

Table 3. Occlusal lengths of upper tooth segments of *Sporadotragus parvidens*.

| | Samos | | | | Pikermi | | |
|-------|------------------|--------------|--------------|--------------|-----------------|-----------------|------------------|
| | NHMW 1911-V-1 | SMF M1977 | SMF M1975 | SMF M7870 | BMNH M-11417 | BMNH M-10833 | MNHN PIK-2453 |
| P2-P4 | 28.3 | 28.5 | 28.6 | 29 | 28.2 | - | - |
| M1-M3 | 42.3 | 44 | 42.7 | 42.2 | 40.5 | 45.5 | 41 |