

STUDY OF THE TUROLIAN HIPPARIONS OF THE LOWER AXIOS
VALLEY (MACEDONIA, GREECE)
4. LOCALITIES OF DYTIKO

by

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Mots-clés: Mammifères, Equidae, *Hipparion*, Turolien, Basse Vallée d'Axios, Macédoine, Grèce.

ABSTRACT

The hipparions from the Dytiko localities of the lower Axios valley (Macedonia, Greece) are studied. The material comes from three localities Dytiko-1, 2, 3 (DTK, DIT, DKO), which are situated near the village of Dytiko, about 60 km northwest to Thessaloniki. Three species have been determined, the medium-sized *H. mediterraneum*, the small-sized *H. matthewi* and the very small-sized *H. periafricanum*. The determined *Hipparion* species, their morphological characters and their comparison with the other Axios valley material indicate a Late Turolian age for the Dytiko localities.

RÉSUMÉ

Les hipparions de la région du Dytiko dans la basse vallée d'Axios sont étudiés. Le matériel provient de trois localités, Dytiko-1, 2, 3 (DTK, DIT, DKO), vers 60 km au Nord-Ouest de Thessaloniki, aux environs du village de Dytiko. Trois espèces sont déterminées : *H. mediterraneum* de taille moyenne, *H. matthewi* de petite taille et *H. periafricanum* de très petite taille. Les espèces d'*Hipparion* déterminées, leurs caractères morphologiques et leur comparaison au matériel de la Vallée d'Axios, déjà étudié, montre que l'âge de Dytiko est Turolien supérieur.

INTRODUCTION

In this article the study of the lower Axios valley hipparions is continued with the material from the Dytiko localities. The material was studied earlier by Koufos (1979, 1980) but the continued excavations in the following years have yielded more material, which allows a better determination, description and comparison. This article continues our effort to study the genus *Hipparion* in Greece, which began with the Pikermi material (Koufos, 1987a) and continued with the material from the Vallesian and Turolian localities of the lower Axios valley (Koufos, 1986, 1987b, 1987c, 1988). Four species, *H. mediterraneum*, *H. gromovae*, *H. matthewi* and *H. periafricanum* were determined in the first collected material (Koufos, 1979, 1980). This interpretation was mainly based on the material from the locality Dytiko-1, which was more abundant. The material from the other two localities of Dytiko was few (3 pieces of bones from DIT and 15 specimens from DKO). The new collected material increases the available samples. More than 50 specimens were added in the DTK material and other 20 in the DIT and DKO material. These are skulls, mandibles, complete legs and enough metapodials. All this material allows a good distinction, determination and comparison with the other Axios valley hipparions and with the Pikermi material which is considered as standard for the comparisons.

LOCALITIES

The Dytiko localities are three and they are known as Dytiko-1 (DTK), Dytiko-2 (DIT) and Dytiko-3 (DKO). All are situated near the village of Dytiko, about 60 km northwest to Thessaloniki (fig. 1). The locality DTK is probably the same as "Ravin du Konikovo" (Arambourg & Piveteau, 1929). All the localities are situated on the banks

of *Platanorrema* (fig. 1). The localities DTK and DIT are very near to the village of Dytiko while DKO is situated about 2 km southern to the village.

The localities belong to the Dytiko Formation, which consists of alternated marls, sandy marls, sands, gravels and fresh-water limestones in the top (Bonis *et al.*, 1985). The fauna of each locality is given in the table-I. The small hipparions, *H. matthewi* and *H. periafricanum*, give an idea about the age of the localities. Both species are representatives of the fourth *Hipparion* Zone of the Mediterranean Neogene indicating a late Turolian age (Sen *et al.*, 1978). The genus *Protragelaphus* is represented by a more advanced form than those of Pikermi and Maragha and the miotragines of the Dytiko localities are also more evolved than those of Pikermi. The presence of the hyaenid *Chasmaporthetes bonisi* (Koufos, 1987d) confirms the idea of a younger age than that of Pikermi. Pollen-analysis in the fresh-water limestones of the formation indicated a Miocene-Pliocene age (Mercier-Sauvage, 1963). All these data agree with the fact that the Dytiko Formation is younger than Pikermi and belongs to Late Turolian. If we consider that the Pikermi age is about 7 m.y. and the end of Miocene-beginning of Pliocene is 5.5 m.y. then we can estimate the age of the Dytiko Formation as being between 7-5.5 m.y.

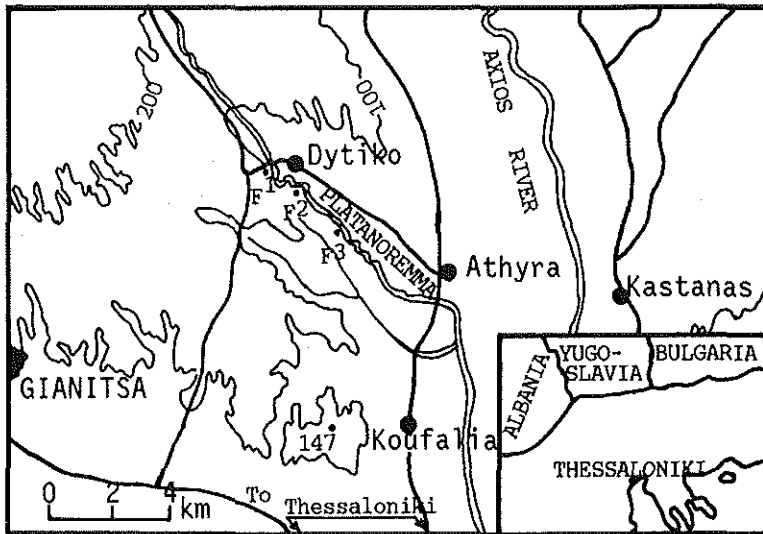


Fig.1- Map of the lower Axios valley indicated the position of the Dytiko mammal localities. F1 = Dytiko-1 (DTK), F2 = Dytiko-2 (DIT) and F3 = Dytiko-3 (DKO).

METHODS

The material was studied according to the recommendations of the International *Hipparion* Symposium, New York 1981 (Eisenmann *et al.*, in press). The carpals and tarsals, except astragalus and calcaneum, were measured according to the system of Gromova (1952). The bones were compared by using scatter and logarithmic ratio diagrams. In the logarithmic ratio diagrams *H. mediterraneum* from Pikermi was used as the standard of comparison; for the measurements of *H. mediterraneum* see Koufos (1987).

Abbreviations. B = breadth; b = 10 mm from the base of the tooth; DAP = anteroposterio diameter; DT = transverse diameter; H = height; L = length; m = middle of the tooth's height; n = number of measured specimens; o = occlusal surface; p = protocone; Plication number = for the upper cheek teeth the sum of the plis in the anterior and posterior borders of the pre- and post-fossette and in the pli caballin; for the lower cheek teeth the sum of the plis in the anterior and posterior border of preflexid, in the anterior border of postflexid and in the pli caballinid; prfl = preflexid; ptfl = postflexid; W.S. = stage of wear.

TAXONOMY

Order **PERISSODACTYLA OWEN, 1848**
Family **EQUIDAE GRAY, 1821**

Genus *HIPPARION* CHRISTOL, 1832

Hipparion mediterraneum (ROTH & WAGNER, 1855)

Synonyms : 1979, 1980 - *H. mediterraneum* KOUFOS

Locality : Dytiko-1, 2, 3, Macedonia, Greece.

Horizon : Late Turolian (late Miocene)

Material : Part of the skull with the mandible, DIT-19; part of the skull, DTK-6; part of upper jaw with P2/-P4/, DTK-218; part of upper jaw with P3/-M3/, DTK-166; part of upper jaw with P3/-M2/, DTK-3; part of upper jaw with P4/-M3/; DTK-2; part of upper jaw with M1/-M3/, DTK-4; P2/, DTK-220; P3, 4/, DKO-35; M1,2/, DTK-7, DKO-10; 4 mandibles with P/2-M/3 dex & sin, DTK-11, 21, 174, DIT-9; 5 horizontal rami of the mandible with P/2-M/3, DTK-9, 10, 12, 217, DIT-10, DKO-9; 2 parts of the horizontal ramus with P/2-M/2, DTK-13, 15; part of the horizontal ramus with P/2-P/4, DTK-19; part of the horizontal ramus with dp/4-M/1, DTK-24; part of the horizontal ramus with M/2-M/3, DTK-219; 3 P/3,4, DTK-17, 18, DKO-32; M/3, DTK-20; radius, DTK-31, 32, 168, 189, DKO-25; 5 proximal parts of radius, DTK-33, 34, 35, 36, 37; 7 distal parts of radius DTK-38, 39, 41, 42, 43, 207, 211; distal part of radius + os magnum + navicular + lunatum + pisiform, DTK-40; os magnum + navicular + lunatum + pisiform, DTK-172, os magnum + navicular + lunatum + pisiform + triquetrum + hamatum, DIT-7; os magnum + lunatum, DIT-15; os magnum + McIII, DKO-21; navicular + pisiform + proximal part of McIII, DTK-44; os magnum DTK-45; 3 navicular DTK-40, DIT-8, DKO-31; 2 lunatum, DTK-201, 202; 8 third metacarpals, DTK-47, 61, 142, 143, 152, 158, DIT-2, DKO-21; 11 proximal parts of McIII, DTK-44, 57, 59, 60, 134, 135, 145, 146, 147, 148, DKO-27; 7 distal parts of McIII, DTK-48, 50, 51, 52, 53, 54, 136; distal part of McIII + phalanx I +II +III, DTK-209; tibia + calcaneum + astragalus, DIT-18; distal part of tibia + cuboid + astragalus + MtIII + PhI, DIT-17; distal part of tibia + astragalus DKO-13; 14 distal parts of tibia, DTK-62, 64, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 77, 190; navicular + cuneiform I + calcaneum + astragalus + MtIII, DTK-153; navicular + cuneiform I + astragalus + calcaneum, DKO-26; navicular + cuboid + cuneiform I + calcaneum + astragalus, DTK-80; navicula + cuboid + cuneiform I, DTK-89, 197; navicular + astragalus, DTK-87; navicular + cuneiform I, DTK-92; navicular + cuneiform I + cuneiform II + MtIII, DTK-212; 8 naviculars, DTK-69, 93, 95, 178, 180, 195; 6

cuboids, DTK-69, 97, 98, 99, 181, 223; 4 cuneiforms I, DTK 90, 91, 96, 182; calcaneum + astragalus, DTK-78, 79, 82, 84, 88, 204; calcaneum, DTK-183, 205, DIT-18; astragalus DTK-83, 86, 169, 170, 175, 177, 221, DIT-11; 7 third metatarsals, DTK-100, 101, 102, 150, 154, DIT-4, DKO-22; 12 proximal parts of MtIII, DTK-103, 104, 105, 106, 198, 163, 164, 199, 224, 225, 232, DKO-14; 14 distal parts of MtIII, DTK-49, 56, 117, 118, 119, 125, 159, 160, 208, 226, 227, 228, 229, 231; distal part of MtIII + phalanx I + II, DTK-171, 210; MtIII + phalanx I + II + III, DIT-15; phalanx I + II + III, DTK-128, 130; phalanx I + II, DTK-129, DIT-12, DKO-29; phalanx II + III, DIT-6; 3 phalanges I, DTK-184, 185, DKO-28; 3 phalanges II, DTK-131, 132, DIT-13;

Diagnosis : Medium size; short and narrow muzzle; moderate narial opening; single and oval preorbital fossa; distance orbit-preorbital fossa moderate; simple-moderate enamel plication in the upper cheek teeth; rounded-elliptical and isolated protocone; well developed parastylid; small and rare protostylid; elongated and slender metapodials.

