GAZELLOSPIRA TORTICORNIS (AYMARD, 1854) FROM THE LATE PLIOCENE LOCALITY OF SÉSKLO (THESSALY, GREECE)

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ABSTRACT

The locality of Sésklo (E. Thessaly, Greece) has yielded an interesting fossil fauna of Late Pliocene age (MNQ17). The Bovids are the most frequent elements, comprising mainly the genera *Gazella* and *Gazellospira*. The sample of *Gazellospira torticornis* is described in this study. Its morphology and dimensions are typical, showing no considerable differences in comparison to the Western European samples.

Key words: Pliocene, Artiodactyla, Bovidae, *Gazellospira*, Thessaly, Greece.

RESUMÉ

GAZELLOSPIRA TORTICORNIS (AYMARD, 1854) DE LA LOCALITÉ PLIOCÈNE SUPÉRIEUR DE SÉSKLO (THESSALIE, GRÈCE)

La localité de Sésklo a livré une faune intéressante d'âge Pliocène supérieur (MNQ17). Les Bovidés sont les éléments les plus fréquents. Il s'agit principalement de *Gazella* et de *Gazellospira*. L'échantillon de *Gazellospira torticornis* est décrit dans l'article présent. Comparé avec les échantillons d'Europe occidentale, aucune différence morphologique ou dimensionnelle n'est décelable.

Mots-clés : Pliocène, Artiodactyles, Bovidé, *Gazellospira*, Thessalie, Grèce.

INTRODUCTION

The locality of Sésklo (Magnesia, Thessaly, Greece; fig. 1) is situated about 10 km west of the town of Vólos the capital of the Magnesia district. It is located in a basin filled with Neogene fluvio-lacustrine clay sediments. The basement of the basin is formed of metamorphic rocks (peridotites, serpentinites and slates with marble and ophiolite intercalations) that tectonically overlie a formation of Jurassic slates and Triassic–Jurassic marbles (Symeonidis & Tataris, 1983). The clays that fill the basin are red coloured, about 100 m thick and inclined to the SE. Lithologically they are very uniform, with some pebble intercalations in the uppermost layers.

A part of the basin is used by the local cement industry as a clay pit. It was during the works in the pit in the years 1971–1991 that the fossils were found. The studied specimens come from the excavation of 1982, except for two (see material list) that were found in 1991 in a different site of the basin. The two sites show no faunal differences and are considered as roughly isochronous. Unfortunately, none of the excavation sites are now available for field studies, due to the quarry development.

The fossil fauna of Sésklo is already described in other papers (Symeonidis & Tataris, 1983; Symeonidis, 1992; Athanassiou, 1996; Kostopoulos & Athanassiou, 1997, 2005; Athanassiou, 2001, 2002a, 2002b). The faunal list, given by Athanassiou (1996) (and, concerning the Artiodactyla, revised by Kostopoulos & Athanassiou, 1997, 2005, and Athanassiou, 2002a, 2002b), includes Carnivora [*Nyctereutes megamastoides* (Pomel, 1843), *Vulpes* cf. *alopecoides* Forsyth Major, 1875, *Homotherium crenatidens* (Fabrini, 1890)], Proboscidea [*Anancus arvernensis* (Croizet & Jobert, 1828), *Mammuthus meridionalis* (Nesti, 1825)], Perissodactyla [*Equus stenonis* Cocchi, 1867, *Stephanorhinus* sp.] and Artiodactyla [cf. *Croizetoceros ramosus* (Croizet & Jobert, 1828), cf. *Metacervoceros rhenanus* (Dubois, 1904), cf. *Eucladoceros* sp., *Mitilanotherium martinii* (Sickenberg, 1967), *Gazella borbonica* Depéret, 1884, *Gazella bouvrainae* Kostopoulos, 1996, *Gazella aegaea* Athanassiou, 2002, *Gazellospira torticornis* (Aymard, 1854), cf. *Gallogoral meneghinii* (Rütimeyer, 1878) and *Euthyceros thessalicus* Athanassiou, 2002]. The faunal assemblage is of villafranchian type and suggests a lower MN17 (MNQ17) age (Athanassiou, 1996).

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Figure 1: Geographical position of the locality of Sésklo.
Figure 1 : Position géographique de la localité de Sésklo.

The genus *Gazellospira* comprises currently two species, the typical *G. torticornis* (Aymard, 1854) and the smaller and rare *G. gromovae* Dmitrieva, 1975 (Dmitrieva, 1977). The species *G. torticornis* is already known from Greek localities, as Vólax (Kostopoulos, 1996, 1997), Dafneró, Krímni, possibly Gerakaroú (Kostopoulos & Koufos, 1994; Kostopoulos, 1996), Halykés (Athanassiou, 1996) and Vaterá (De Vos *et al.*, 2002). Some specimens from Sésklo are already published by Symeonidis (1992); this was the first report on the presence of the genus in the Greek territory. The studied material attributed to the species is relatively rich, but it is in fragmentary state, not allowing some kind of comparisons (e.g. of the long bone length). The finds of the Sésklo fossil fauna belong to the collections of the Museum of Geology and Palaeontology, of the National and Kapodistrian University of Athens.

SYSTEMATICS

Order : Artiodactyla Owen, 1848

Family : Bovidae Gray, 1821

Subfamily : Antilopinae Baird, 1857

Genus : *Gazellospira* Pilgrim & Schaub, 1939

Gazellospira torticornis (Aymard, 1854)

Synonymy : *Gazellospira torticornis* (Aymard) — Symeonidis (1992).

Material : Cranium part, Σ-247; part of right horn core, Σ-330; part of left horn core, Σ-406, Σ-961, Σ-1145; part of right horn core, Σ-1114; part of maxilla with P^3–M^1 sin., Σ-74, Σ-313, Σ-491; part of maxilla with P^4–M^3 sin., Σ-171; part of maxilla with P^4–M^2 dext., Σ-385; part of maxilla with P^4 and M^1 sin., Σ-390; part of maxilla with P^2–M^1 sin., Σ-452; M^1 dext., Σ-392; M^1 sin., Σ-459; $P^{2,3}$ dext., Σ-427; M^3 sin., Σ-1024, Σ-1200; M^3 dext., Σ-1201; part of mandible with P_4–M_3 sin., Σ-394, Σ-398; part of mandible with P_2 sin., Σ-444; part of mandible with P_3–M_3 dext., Σ-716; part of mandible with P_2–M_3 dext., Σ-1160; part of mandible with D_4–M_1 dext., Σ-428; part of mandible with D_3–M_1 dext., Σ-1013; parts of humerus, radius and ulna sin., Σ-76; distal part of humerus sin., Σ-43, Σ-181, Σ-306, Σ-945, Σ-1142; distal part of humerus dext., Σ-943, Σ-1143; proximal part of radius sin., Σ-1113; distal part of radius sin., Σ-936, Σ-971; distal part of radius dext., Σ-305, Σ-942; ulna sin., Σ-1141; proximal part of metacarpal III-IV sin., Σ-35, Σ-909, Σ-910, Σ-912, Σ-913; proximal part of metacarpal III-IV dext., Σ-707, Σ-911, Σ-1021; distal part of metacarpal III-IV sin., Σ-4, Σ-908; distal part of metacarpal III-IV, Σ-914, Σ-923; distal part of metacarpal III-IV with proximal phalanges dext., Σ-93, Σ-445; proximal part of tibia dext., Σ-1188; distal part of tibia sin., Σ-84, Σ-485, Σ-937, Σ-1148; distal part of tibia dext., Σ-33, Σ-938, Σ-33, Σ-950; astragalus, sin. Σ-319; juvenile astragalus and calcaneum sin., Σ-466; calcaneum sin., Σ-1114; juvenile calcaneum dext., Σ-971; astragalus, calcaneum, scaphocuboid, cuneiforms and proximal part of metatarsal III-IV sin., Σ-1112; proximal part of metatarsal III-IV sin., Σ-702, Σ-901, Σ-902, Σ-907, Σ-919; proximal part of metatarsal III-IV dext., Σ-10, Σ-53, Σ-183, Σ-224, Σ-293, Σ-903, Σ-904, Σ-905, Σ-906, Σ-917, Σ-918, Σ-919; proximal part of metatarsal III-IV, scaphocuboid, cuneiforms dext., Σ-423; distal part of metatarsal III-IV sin., Σ-1111; distal part of metatarsal III-IV dext., Σ-78, Σ-701, Σ-900, Σ-925; distal part of metatarsal III-IV, proximal parts of phalanges sin., Σ-916; distal part of proximal phalanx, Σ-1127.

Two more specimens that come from another site of the locality (right radius, Σ-2001; distal part of right tibia, Σ-2002) probably belong to the species.