DESCRIPTION

The available skull material contains three pieces of the skull strongly compressed and broken. The muzzle is short and narrow. The narial opening has medium depth, its posterior end is situated above P2/ and not very far in front of the orbits. The diastema is moderate (85-88 mm). The palate is short and wide; the index 2/13 (Palatal length x 100/Palatal breadth between P4/ and M1/) is at mean 179.5 versus 183 for *H. mediterraneum* from Pikermi. The choanae are wide and their anterior border is situated behind the middle of M2/. The orbits are rounded and their anterior border is situated above M3/. The preorbital fossa is single, oval, narrow with well defined posterior border and it is situated far enough from the orbits. Its posterior end is situated above the middle of M1/. The crista facialis is well developed and its anterior end is situated above the limit of P4/ and M1/. The mandible has a short and narrow snout; the index 2/7 is at mean 214 and the index 16/7 165 for the Dytiko localities material versus 213 and 178 respectively for Pikermi *H. mediterraneum* (for the numbers of measurements see Tabl. 2).

The tooththrows have moderate dimensions (Length P2/-M3/ = 142.0-145.0 mm; length P/2-M/3 = 136-151 mm). The upper cheek teeth have closed and isolated fossettes (except two P2/ with connected fossettes), simple-moderate enamel plication, rounded or elliptical and isolated protocone (except the very worn teeth, where it is connected with the protoloph), simple pli caballin which in the very worn teeth is rudimentary or absent elliptical hypocone with well developed and deep distal hypoconal groove; lingual hypoconal groove only in M3/. The lower cheek teeth have well developed parastylid, small and rare protostylid, elliptical-rounded metaconid and metastylid, elliptical entoconid, simple enamel in the flexids, shallow U-shaped linguaflexid and narrow, deep ectoflexid which in the molars reaches the linguaflexid. A simple pli caballinid is sometimes present usually in the premolars. There are not enough measurable teeth to calculate the hypsodonty indices. There is only one M/1,2 in which the index $Lm/H \times 100$ is 49 and another M/1,2 in which the index $H/Lb \times 100$ (Sondaar, 1961) is 230. These indices probably mean hypsodont teeth but the available material is too poor for certain results.

The metapodials are slender and elongated. The index 11/1 is at mean 15.1 for McIII and 13/7 for MtIII of the Dytiko metapodials versus 14.9 and 13.2 respectively

for *H. mediterraneum* of Pikermi; for the numbers of measurements see Tab. 20, 27). The index Height McIII x 100/Height of radius is 79.5 for the Dytiko metacarpals versus 80.0 for the Pikermi *H. mediterraneum*. The index Height MtIII x 100/Height of tibia is 73.5 for the Dytiko material versus 77 for the Pikermi one (measurements of Pikermi metapodials from Koufos, 1987a). The first indicates slender and the second one elongated metapodials. In the metatarsals the facet for cuneiform II is present (in 20 available specimens only one is without facet for cuneiform II; frequency 5%). The keel index of the Dytiko metapodials (Sen *et al.*, 1978) is at mean 120 for McIII and 127 for MtIII versus 119.5 for McIII and 123 for MtIII of *H. mediterraneum* from Pikermi.

DISCUSSION

Pikermi is the type locality of *H. mediterraneum* and the name *Hippotherium gracile* var. *mediterraneum* was given at first to the whole material of Pikermi by Roth & Wagner (1855). Later Hensel (1860) described all the hipparions of Pikermi under the name *H. mediterraneum* and a little later (Hensel, 1862) he recognized in the metapodials two different species *H. mediterraneum* and *H. brachypus*. After that the Pikermi hipparions were referred as *H. gracile* (Gaudry 1862-67; Weithofer, 1888). More later Pirlot (1956) distinguished from the skulls two forms, *mediterraneum* and *brachypus*. Forstén (1968) recognized *H. mediterraneum* in the Pikermi material as a certain species. Recently the study of the Pikermi material has shown the presence of two species *H. mediterraneum* and *H. brachypus* (Koufos, 1987a). The species *H. mediterraneum* is also known from Halmyropotamos (Melentis, 1967). In the lower Axios valley all the hipparions material was first described under the name *H. gracile* (Arambourg-Piveteau, 1929). Later *H. mediterraneum* was found in the Dytiko localities and described by Koufos (1979, 1980). The main morphological characters of *H. mediterraneum* from Pikermi (Koufos, 1987a) are similar to those of the Dytiko material. However a comparison of the Dytiko material with that of the type locality is necessary to confirm these similarities and to find if there are differences between the type and studied material.

There are two pieces of skull from the Dytiko localities. The better is that from DTK, which has more or less similar dimensions with the Pikermi material (Fig. 2). The most significant difference is the longer distance orbit-preorbital fossa (measurement 32 in Fig. 2). The absolute value for the DTK skull is near the maximum values for the Pikermi material. The choanae of the DTK skull seems to be wider (measurement 12 in Fig. 2), but the skull is broken at this point and the breadth was estimated. The skull from DIT is very compressed and broken but its available measurements and teeth dimensions are very near to those of Pikermi material. The mandible of *H. mediterraneum* from Dytiko localities is also similar in size with that from Pikermi. The DTK and DKO material seem to have shorter diastema P/2-I/3 and the DTK material has slightly wider snout (measurements 16, 14 in Fig. 3). The absolute values for both measurements of the studied mandibles fall into the range of variations for *H. mediterraneum* of Pikermi. The small differences of the Dytiko skulls and mandibles from those of Pikermi are probably due to the small number of specimens and in the bad preservation of the material.

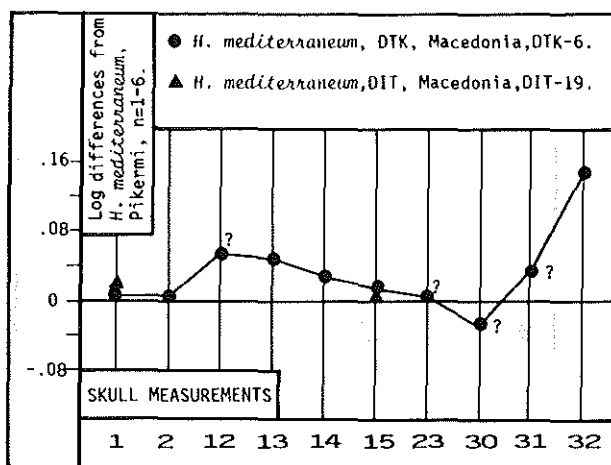


Fig.2- Ratio diagram comparing the skull of *H. mediterraneum* from Dytiko localities.

1. Muzzle length: Prosthion - middle of the line connecting the anterior borders of P2/; 2. Palatal length: middle of the line connecting the anterior borders of P2/ to anterior border of choanae; 7. Premolar length (alveolar); 8. Molar length (alveolar); 9. Tooth series length (alveolar); 12. Maximal breadth of choanae; 13. Palatal breadth between P4/ and M1/; 14. Minimal muzzle breadth; 15. Muzzle breadth: breadth between the posterior borders of I3/; 23. Anterior ocular line: prosthion - most external point of the posterior border of the orbit; 30. Length of the nasoincival notch: prosthion - posterior end of the nasal opening; 31. Cheek length: posterior end of the nasal opening to the anterior border of the orbit; 32. Distance orbit - preorbital fossa.

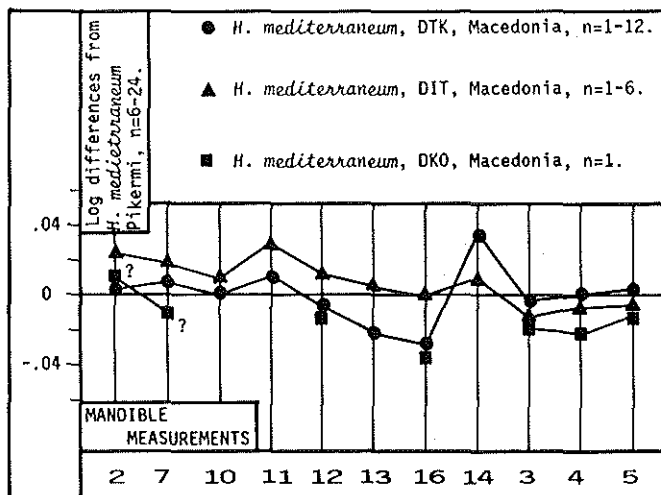


Fig.3- Ratio diagram comparing the mandible of *H. mediterraneum* from Dytiko localities.

2. Muzzle length: middle of the line connecting the anterior borders of P/2 to a point situated between the two I/1; 3. Premolar length (alveolar); 4. Molar length (alveolar); 5. Toothseries length (alveolar); 7. Muzzle breadth: breadth at the incisors border; 10. Height of the jaw behind M/3; 11. Idem between P/4 and M/1; 12. Idem in front of P/2; 13. Symphysis length; 14. Minimal breadth of the diastema; 16. Length of diastema P/2-I/3.

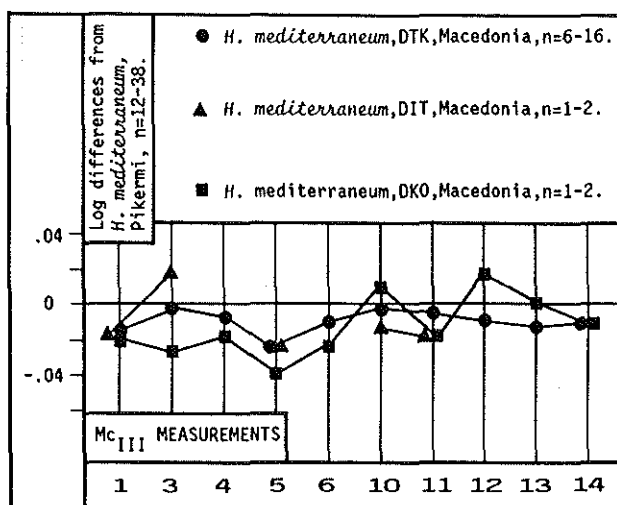


Fig.4- Ratio diagram comparing the third metacarpals of *H. mediterraneum* from Dytiko localities. 1. Maximal length; 3. Breadth of the diaphysis (in the middle); 4. DAP idem at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Maximal diameter of the articular facet for magnum; 10. Distal maximal supra-articular breadth; 11. Distal maximal articular breadth; 12. Distal maximal DAP of the keel; 13. Distal minimal DAP of the lateral condyle; 14. Distal maximal DAP of the medial condyle.

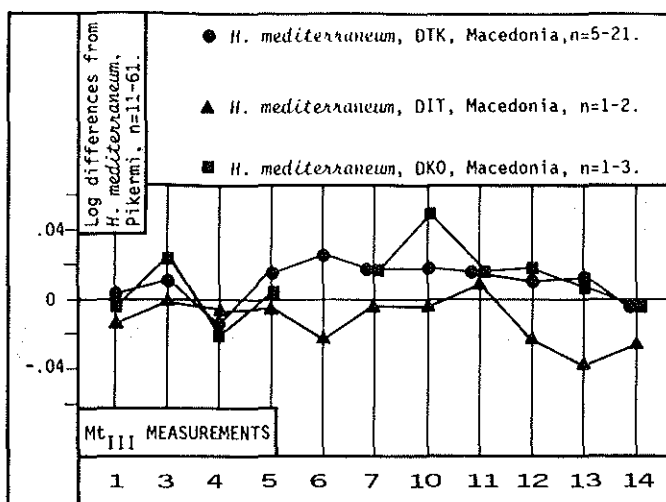


Fig.5- Ratio diagram comparing the third metatarsals of *H. mediterraneum* from Dytiko localities. 1. Maximal length; 3. Breadth of the diaphysis (in the middle); 4. DAP of the diaphysis at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Maximal diameter of the articular facet for the cuneiform I; 10. Distal maximal supra-articular breadth; 11. Distal maximal articular breadth; 12. Distal maximal DAP of the keel; 13. Distal minimal DAP of the lateral condyle; 14. Distal maximal DAP of the medial condyle.

The metapodials of *H. mediterraneum* from the Dytiko localities have more or less similar dimensions to those from Pikermi (Fig. 4, 5). The metacarpals from the three localities seem to be somewhat shorter (measurement 1 in Fig. 4) and slightly slenderer than those of Pikermi, while the metatarsals (Fig. 5) seem to be somewhat more robust than those of Pikermi. Nevertheless the small number of specimens from DKO and DIT cannot ascertain these differences. The calculated keel index for the Dytiko material (119.5-120 for McIII, and 126.6-130.0 for MtIII) are very near to those for *H. mediterraneum* of Pikermi (119.4 for McIII and 123.0 for MtIII). The frequency of the metatarsals lacking a facet for cuneiform II is low in both samples from Dytiko and Pikermi. The other bones of the Dytiko *H. mediterraneum* were compared by scatter and ratio diagrams and always the similarity between the two samples was clear. Thus one can suppose that the medium-sized hipparion of the Dytiko localities must belong to *H. mediterraneum*.

Hipparion matthewi ABEL, 1926

Synonyms : 1979, 1980 *H. matthewi* KOUFOS
1979, 1980 *H. gromovae* KOUFOS

Locality : Dytiko- 1, 2, 3, Macedonia, Greece.

Horizon : Late Turolian (late Miocene).

Material : Part of the skull with the mandible, DKO-36; 3P2/, DTK-213, DKO-33, 34; 2 M3/, DTK-8, 214; 3 pieces of horizontal ramus with P/2-M/3, DKO-15, 16; radius, DIT-6; third metacarpal, DTK-144; 2 proximal parts of McIII, DTK-194, DKO-18; 2 distal parts of McIII, DTK-136, DKO-3; 8 distal parts of tibia, DTK-63, 69, 76, 186, 187, 203, DKO-4, DIT-1; distal part of tibia + navicular + cuboid + cuneiform I + calcaneum + astragalus + MtIII, DIT-20; cuboid + cuneiform I + calcaneum + astragalus, DTK-206; navicular + cuneiform I, DTK-196; cuboid DTK-193; astragalus + calcaneum, DTK-81; 3 astragali DTK-176, 192, 198; 2 third metatarsals, DTK-120, 155; 5 proximal parts of MtIII, DTK-5, 121, 122, 162, 200; 10 distal parts of MtIII, DTK-55, 123, 137, 149, 156, 157, 161, 165, 230, 233 phalanx I+II+III, DTK-127.

Diagnosis : Small size; short and narrow muzzle; short narial opening, situated far in front of the orbits; simple enamel plication; rounded and isolated protocone; moderate parastylid; moderately developed protostylid; relatively long and slender metapodials.

DESCRIPTION

The available piece of the skull preserves the muzzle and the maxilla with both toothseries. The muzzle is short and narrow (measurements 1, 14 in Fig. 6). The narial opening is short and its posterior end is situated far in front of the orbits (measurements 30, 31 in Fig. 6). The diastema is short (69 mm) and the palate is long and narrow; the index 2/13 is 204. The choanae are not well preserved but seem to be elliptical and their anterior border seems to be situated in M2/. The crista facialis ends above the posterior border of M1/. The mandible is small with short and relatively wide snout (measurements 2, 16, 7 in Fig. 7). The index 2/7 is 191 and 16/7 130 versus 205 and 147.5 for the type material (for the numbers of measurements see Tab. 1, 2).

The symphysis is elongated comparatively to the size of the mandible (measurement 13 in Fig. 7).

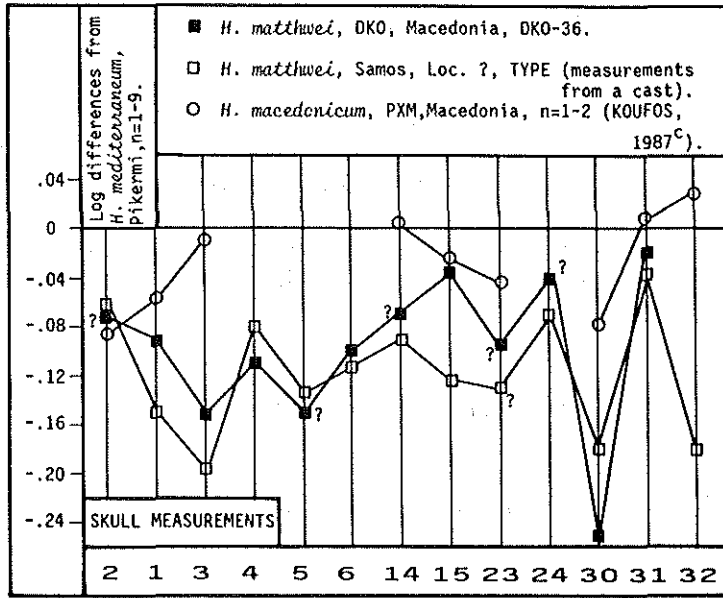


Fig.6- Ratio diagram comparing the skull of *H. matthewi* with the type one and with that of *H. macedonicum*; for the measurements see Fig. 2 in addition with the following.
 3. Length from anterior border of choanae to vomer; 4. Length vomer-basion; 5. Post-palatal length: basion-anterior border of choanae; 6. Basilar length : basion-prosthion; 24. Posterior ocular line: most external point of the posterior border of the orbit-middle of the supra occipital crest.

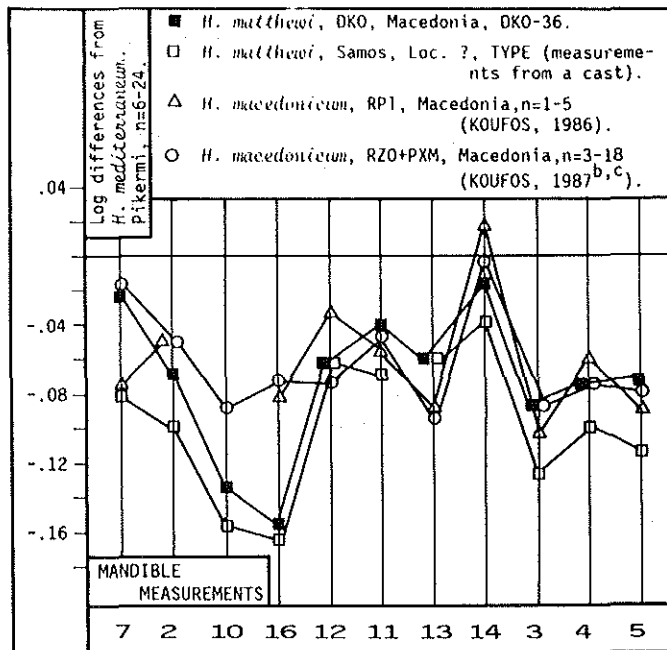


Fig.7- Ratio diagram comparing the mandible of *H. matthewi* with the type one and with that of *H. macedonicum*; for the measurements see Fig. 3.