Description: The cranium part (fig. 2) retains the frontal region with the basal parts of the horn cores. The frontals are very wide, slightly convex, with strong, high, plicate sutures. The cranium has a very stout appearance, as the cranial bones are thick and strong. The face area is flat and it is characterised by the presence of numerous sinuses. The orbits are wide and extend laterally far beyond

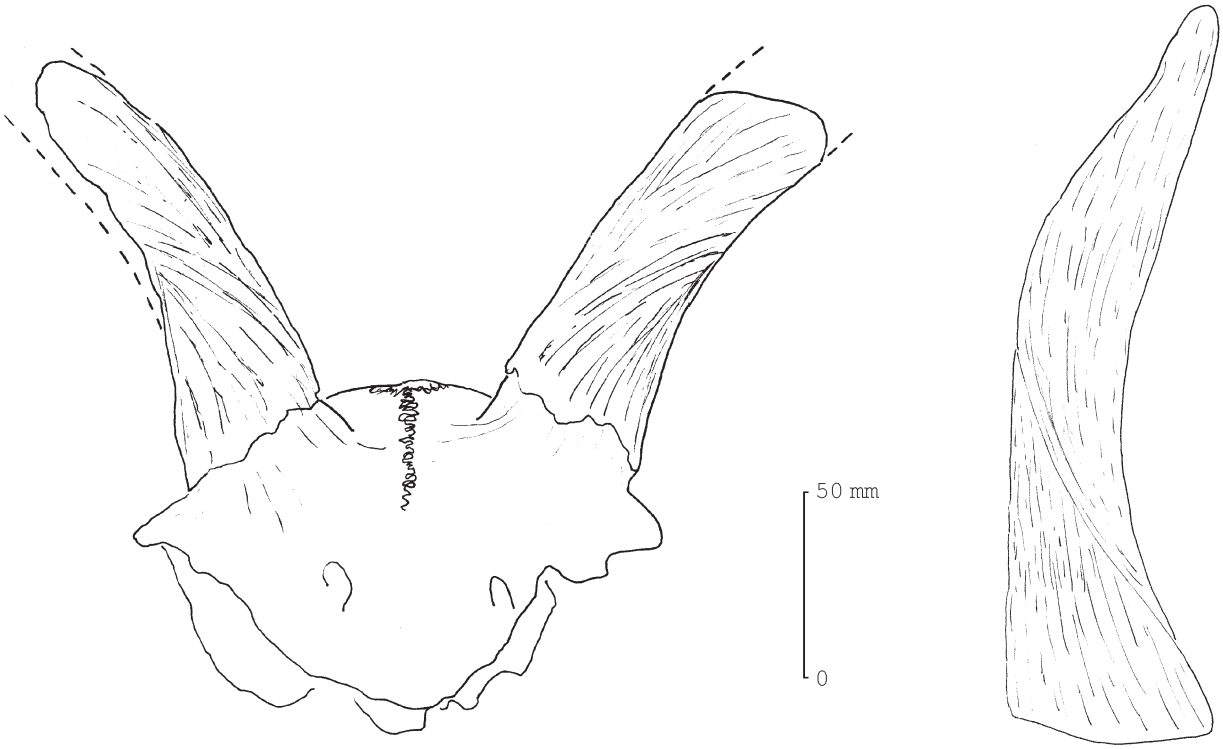

Figure 2: Sketch drawings of the cranium Σ-247 (anterior view) and the horn core part Σ-330.
Figure 2 : Dessin du crâne Σ-247 (vue antérieure) et de la cheville osseuse Σ-330.

the horn core bases. The horn cores (fig. 2) are massive and compact, without sinuses. They are inserted above the orbits, away of each other, following a postero-lateral direction. They are greatly divergent. The minimal distance between their bases is 53 mm, while the same distance at about 10 cm above the cranial roof is approximately 170 mm. The corresponding distances between the lateral sides of the cores are 132 and approximately 250 mm. The most characteristic feature of the horn cores is the normal torsion (i.e. the right horn twists clockwise, dorsally seen). The spiral is open. The core surface has longitudinal grooves that follow its torsion. A marked keel runs the whole core, beginning from the postero-lateral side of its base, following the spiral. The keel becomes more blunt near the apex. The core cross section is generally elliptical in shape, but more or less pointed in the side of the keel (fig. 3). The maximal diameter of the core base is 48.5 mm and the minimal one is