The tooth rows length is small (length P2/-M3/ = 118.5-119.0 mm; length P2-M/3 = 119.5-122.0 mm). The description of the upper cheek teeth is based on one specimen (DKO-36) whose teeth are in the second stage of wear. The upper cheek teeth have closed and isolated fossettes except P2/, simple enamel plication, rounded and isolated protocone, small and simple pli caballin except P2/ where it is double, elliptical hypocone with well developed distal hypoconal groove and lingual one only in M3/. The lower cheek teeth have moderately developed parastylid, medium-sized protostylid in M/1, elliptical-triangular metaconid, rounded-elliptical metastylid, elliptical entoconid, simple enamel in the flexids, shallow and U-shaped linguaflexid and narrow deep ectoflexid which in the molars reaches the linguaflexid. There are not measurable cheek teeth to calculate the hypsodonty indices.

The metapodials are slender (index 11/1 for McIII 16.4 and for MtIII 12-13.2) and relatively long (index Height McIII x 100/Height of radius = 72.0); for the numbers of measurements see Tab. 20, 27. In the metatarsals the facet for cuneiform II is always present (in 8 available specimens it is always present). The keel index (Sen *et al.*, 1978) of the Dytiko *H. matthewi* is 119.5 for McIII and 125.8 for MtIII.

DISCUSSION

The type skull of *H. matthewi* comes from Samos (locality unknown) and it is stored in the Hungarian Geological Survey. The measurements referred here to the type skull of *H. matthewi* are coming from a cast preserved in the Laboratory of Geology and Palaeontology of Thessaloniki University. The small hipparion skulls of Samos were determined to *Hemhipparion matthewi* (Wehrli, 1941). Later Gromova (1952), basing herself on the descriptions of Wehrli considered *H. matthewi* as good species. Later on Forstén (1968) studied the material of Samos stored in the various European museums and she distinguished the small-sized *H. matthewi*. Sondaar (1971) studied the material stored in the American Museum of Natural History (collection of Brown) with locality indications, recognized a small hipparion in Q5 and considered it to be, similar to *H. matthewi*. Later (Forstén, 1980) studied again the Samos hipparions and she recognized *H. matthewi* (small form) in Q5. In the continental Greece *H. matthewi* was unknown. It is referred in the old material of the lower Axios valley (collection of Arambourg), which is without locality indications, by Forstén (1968). I have seen this material in the Museum of Paris and most of this seems to belong to the Vathylakkos localities (especially the skulls). Sondaar (1971) considered that some dentitions of this material are of comparable size with those of *H. matthewi*. Arambourg (1959) referred the Thessaloniki small hipparion to *H. minus*. The new excavations in the localities of Vathylakkos have yielded a lot of material of this small-sized hipparion which differs from *H. matthewi* and it is determined as a new species, *H. macedonicum* (Koufos, 1984, 1986, 1987b, 1987c, 1988). Thus possibly these small skulls of Arambourg collection belong to this species. In the Dytiko localities *H. matthewi* was referred by Koufos (1979, 1980) but the studied material was very few. Now there is enough material, which allows a better description and comparison.

The main characteristics of *H. matthewi* as given by the different authors are: the small size, the short and narrow muzzle, the short narial opening, the single and faint preorbital fossa which is situated near the orbits, the simple enamel plication in the upper cheek teeth, the frequent and early connection of the protocone with the protoloph, the slender metapodials and the presence of a facet for cuneiform II in the metatarsals.

These morphological characters were found in the Dytiko material which seems to be similar with *H. matthewi*.

The comparison of the Dytiko piece of skull (DKO-36) with the type skull of *H. matthewi* (Fig. 6) shows that both skulls are more or less similar (parallel lines), but the DKO skull is slightly larger. The muzzle length of the DKO skull (measurement 1 in Fig. 6) seems to be rather longer than that of the type skull. According to Sondaar (1971) the muzzle length of *H. matthewi* may be variable. In some small skulls from Q5 stored in AMNH, which referred by Sondaar (1971) to *H. matthewi*, the muzzle length is at mean 95.2 mm versus 95 mm for DKO and 80 mm for the type skull. The palatal breadth (measurement 13 in Fig. 6) of the DKO skull is rather larger than that of the type skull but the last is laterally compressed and possibly the measured palatal breadth is not the real one. The muzzle breadth at the incisors border (measurement 15 in Fig. 6) is larger in the DKO than in the type skull. The similarity of the DKO mandible with the type one of *H. matthewi* is more clear (Fig. 7). The same differences found in the skull are also found in the mandible. The snout of the DKO mandible is slightly longer and wider at the incisors borders than the type material (measurements 2, 7 in Fig. 7).

The studied metacarpals are very few, one complete and two fragments. The comparison with the material from the type locality is difficult because the old material from Samos is mixed; nevertheless Sondaar (1971) refers some metapodials from Q5, of Samos to *H. matthewi* and gives their dimensions. This material from Q5 is similar in dimensions with the DTK and DKO metacarpals, but there are some differences in the distal part which is smaller in *H. matthewi* from Q5 (Fig. 8).

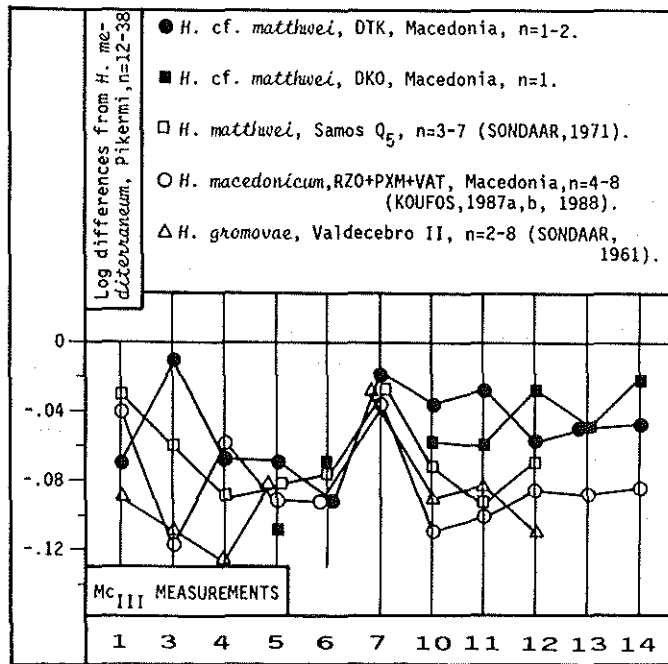


Fig. 8- Ratio diagram comparing the third metacarpal of *H. matthewi* with that of other small-sized hipparions; for the measurements see Fig. 4.

The Dytiko metatarsals of *H. matthewi* are larger than those of the type locality referred by Sondaar (1971) and they have some similar dimensions with those referred by Forstén (1968), (Fig. 9). The few material from Dytiko and the doubtful origin of the old Samos collections cannot give certain results for the metapodials, which must be referred to as *H. cf. matthewi*.

The small-sized *H. macedonicum* of the lower Axios valley was compared with the type material of *H. matthewi* earlier (Koufos, 1984, 1986, 1987b, 1987c) but it is useful to compare this with the DKO material. The skull of *H. macedonicum* is similar

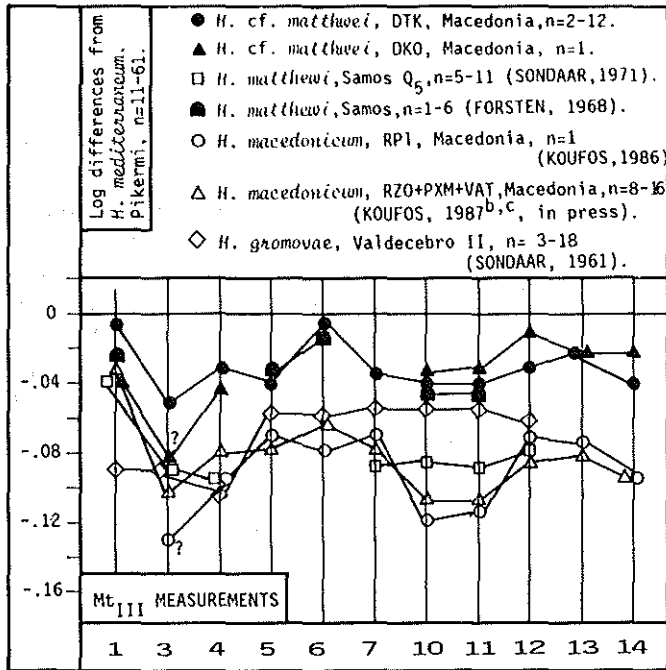


Fig.9- Ratio diagram comparing the third metatarsal of *H. matthewi* with that of other small-sized hipparions; for the measurements see Fig. 5.

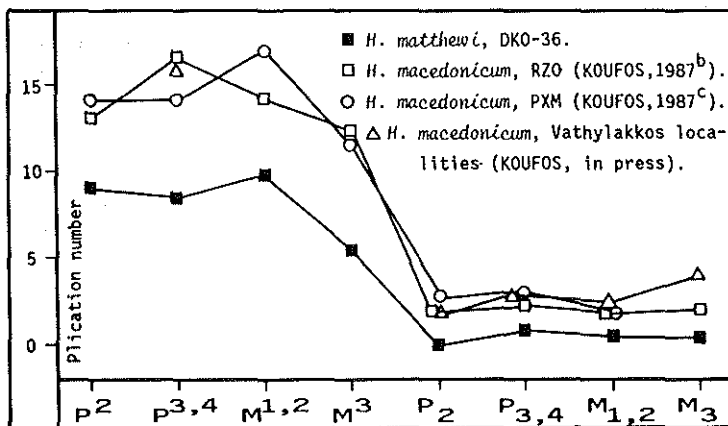


Fig.10- Plication number of the upper and lower check teeth of *H. matthewi* and *H. macedonicum*.

The skull of *H. macedonicum* is similar in size with *H. matthewi* but it has longer and wider muzzle (measurements 1,14 in Fig. 6) and deeper narial opening, situated near the orbits (measurements 30, 31, in Fig. 6). The skull of *H. macedonicum* has a remarkably longer distance between orbit and preorbital fossa than the type skull of *H. matthewi* (measurement 32 in Fig. 6). The DKO skull is broken at that point and so no data about preorbital fossa. The comparison of the DKO mandibles with the type mandible of *H. macedonicum* and with the material of *H. macedonicum* from RZO and PXM (Fig. 7) shows that the mandibles of both species are of comparable size but there are some significant differences as the higher ramus, the shorter symphysis, the wider muzzle and the longer diastema P/2-I/3 of *H. macedonicum* than those of *H. matthewi* (measurements 10, 12, 13, 14, 16, in Fig. 7).

The cheek teeth of *H. macedonicum* are more plicated than those of the Dytiko material (Fig. 10) and they are characterized by a high index $4/3 = \text{Lower molar length} \times 100 / \text{Lower premolar length}$; this index is at mean 105 for RP1 and 100 for RZO *H. macedonicum* versus 96 for the DKO material. In the PXM material this index is at mean 92.5 and may be this is due to the fact that almost all the available mandibles are with extremely worn teeth. The protocone of *H. macedonicum* is usually isolated while in *H. matthewi* shows an early connection with the protoloph. Unfortunately in the Dytiko material there is only one skull with teeth of the second stage of wear and it is impossible to see the protocone connection. The enamel in the flexids borders of the lower cheek teeth of *H. macedonicum* is crenulated while it is not in *H. matthewi*. The metapodials of *H. macedonicum* are clearly smaller than those of Dytiko (Fig. 8, 9). The metacarpals of *H. macedonicum* are somewhat longer than those of DTK but slenderer especially in the distal part (Fig. 8) and the metatarsals have similar height but they are slenderer (Fig. 9).

The morphological and metrical comparisons of the Dytiko material show that it is similar to *H. matthewi*, although the Dytiko material of *H. matthewi* is slightly larger than the type one and the material from Q5 of Samos.

Hipparion periafricanum VILLALTA & CRUSAFONT, 1957

Synonyms : 1980 *H. periafricanum* KOUFOS 1979,

Locality : Dytiko-1, 3, Macedonia, Greece.

Horizon : Late Turolian (late Miocene).

Material : Piece of maxilla with P2/-M2/, DTK-1; piece of maxilla with P4/-M1/, DTK-167; humerus + radius + os magnum + navicular + lunatum + pisiform + triquetrum + McIII, DKO-23; radius + os magnum + navicular + lunatum + pisiform + triquetrum + McIII + PhI + PhII, DKO-24; proximal and distal part of McIII, DTK-133; femur + tibia + navicular + cuboid + cuneiform I + calcaneum + astragalus + MtIII, DKO-37; distal part of tibia DTK-191; 3 naviculars, DTK-139, 140, 188; third metatarsal, DTK-138; 2 proximal parts of MtIII, DTK-151, DKO-30; first phalanx, DTK-141; second phalanx, DKO-19.

Diagnosis : Very small size; closed and isolated fossettes; very simple enamel plication; rounded-elliptical protocone; early connection of the protocone with the protoloph in P2/; pli caballin absent in molars; elongated and slender metapodials.

DESCRIPTION

The teeth are very small with closed and isolated fossettes except in P2/ in which they are connected. The enamel plication is very simple and the plis are rounded. The boucle-prefossette (Sondaar, 1961) is absent and the pli caballin is very small-rudimentary in the premolars and usually absent in the molars. The protocone is rounded-elliptical and isolated except in P2/, in which it shows an advanced connection with the protoloph. The hypocone is angular with shallow and U-shaped distal hypoconal groove. The pli protoloph and pli hypostyle (Sondaar, 1961) are usually absent especially in the molars. Unfortunately there are not available teeth to calculate the hypsodonty indices.

The metapodials are elongated (Height McIII/Height Radius 87.3 and Height MtIII/Height Tibia 80.1) and slender (11/1 12.25 for McIII and 11.5-11.6 for MtIII); for the numbers of measurements see Tab. 20, 27. A facet for cuneiform II is always present in the studied metatarsals. The keel index (Sen *et al.*, 1978) is 117.3-123.3 for McIII and 126-126.4 for MtIII.

DISCUSSION

The species *H. periafricanum* was erected by Villalta & Crusafont (1957) and the type material comes from the locality Rambla de Valdecebro II (Spain), in which it was found with *H. gromovae*. Later Sondaar (1961) studied the type material and some other from the locality Rambla de Valdecebro III and he gave a good description of the species. More later Forstén (1968) recognized this species in the hipparions material from Spain and gave its main morphological characters without significant differences from those given by Sondaar (1961). The known material from Spain was revised by Alberdi (1974), who described it and gave its main characters and its stratigraphic position.

In the lower Axios valley *H. periafricanum* was found in the locality DTK (Koufos, 1979, 1980). The presence of *H. periafricanum* in the Axios valley is very important because this very small-sized species was unknown in eastern Mediterranean region. The excavations of the following years confirmed this presence and new postcranial material were recovered from the Dytiko localities (DTK and DKO) which is now described and compared. The known postcranial material from Spain are pieces of metapodials, carpals or tarsals and phalanges. The proportions of the limbs were almost unknown and it cannot be ascertained if the metapodials were elongated or no, were slender or no. The DKO material contains two complete anterior legs and one posterior leg, which probably belong to the same individual and thus it is possible to have some data about the proportions of the limbs.

There are not contradictions in the diagnosis of the various authors for *H. periafricanum*, because all of them studied the only known material from Spain. The main characteristics given are the very small size, the very simple enamel plication, the almost constant absence of boucle prefossette, and pli protoloph, the absence of pli caballin and pli hypostyle in the molars, the connected fossettes in P2/, the early connection of the protocone with the protoloph in P2/, the slightly developed hypocone, the high hypsodonty and the elongated and slender metapodials.

The described teeth have most of the main morphologic characters of *H. periafricanum* as the connected fossettes in P2/, the small hypocone, the connected

protocone in P2/, the absence of pli caballin in the molars and the absence of boucle-prefossette, and pli protoloph. The size of the studied teeth are into the range of variations for *H. periafricanum* as given by the various authors (Fig. 11). In these diagrams the occlusal length against occlusal breadth is given for the teeth of all stages of wear. The premolar length of the DTK-1 is 55.8 mm versus 53.5-55.8 mm for *H. periafricanum* (Sondaar, 1961) and 53.5-57.7 (Alberdi, 1974). In Fig. 12 the teeth dimensions of the upper cheek teeth are compared in a logarithmic ratio diagram. The used measurements are from teeth of IIIId stage of wear, in which the studied teeth belong. The DTK teeth dimensions are similar to those of *H. periafricanum* (parallel lines) but slightly larger. The teeth dimensions of *H. matthewi* from DKO are quite larger than those of *H. periafricanum*. Thus the teeth dimensions of the specimens DTK-1 and DTK-167 are into the range of variations for *H. periafricanum*. The enamel plication, expressed, by plication number (Forstén, 1968), for the studied material and for *H. periafricanum* is given in Fig. 13. The used teeth are again those of IIIId stage of wear as the studied ones. It is clear that the DTK teeth have an intermediate position between the values given by Sondaar (1961) and Alberdi (1974). There is a difference in P2/ but it is probably due to the small number of specimens (1 from each locality). Thus in this feature the Dytiko teeth are very close to *H. periafricanum*.

The postcranials of *H. periafricanum* are very few and badly preserved and thus the comparison is difficult, although Sondaar (1961) gives the measurements of some pieces of metapodials with which we shall compare the Dytiko material (Fig. 14, 15). The metapodials of *H. periafricanum* seem to be smaller than those of Dytiko. The last ones are situated between those of *H. periafricanum* and *H. matthewi*. The metacarpals of *H. matthewi* from Dytiko seem to be shorter and more robust than those of *H. periafricanum* from the same localities.

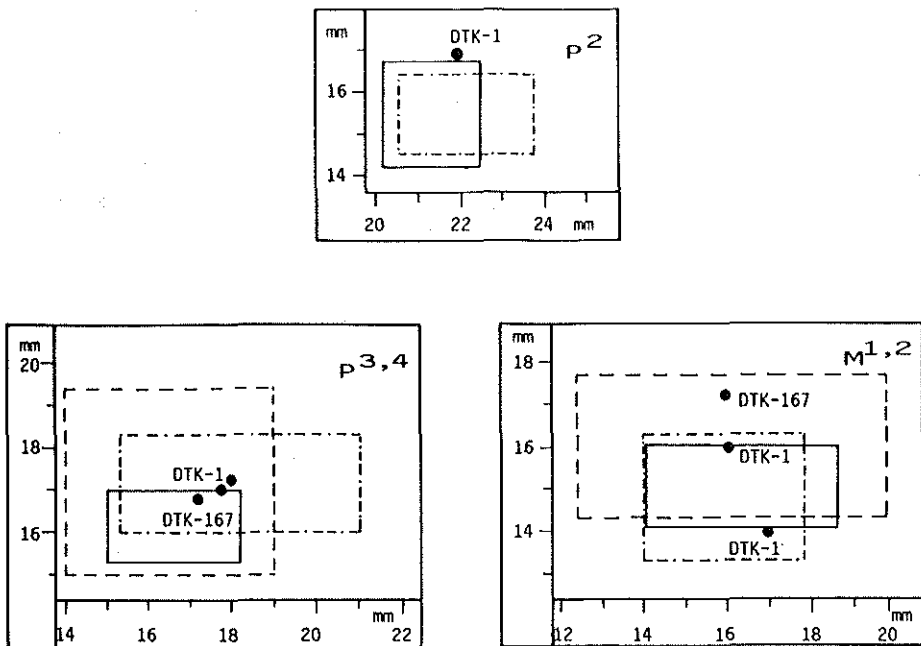


Fig.11- Scatter diagrams with the dimensions of the upper cheek teeth of *H. periafricanum* given by various authors. - Villalta & Crusafont (1957); - - Sondaar (1961); . - Alberdi (1974).