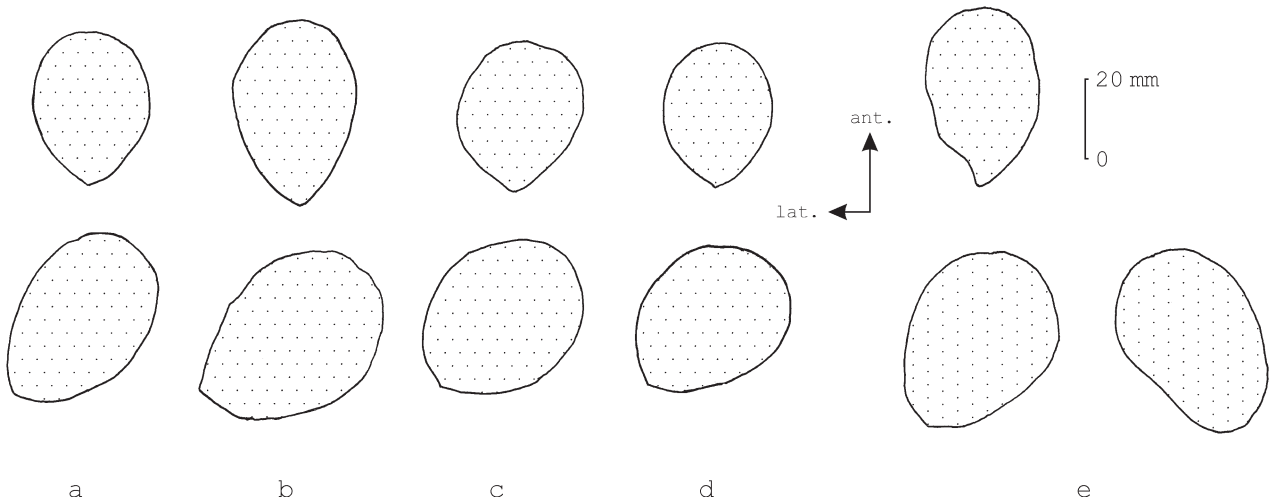

Figure 3: Comparison of horn core cross-sections. a : CP-59, Le Coupet; b : LP-166, Pardines; c : Se-1, Senèze; d : Se-200, Senèze; e : Σ-247 (left and right horn cores). The sections were made at the base and at the area, where the keel is at the posterior side of the core (approximately 4–5 cm above the base). All comparative specimens belong to the Natural History Museum of Basle.
Figure 3 : Comparaison des sections des chevilles osseuses. a : CP-59, Le Coupet; b : LP-166, Pardines; c : Se-1, Senèze; d : Se-200, Senèze; e : Σ-247 (cheville osseuse gauche et droite). Les sections sont faites à la base et au niveau de la zone où la carène se trouve en position postérieure sur la cheville osseuse (4–5 cm au dessus de la base approximativement). Tous les spécimens font partie des collections du Muséum d'Histoire Naturelle de Bâle.

34.0–36.6 mm. The total horn core length is not known, as all available specimens are broken. The longest available part (Σ-330, fig. 2) is 203 mm long.

The upper premolars are relatively long. However, the premolar/molar ratio cannot be calculated, as there is not any complete upper toothrow in the sample. The styles are large enough, being more prominent than the paracone in the not much worn premolars. The molar lobes are triangular in shape. The buccal styles are well developed. The parastyle and the mesostyle of M^1 are inclined to the front, while the metastyle is inclined to the rear. The mesostyle of M^2 and M^3 is more or less perpendicular to the longitudinal axis of the tooth. The metastyle of M^3 is elongated and almost parallel to the tooth axis. There are no enamel islets in the molar occlusal surface, and generally no entostyle between the lobes, except for one case, where it is rudimentary (M^2 of Σ-385). The shape and the dimensions of the occlusal surface are highly variable, depending on the wear stage of the tooth. The hypsodonty index is not well known, as the unworn teeth are very rare. An index of 123.0 is calculated for an isolated unworn M^3 (Σ-1201).

The lower premolar row is relatively long. The average premolar/molar ratio is 57.3 %, ranging from 56.1 to 58.5 %. The P_2 has weak parastylid and metaconid, and transversal entoconid and entostylid. In P_3 the paraconid and the parastylid are well separated. The valley between the metaconid and the entoconid is very wide. The two posterior valleys are, on the contrary, very narrow and close near the base of the crown. The morphology of P_4 is variable, as there are molarised, non-molarised and intermediate specimens. In the molarised ones (Σ-398, Σ-1160) the metaconid is very elongated and fused to the entoconid. The valley between the paraconid and the metaconid is very narrow, almost closed. The valley between the entoconid and the entostylid is slightly open only in the upper part of the crown. The non-molarised specimen (Σ-716) has independent cusps and stylids, which are separated by deep valleys. The deeper and more open valley is the one between the paraconid and the metaconid. The paraconid and the parastylid are, however, separated only in the upper part of the crown. An intermediate morphology is found in one specimen (Σ-394). The valley between the paraconid and the metaconid is fairly wide, but the third one (between the metaconid and the entoconid) is virtually closed. The entoconid and the entostylid are fused, forming a small enamel islet in the occlusal surface. The lower molars are characteristic, as they have mesially a strong goatfold (weaker in M_1, plausibly because of the more advanced attrition stage of this molar). They are narrow, almost prismatic and hypsodont. The lingual wall is relatively flat, without prominent stylids. The buccal cusps (protoconid and hypoconid) are angular buccally. There is no ectostylid between the lobes (except for a rudimentary one in one specimen).

Most of the postcranial bones (humerus, radius, ulna, tibia and calcaneum) are typically bovid in morphology, and they are grouped here because of their size. The metapodials, which represent the major part of the postcranial material, are, however, morphologically divergent, having some cervid-like characters. The clearest character is probably the concave plantar surface of the shaft that forms a longitudinal grove. The proximal articulation of the metacarpals is also morphologically particular in having relatively more developed facet for the unciform. In Bovidae this facet is usually much smaller than the one for the articulation of the capitotrapezoid. Some metacarpals (as Σ-35 and Σ-445) are more robust than the others, having stronger shafts, though the corresponding articulations do not show any similar metrical difference. This particular

Upper dentition	P^2		P^3		P^4		M^1		M^2		M^3	
	Length	Width	Length	Width	Length	Length	Width	Width	Length	Width	Length	Width
n	—	—	2	2	6	6	9	8	2	2	2	2
min	—	—	9.2	10.5	8.8	12.2	13.0	14.0	25.0	18.5	24.6	19.0
max	—	—	12.0	11.2	12.4	14.5	24.4	20.0	25.2	22.2	26.0	21.0
$\bar{x}$	—	—	10.6	10.9	11.3	13.8	19.7	17.9	25.1	20.4	25.0	19.9

Lower dentition	P_2		P_3		P_4		M_1		M_2		M_3	
	Length	Width	Length	Width	Length	Width	Length	Width	Length	Width	Length	Width
n	1	1	2	2	4	4	6	5	4	4	4	4
min	10.0	6.7	13.5	8.2	13.2	7.9	15.2	9.7	20.0	12.8	28.5	12.0
max	10.0	6.7	13.8	8.6	15.0	9.1	19.8	11.9	23.3	13.9	31.0	12.9
$\bar{x}$	10.0	6.7	13.7	8.4	14.2	8.6	16.6	11.2	21.1	13.1	30.2	12.7

Table 1: Dental measurements of *Gazellospira torticornis* from Sésklo.
Tableau 1 : Dimensions dentaires de *Gazellospira torticornis* de Sésklo.

Humerus	length	distal epiphysis DAP	distal articulation min. trochlear DAP	distal articulation DT
n	—	2	4	5
min	—	40	23.4	43.0
max	—	41.0	24.5	47
$\bar{x}$	—	40.5	24.0	44.5

Radius	length	prox. articulation DAP	prox. articulation DT	shaft minimal DT	distal articulation DAP	distal articulation DT
n	1	2	1	1	5	3
min	245.5	23	41.8	29	25.2	38.5
max	245.5	24.0	41.8	29	28.0	38.6
$\bar{x}$	245.5	23.5	41.8	29	26.4	38.6

Metacarpal III-IV	length	prox. articulation DAP	prox. articulation DT	shaft minimal DT	distal articulation DAP	distal articulation DT
n	—	7	7	4	5	5
min	—	21.5	31.5	19.5	24.3	35.2
max	—	24.9	36.9	24.5	27.3	40.9
$\bar{x}$	—	23.3	33.8	21.9	25.8	37.8
s	—	1.4	1.8	2.3	1.3	2.2
V	—	6.0	5.3	10.5	5.0	5.8

Tibia	length	prox. articulation DAP	prox. articulation DT	shaft minimal DT	distal articulation DAP	distal articulation DT
n	—	—	—	—	5	5
min	—	—	—	—	28.2	33.0
max	—	—	—	—	32.0	41.0
$\bar{x}$	—	—	—	—	30.1	38.1

Metatarsal III-IV	length	prox. articulation DAP	prox. articulation DT	shaft minimal DT	distal articulation DAP	distal articulation DT
n	—	13	13	10	5	5
min	—	31.0	28.0	20.0	24.4	36.1
max	—	38.0	35.0	23.0	27.2	39.1
$\bar{x}$	—	35.4	32.8	21.8	26.0	38.3
s	—	1.9	1.9	1.0	1.0	1.1
V	—	5.4	5.8	4.6	3.8	2.9