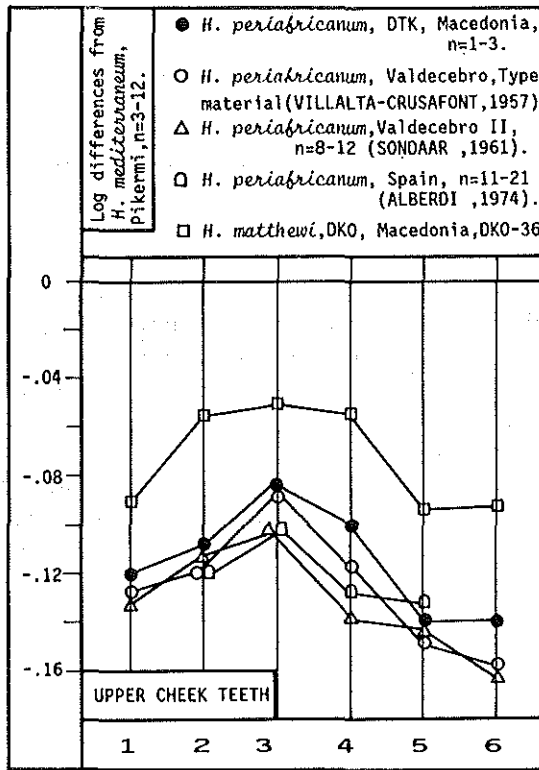


Fig.12- Ratio diagram comparing the upper cheek teeth dimensions of *H. periafricanum*.
 1. Length of P2/; 2. Length of P3,4/; 3. Length of M1, 2/; 4. Breadth of P2/; 5. Breadth of P3, 4/; 6. Breadth of M1,2/.

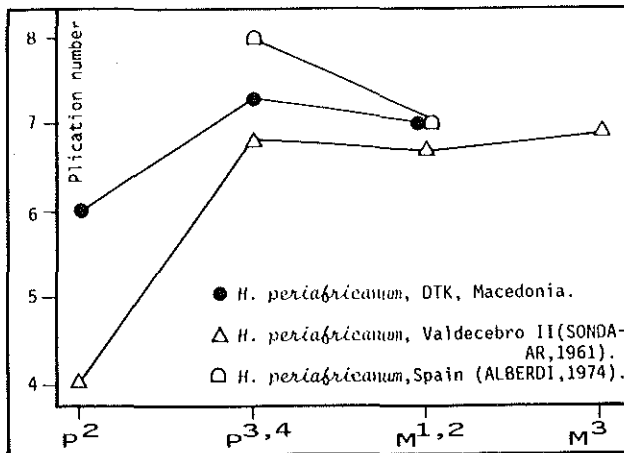


Fig.13- Plication number of the upper cheek teeth of *H. periafricanum* from various localities (III d W.S.).

A better comparison is available for the second phalanx (Fig. 16) which is larger in the Dytiko sample. The comparison of the other small bones (carpals, tarsals) of the Dytiko with those given by Sondaar (1961) for *H. periafricanum* of Spain shows that the absolute dimensions of the Dytiko material are larger than those of Spanish. Thus one can consider that the Dytiko postcranials have larger dimensions than those of *H. periafricanum* from the type locality. But the small number of specimens, the incomplete metapodials from the type locality and the absence of enough teeth material make such a conclusion enough doubtful.

A small-sized hipparion, named *H. macedonicum* is also known from the Vallesian/Turolian of lower Axios valley (Koufos, 1984, 1986, 1987b, 1987c, 1988). The bigger size, the richer enamel plication in the upper cheek teeth, the presence of a rudimentary lingual hypoconal groove, the well developed pli caballin and hypocone, the presence of boucle prefossette and pli protoloph, the certain presence of pli hypostyle in the molars, the longer and more robust metapodials distinguish *H. macedonicum* from *H. periafricanum*.

The studied Dytiko material is morphologically and metrically similar to the Spanish *H. periafricanum* but the dimensions of the bones are slightly larger than those of the type material. It is difficult to consider that the Dytiko material represents a new species or subspecies because of the poorness of the material. On the other hand, the range of variations of *H. periafricanum* from Spain is not very well known (especially for postcranials) and renders more difficult the above mentioned conclusion.

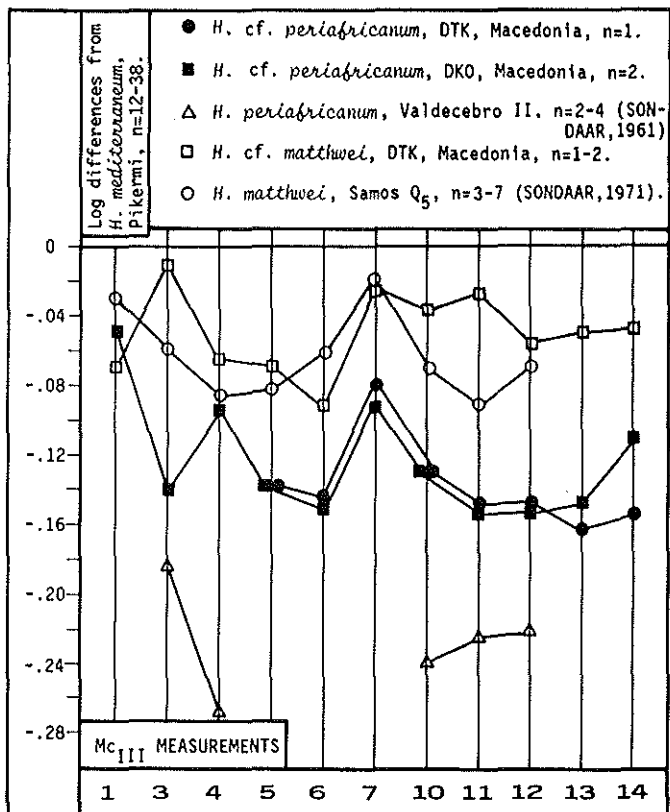


Fig.14- Ratio diagram comparing the third metacarpal of *H. periafricanum* from various localities; for the measurements see Fig. 4.

However the teeth from Dytiko are morphologically and dimensionally very similar to those of *H. periafricanum* from Spain. Thus we must consider the Dytiko teeth material similar to *H. periafricanum* but the postcranials must be referred to as *H. cf. periafricanum*. I hope that the continued excavations will give us enough material for a better knowledge of morphology and dimensions of this very small hipparion.

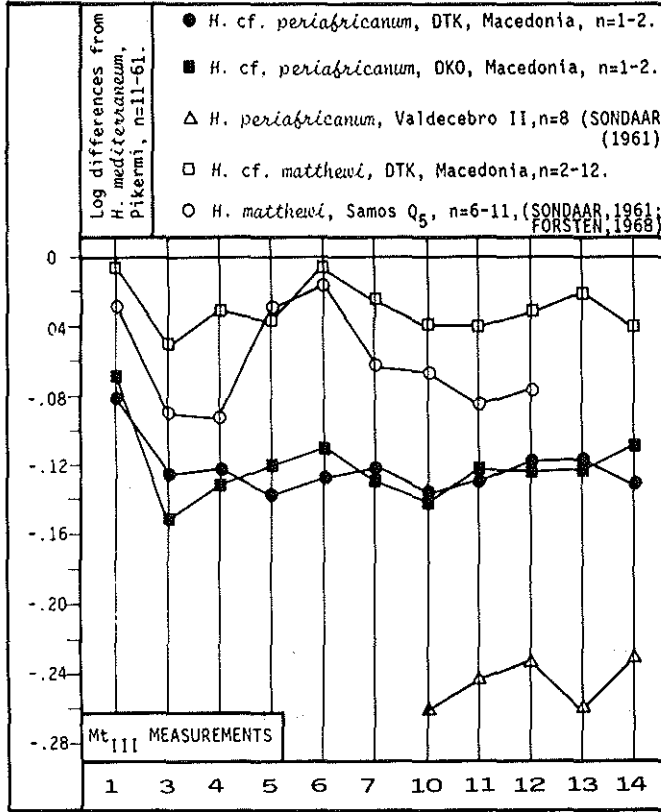


Fig.15- Ratio diagram comparing the third metatarsals of *H. periafricanum* from various localities; for the measurements see Fig. 5.

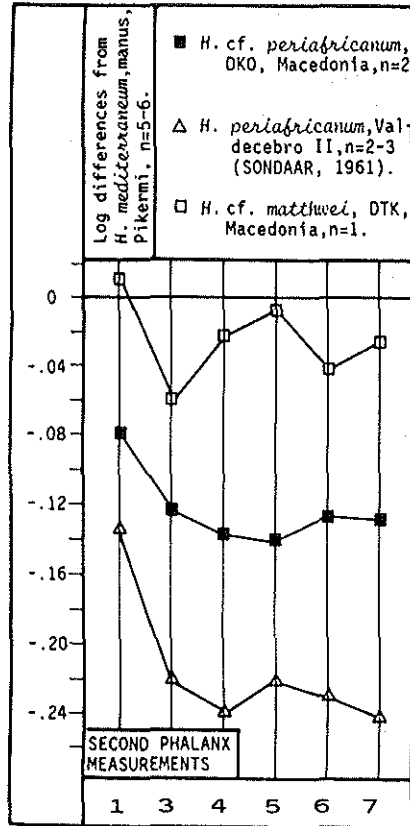


Fig.16- Ratio diagram comparing the second phalanx of *H. periafricanum* from various localities. 1. Maximal length; 3. Minimal breadth of the diaphysis; 4. Maximal proximal breadth; 5. Proximal DAP; 6. Maximal distal articular breadth; 7. Distal articular DAP.

AGE OF THE DYTIKO HIPPARIONS

The fauna of the Dytiko localities (Tab.I) allows to date them back as late Turolian (MN-13). More precisely the Dytiko fauna is younger than Pikermi and its absolute age is between 7-5.5 m.y.. The presence of two small-sized hipparions in the Dytiko fauna indicates a late Turolian age too. Some morphological features of the Dytiko hipparions confirm also this age.

The enamel plication is usually richer in the Vallesian than in the Turolian hipparions except the hipparions of Asia Minor (Staesche & Sondaar, 1979). The moderate-simple or very simple enamel plication of the Dytiko material is an evidence that it belongs to the Turolian hipparions. The plication number of the upper cheek teeth for the Dytiko *H. mediterraneum* is smaller than that of Pikermi indicating a younger age. The plication number for the upper cheek teeth of *H. matthewi* and *H. periafricanum* from Dytiko is also smaller than that of *H. gromovae* and *H. periafricanum* from Valdecebro (Spain), another indication that the Dytiko material is younger than Pikermi and more close to the late Turolian hipparions.

The primitive Vallesian hipparions have high frequency of P2/ with confluent fossettes, then this frequency is smaller in Turolian and again increases in the Pliocene forms (Tab. II). The frequency of the Dytiko material is close to those of the Turolian forms indicating a similar age.