Table 2: Postcranial bone measurements of *Gazellospira torticornis* from Sésklo.
Tableau 2 : Dimensions du matériel postcrânien de *Gazellospira torticornis* de Sésklo.

situation is, however, also seen in specimens published by Pilgrim & Schaub (1939 : Taf. III, Fig. 5, 8) and it is explained as a result of sexual dimorphism. The length of the long bones is not known, as all available specimens are broken. However, an almost complete metatarsal (Σ-702) allows a length estimation of 260–270 mm, which is quite comparable to the values given by Pilgrim & Schaub (1939) (247.2–266 mm) and Duvernois & Guérin (1989) (247–267 mm). A radius (Σ-2001), which, however, comes from another layer but can be attributed to the species, is 245,5 mm long; this value is also inside the range of the species given by Pilgrim & Schaub (1939) and Duvernois & Guérin (1989) (242–262 mm).

DISCUSSION

The morphology and the dimensions of the horn cores, the lower teeth and the metapodials are typical for *Gazellospira torticornis*. Some small differences, however, do exist, showing a certain degree of variation in the species. Comparing the horn core cross-sections from Sésklo to the sections of other West-European specimens attributed to the species (Fig. 3), one can observe that the Thessalian specimen is relatively large, similar to LP-166 from Pardines (Museum of Basle). Quite similar is also the specimen DFN-156 (not depicted) from Dafneró, which has a maximal base diameter of 48 mm (Kostopoulos, 1996).