The protocone index ($L_p \times 100/L_o$) gives also an idea about the age of hipparions. It is usually higher in the primitive forms (Vallesian or Vallesian/Turolian, zones MN-10, 11) and smaller in the Turolian forms (MN-12, 13). (Fig. 18). The values of protocone index of the Dytiko cheek teeth are smaller than those of Pikermi and close to those of Valdecebro II (*H. gromovae* and *H. periafricanum*). Thus in this feature the Dytiko material is younger than Pikermi indicating a late Turolian age. If we consider that Pikermi belongs to MN-12 then the Dytiko must belong to MN-13.

The hypsodonty index can also be used to distinguish the primitive from the more advanced hipparions. Unfortunately the measurable teeth from Dytiko are very few and thus it is impossible to calculate the hypsodonty indices. Although two available teeth have indices, which indicate that they are hypsodont like Turolian hipparions.

Another morphological feature indicating the age of hipparions is the facet for cuneiform II. The absence frequency of this facet is higher in the Vallesian than in the Turolian forms (Tab. III). There is an exception in *H. gromovae*, which has high frequency of MtIII lacking a facet for cuneiform II, and this characteristic is used for its distinction from *H. matthewi* (Sondaar, 1961). The facet for cuneiform II is almost present in the Dytiko material and in that feature it is very close to the late Turolian forms.

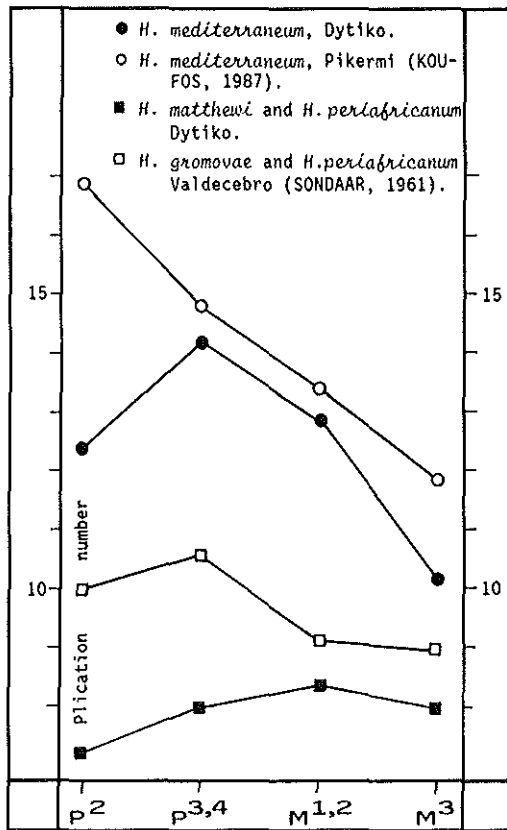


Fig.17- Plication number of the upper cheek teeth of hipparions from various localities.

CONCLUSIONS

Three different species of *Hipparion* have been determined in the Dytiko material. The middle-sized *H. mediterraneum* Roth & Wagner, the small-sized *H. matthewi* Abel and the very small-sized *H. periafricanum* Villalta & Crusafont. The last two species were well determined by the skulls and teeth; the postcranials from the type localities are very few and a good comparison is impossible. Therefore, the postcranials of Dytiko were referred to as *H. cf. matthewi* and *H. cf. periafricanum*. I believe that the continued excavations will provide us more material allowing a better distinction and comparison. Some morphological features of *H. mediterraneum* from Dytiko as the less plicated enamel in the upper cheek teeth (Fig. 17), the smaller protocone index (Fig. 18), the slightly slenderer metapodials and the lower frequency of MtIII without a facet for cuneiform II, than those of *H. mediterraneum* from Pikermi, indicate a younger age. The presence of *H. matthewi* which is similar but somewhat larger than the type material from Samos confirms the above age. This small-sized species is the type

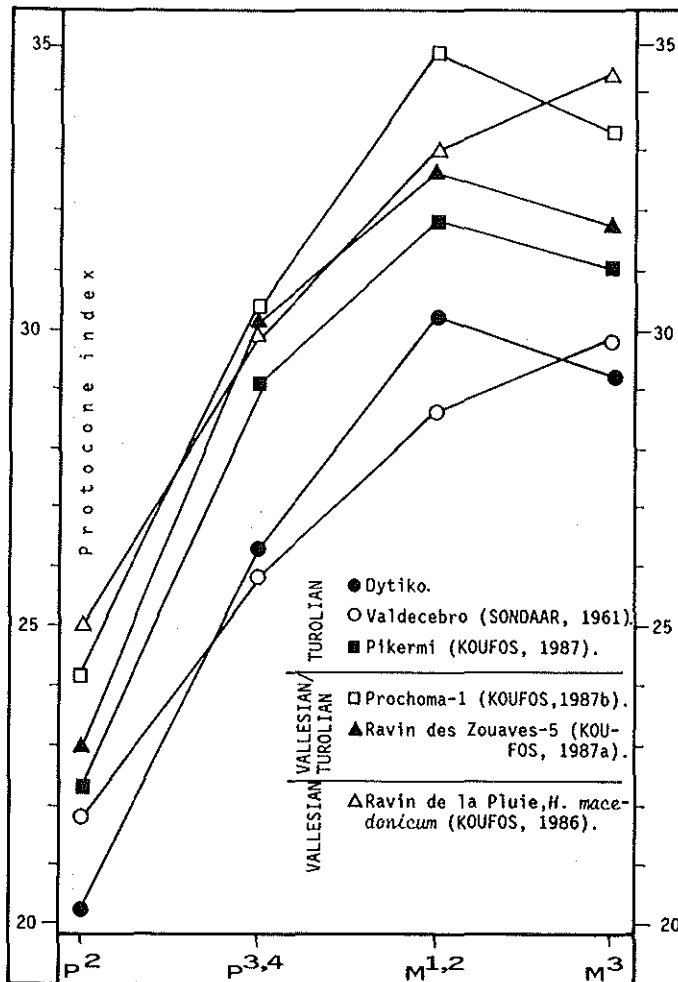


Fig.18- Protocone index for hipparions of various localities.

representative of the Zone-4 of *Hipparion* in the Mediterranean Neogene (Sen *et al.*, 1978) indicating a late Turolian age. The few material from Dytiko, as well as the not well known material from Samos make difficult the comparison between them. The third species from Dytiko is very small. The comparison of the upper cheek teeth with those of *H. periafricanum* from Spain shows that they are morphologically and metrically similar (Fig. 11, 12, 13). But the available postcranial material from Dytiko has somewhat larger dimensions than that of *H. periafricanum* from Spain and it is situated between *H. matthewi* and *H. periafricanum* (Fig. 14, 15, 16). The scarcity of the material from both areas (Axios valley and Spain) does not give a good knowledge of the ranges of variations in the dimensions of various bones and renders difficult their comparison. The similarity of the teeth with those of *H. periafricanum* allow us to consider the very small-sized hipparion from Dytiko as a *H. periafricanum* but with larger dimensions. *H. periafricanum* is also another representative of the late Turolian (Alberdi, 1974; Sen *et al.*, 1978). After the above mentioned interpretation the Dytiko localities must be considered younger than Pikermi belonging to late Turolian (MN-13) an age confirmed by all the other fauna (Tab. I).

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ANNEXES

TABLES I-III

FAUNA	DTK	DIT	DKO
<i>Protictitherium crassum</i>			+
<i>Chasmaporthetes bonisi</i>	+		
<i>Choerolophodon pentelici</i>	+		
<i>Hipparion mediterraneum</i>	+	+	+
<i>Hipparion matthewi</i>	+	+	+
<i>Hipparion periafricanum</i>	+		+
<i>Dicerorhinus orientalis</i>	+		
<i>Protragelaphus theodori</i>	+		+
" <i>Graecoryx</i> " cf. <i>valenciennesi</i>	+	+	+
<i>Gazella</i> sp.	+	+	+
<i>Palaeoreas lindermayeri</i>	+	+	
<i>Bohlinia attica</i>	+	+	
<i>Palaeotragus rouenii</i>		+	
<i>Dorcatherium puyhauberti</i>		+	
<i>Pliocervus pentelici</i>	+		
<i>Microstonyx major</i>	+		
<i>Mesopithecus pentelicus</i>	+	+	+
<i>Hystrix</i> sp.			+

Table I. Faunistic list of the Dytiko localities (De Bonis *et al.*, 1985; Koufos, 1987d).

	KOUFOS (1986,87,87a)	SONDAAR (1961)	ALBERDI (1974,75)
RUSCINIAN			
<i>H. crusafonti</i>	-	100%	50%
TUROLIAN			
Dytiko	41.5%	-	-
Valdecebro II	-	7.3%	27%
Pikermi	26%	-	-
Concud	-	28%	46%
VALLESIAN			
Ravin des Zouaves-5	36%	-	-
Ravin de la Pluie	66%	-	-
Nombrevilla	-	85.3%	80%
Eppelsheim	-	31.6%	57%

Table II. Frequency of P2/ with confluent fossettes.

		Total number of MtIII	MtIII without facet for cuneiform II	% absence of the facet
TUROLIAN	Dytiko	31	1	3.2
	Kinik	6	1 ?	16.6?
	Samos Q5	6	0	0
	Maragha	20	2	10.0
	Valdecebro II	12	7	58.3
	Pikermi	69	8	11.5
	Concud	11	1	9.0
	Garkin	18	0	0
VALLESIAN TUROLIAN	Ravin des Zouaves-5	6	1	16.5
	Montredon/Soblay	5	1	20.0
	Kayadibi	6	1	16.5
VALLESIAN	Ravin de la Pluie	2		100.0
	Esmé-Akça	17	7	41.0
	Can Llobateres	6	3	50%
	Eppelsheim	4	3	75%

Table III. Frequency of metatarsals without a facet for cuneiform II; data from Sen *et al.* (1978); Koufos (1987a,b).

TABLES 1-30

Table 1. *Hipparion mediterraneum* and *Hipparion matthewi*, Dytiko, Macedonia, skull.