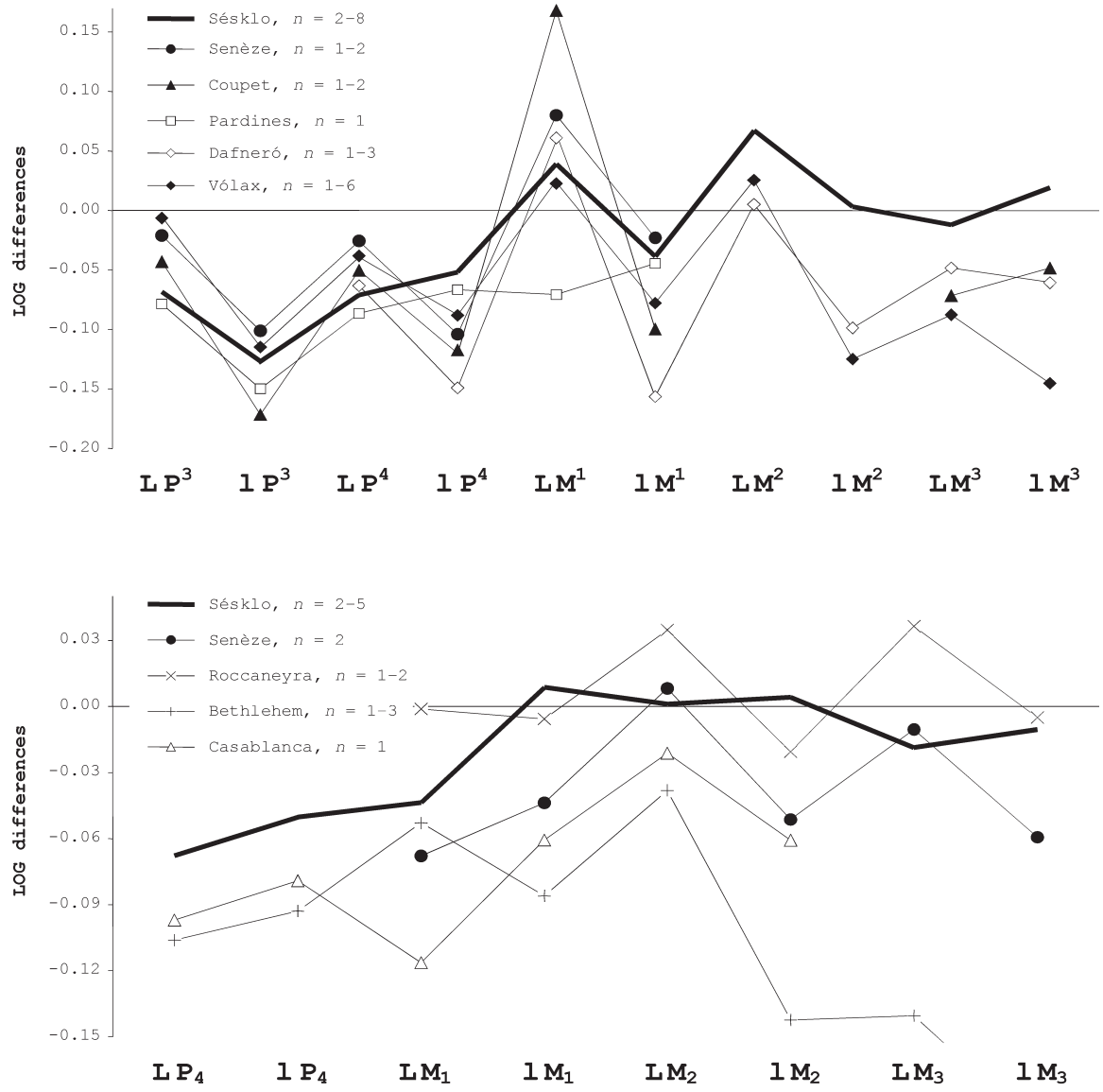

Figure 4: Ratio diagrams of the upper and lower teeth dimensions of the samples from Sésklo, Senèze, Le Coupet, Roccaneyra, Pardines (Museum of Basle collections), Bethlehem (Hooijer, 1958), Casablanca (Soto & Morales, 1985), Dafneró and Vólax (Kostopoulos, 1996). Standard : mean values of *Gallogoral meneghinii*, according to Guérin (1965).
Figure 4 : Diagrammes des rapports des dents supérieures et inférieures des échantillons de Sésklo, Senèze, Le Coupet, Roccaneyra, Pardines (collection du Muséum de Bâle), Bethlehem (Hooijer, 1958), Casablanca (Soto & Morales, 1985), Dafneró et Vólax (Kostopoulos, 1996). Standard : dimensions moyennes de *Gallogoral meneghinii*, selon Guérin (1965).

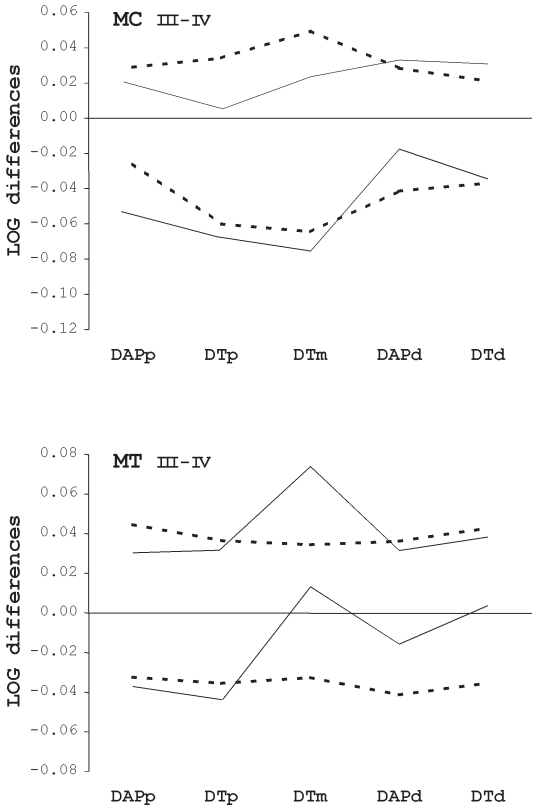

Figure 5: Comparison of the metapodial measurement range from Sésklo (solid line) to the metrical range of *Gazellospira torticornis* given by Duvernois & Guérin (1989) (dashed line). Standard : mean values of *Gazellospira torticornis*, according to Duvernois & Guérin (1989).
Figure 5 : Comparaison des dimensions des métapodes de Sésklo (ligne continue) avec les dimensions de *Gazellospira torticornis* cités par Duvernois & Guérin (1989) (ligne discontinue). Standard : dimensions moyennes de *Gazellospira torticornis*, selon Duvernois & Guérin (1989).

The morphological difference between the left and the right horn core cross-sections of Σ-247 is also observed in the specimens from Senèze.

The comparison of the dental material shows only some small metrical differences (Fig. 4). Some of them, as in the length of M^1, are primarily attributed to different attrition degree (e.g. the specimen from Le Coupet belongs to a young individual, while the specimen from Pardines to an aged one). All samples are considerably similar in proportions, at least in the premolars. The mandibular teeth samples seem to be less similar to each other, but, again, the metrical differences are small (usually less than 0.1). The sample from Sésklo tends, however, to have rather wide molars relatively to their length, while the sample from Bethlehem has clearly smaller molars. As far as the morphology is concerned, the dental material from Sésklo is in accordance to the description of Pilgrim & Schaub (1939) and the neodiagnosis of Duvernois & Guérin (1989). A small difference is observed in the morphology of P_4, which is not fully molarised in any specimen from Sésklo. At least two specimens in the Museum of Basle have completely closed lingual wall in P_4 (LP-41 from Pardines and Se-1734 from Senèze). However, there are also less molarised P_4 (as in the Rn-128 and Rn-129 from Roccaneyra), confirming the considerable variation in the morphology of this premolar, which was observed in the studied material.

The long bone dimensions are generally very close to the metrical data given by Pilgrim & Schaub (1939) and Duvernois & Guérin (1989). A direct comparison of the metapodial dimensional range is given in Fig. 6. Small differences (about 0.04) are observed in the metacarpal proximal extremity measurements and the metatarsal shaft width. In comparison to the other three Greek localities, which have yielded adequate postcranial material, Dafneró, Vólax and Vaterá, the studied material has relatively bigger dimensions, especially concerning the metatarsal. The range given by

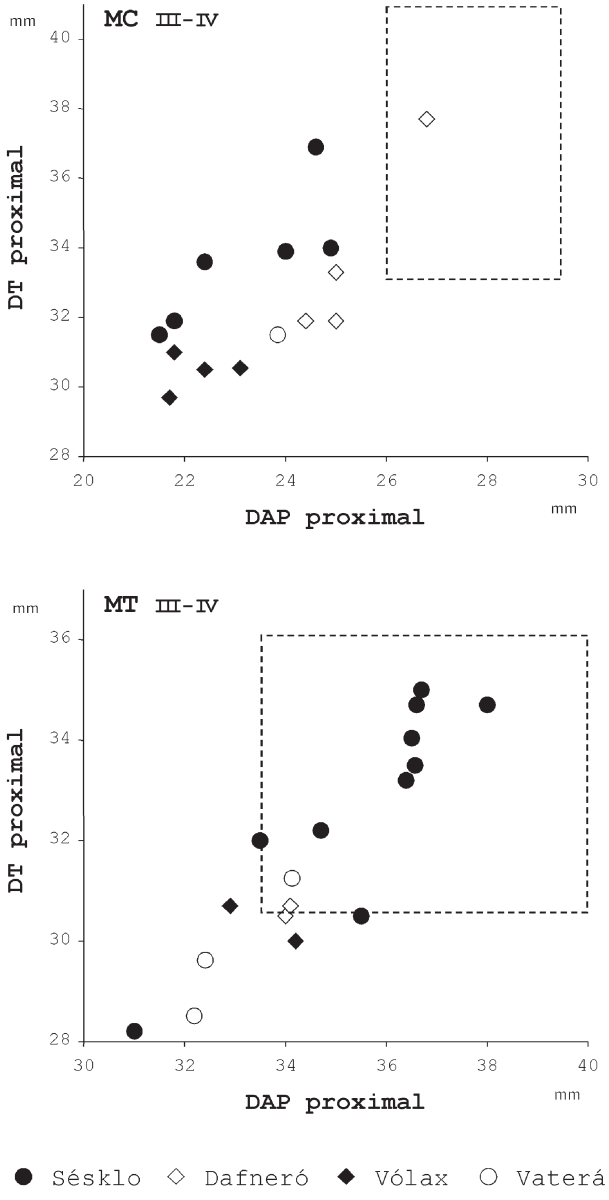

Figure 6: Scatter diagrams of the metapodial proximal articular dimensions of Greek samples. Data from Dafneró and Vólax according to Kostopoulos (1996). The rectangle represents the metrical range of *Gazellospira torticornis* given by Duvernois & Guérin (1989).
Figure 6 : Diagrammes de dispersion des dimensions proximales articulaires des métapodes des échantillons grecs. Données de Dafneró et Vólax selon Kostopoulos (1996). Le rectangle représente les dimensions de *Gazellospira torticornis* cités par Duvernois & Guérin (1989).

Duvernois & Guérin (1989) is higher, but it apparently represents maximal measurements, not articular.

Summarising the comparisons, the *Gazellospira torticornis* material from Sésklo does not appear to differ either morphologically or metrically from the already known samples of the Western Europe and Greece. This is in contrast to the presence of morphological and dimensional distinctive characters in the Greek faunal elements (especially the Bovids) that differentiate them from the Western European ones (Athanassiou, 1996; Kostopoulos, 1996; Kostopoulos & Athanassiou, 1997; Athanassiou, 2002a, b). The species shows morphological stability in space and possibly also in time, as it is shown by the few findings of the species that come from Early Pleistocene Greek localities (Athanassiou, 1996; Kostopoulos, 1996).

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