1. Muzzle length: Prosthion - middle of the line connecting the anterior borders of P2/; 2. Palatal length: middle of the line connecting the anterior borders of P2/ to anterior border of choanae; 3. Length from anterior border of choanae to vomer; 4. Length vomer - basion; 5. Post-palatal length: basion - anterior border of choanae; 6. Basilar length: basion - prosthion; 7. Premolar length (alveolar); 8. Molar length (alveolar); 9. Toothseries length (alveolar); 10. Choanal length; 11. Minimal breadth of choanae; 12. Maximal breadth of choanae; 13. Palatal breadth between P4/ and M1/; 14. Minimal muzzle breadth; 15. Muzzle breadth: breadth between the posterior borders of I/3; 16. Maximal length of fossa temporalis; 17. Distance basion-foramen ethmoidalis; 18. Frontal breadth: between the most external points of the posterior borders of the orbits; 19. Zygomatic breadth: between the most external points of the zygomatic arcs; 20. Greatest breadth of the supra occipital crest; 21. Occipital breadth at paroccipital processes; 22. Occipital height: upper border of the occipital foramen - middle of the supra occipital crest; 23. Anterior ocular line: prosthion - most external point of the posterior border of the orbit; 24. Posterior ocular line: last point - middle of the supra occipital crest; 25. Facial height: height of the skull in front of P2/; 26. Idem posterior of the orbits; 27. Height of meatus acusticus; 28. Anteroposterior diameter of the orbit; 29. Dorsoventral diameter of the orbit (perpendicular to 28); 30. Length of the nasoincisival notch: prosthion - posterior end of the narial opening; 31. Cheek length: posterior end of the narial opening - anterior border of the orbit; 32. Distance orbit - preorbital fossa (PF); 33. Length of PF; 34. Distance posterior end of PF - infraorbital foramen; 35. Height of PF (perpendicular to 33); 36. Distance ventral border of PF - crista facialis; 37. Distance infraorbital foramen - alveoles of the toothseries; 38. Distance posterior end of PF - alveoles of the toothseries.

	<i>H. mediterraneum</i>				<i>H. matthewi</i>	
	n	\bar{x}	min	max	n	\bar{x}
1	2	117.0	116.0	118.0	1	95.0
2	1	107.0	-	-	1	(90)
3	-	-	-	-	1	(85)
4	-	-	-	-	1	(70)
5	-	-	-	-	1	142.0
6	-	-	-	-	1	325.0
7	4	77.87	76.5	80.0	2	65.00
8	3	66.66	65.5	68.0	2	54.00
9	3	143.33	142.0	(145)	2	119.00
10	-	-	-	-	1	65.0
12	1	41.0	-	-	-	-
13	1	61.0	-	-	1	44.0
14	2	26.0	23.0	29.0	1	(23)
15	2	56.5	56.0	57.0	1	51.0
19	-	-	-	-	1	138.0
20	-	-	-	-	1	38.0
23	1	(330)	-	-	1	(260)
24	-	-	-	-	1	(140)
25	1	(90)	-	-	-	-
28	-	-	-	-	-	60.0
29	1	51.0	-	-	1	38.5
30	2	122.5	115.0	(130)	1	85
31	1	(153)	-	-	1	(120)
32	1	37.0	-	-	-	-
33	1	65.0	-	-	-	-
34	1	69.0	-	-	-	-
35	1	42.0	-	-	-	-
36	1	32.0	-	-	-	-
37	1	54.0	-	-	-	-
38	1	79.0	-	-	-	-

		n	\bar{x}	min	max	s	v
<i>Hipparion mediterraneum</i>	1	-	-	-	-	-	-
	2	8	105.25	99.0	116.0	5.47	5.19
	3	15	72.72	69.0	78.5	2.92	4.01
	4	12	67.79	65.0	71.0	1.91	2.81
	5	12	143.00	135.0	151.0	5.06	3.53
	6	2	110.00	105.0	115.0	-	-
	7	7	49.14	42.5	52.0	3.47	7.06
	8	1	190.0	-	-	-	-
	9	1	167.0	-	-	-	-
	10	3	87.00	85.0	90.0	2.64	3.03
	11	8	62.62	60.0	68.0	2.50	3.99
	12	10	44.95	43.0	48.0	1.36	3.02
	13	4	68.12	66.0	71.5	2.39	3.50
	14	3	18.93	18.8	19.0	0.11	0.58
	15	-	-	-	-	-	-
	16	8	81.62	70.0	95.0	8.34	10.21
<i>Hipparion matthewi</i>	1	-	-	-	-	-	-
	2	1	88.0	-	-	-	-
	3	5	61.40	59.5	65.5	2.38	3.87
	4	5	58.90	57.0	62.5	2.13	3.61
	5	5	122.20	120.0	129.0	3.89	3.18
	6	-	-	-	-	-	-
	7	1	46.0	-	-	-	-
	8	-	-	-	-	-	-
	9	-	-	-	-	-	-
	10	1	63.0	-	-	-	-
	11	2	54.50	54.0	55.0	-	-
	12	3	38.83	37.0	40.5	1.75	4.50
	13	1	56.0	-	-	-	-
	14	1	17.0	-	-	-	-
	15	-	-	-	-	-	-
	16	1	60.0	-	-	-	-

Table 2. *Hipparion mediterraneum* and *Hipparion matthewi*, Dytiko, Macedonia, mandible.

1. Maximal length: posterior point of the articular condyle - anterior point situated between the two I/1 (in projection); 2. Muzzle length: middle of the line connecting the anterior borders of P/2 to a point situated between the two I/1; 3. Premolar length (alveolar); 4. Molar length (alveolar); 5. Toothseries length (alveolar); 6. Distance from posterior end of M/3 to posterior border of the vertical ramus; 7. Muzzle breadth: breadth at the posterior borders of I/3; 8. Height: articular condyle - base of the horizontal ramus; 9. Height: incisura mandibulae - base of the horizontal ramus; 10. Height of the jaw behind M/3; 11. Idem between P/4 and M/1; 12. Idem in front of P/2; 13. Symphysis length; 14. Minimal breadth of the symphysis; 15. Angle formed between horizontal ramus and the line connecting articular condyle with I/1; 16. Length of diastema P/2-I/3.

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v	
P2	L _o	2	30.75	30.5	31.0	-	-	M ¹	2	23.40	23.4	23.5	-	-	
	B _o	2	19.00	19.0	19.0	-	-		2	20.30	20.2	20.4	-	-	
	L _p	2	5.95	5.7	6.2	-	-		2	6.00	6.0	6.0	-	-	
	B _p	2	3.85	3.8	3.9	-	-		2	3.55	3.4	3.7	-	-	
	E.F.	2	<u>3.00, 3.00, 2.50, 1.00</u>								2	<u>6.00, 5.50, 4.00, 1.00</u>			
			1.00									1.00			
P3	L _o	2	25.00	25.0	25.0	-	-	M ²	1	23.4	-	-	-	-	
	B _o	2	20.35	20.0	20.7	-	-		1	17.0	-	-	-	-	
	L _p	2	4.90	4.8	5.0	-	-		2	4.90	4.8	5.0	-	-	
	B _p	2	4.00	4.0	4.0	-	-		2	3.10	3.0	3.2	-	-	
	E.F.	2	<u>4.00, 3.50, 2.50, 0.00</u>								1	<u>2, 5, 1, 1</u>			
			1.00									1			
P4	L _o	2	23.80	23.6	24.0	-	-	M ³	-	-	-	-	-	-	
	B _o	2	17.50	17.0	18.0	-	-		-	-	-	-	-	-	
	L _p	-	-	-	-	-	-		-	-	-	-	-	-	
	B _p	-	-	-	-	-	-		-	-	-	-	-	-	
	E.F.	2	Unwear								-	<u>-</u>			
												-			

Table 3. *Hipparion mediterraneum*, Dytiko, Macedonia, upper permanent cheek teeth (Ist W.S.).

	n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v	
P ²	L _o	1	30.3	-	-	-	-	-	-	-	-	-	-	
	B _o	1	22.4	-	-	-	-	-	-	-	-	-	-	
	L _p	1	6.5	-	-	-	-	M ¹	1	5.8	-	-	-	-
	B _p	1	5.0	-	-	-	-		1	3.6	-	-	-	-
	E.F.	1	$\frac{3, 5, 3, 1}{1}$						1	$\frac{1, 5, 3, 1}{1}$				
P ³	L _o	-	-	-	-	-	-		1	19.1	-	-	-	-
	B _o	-	-	-	-	-	-		1	20.0	-	-	-	-
	L _p	-	-	-	-	-	-	M ²	1	5.5	-	-	-	-
	B _p	-	-	-	-	-	-		1	4.0	-	-	-	-
	E.F.		$\frac{-}{-}$						1	$\frac{0, 4, 3, 1}{1}$				
P ⁴	L _o	1	21.5	-	-	-	-		3	20.60	20.5	20.7	0.10	0.48
	B _o	2	22.50	21.0	24.0	-	-		3	16.96	16.5	17.8	0.72	4.24
	L _p	2	5.60	5.2	6.0	-	-	M ³	3	5.73	5.5	6.0	0.25	4.36
	B _p	2	4.35	4.0	4.7	-	-		3	3.60	3.5	3.7	0.10	2.77
	E.F.	2	$\frac{2.50, 7.00, 5.00, 1.00}{1.00}$						3	$\frac{1.00, 3.33, 3.33, 1.00}{1.00}$				

Table 4. *Hipparion mediterraneum*, Dytko, Macedonia, upper permanent cheek teeth (Ind W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ²	L _o	3	30.06	29.7	30.3	0.40	1.33	M ¹	4	20.52	20.0	21.0	0.42	2.04
	B _o	3	21.73	21.0	22.7	0.87	4.00		4	20.55	20.0	21.0	0.52	2.53
	L _p	3	5.80	5.5	6.2	0.36	6.20		4	6.42	6.0	7.0	0.42	6.54
	B _p	3	4.70	4.7	4.7	0.00	0.00		4	4.15	4.0	4.3	0.13	3.13
	E.F.	2	<u>3.50, 4.00, 4.00, 1.50</u>							4	<u>1.00, 7.00, 4.50, 1.50</u>			
			1.00							1.00				
P ³	L _o	4	23.37	22.2	25.5	1.45	6.20	M ²	4	20.77	20.0	21.3	0.57	2.74
	B _o	4	22.30	20.9	23.5	1.07	4.79		4	19.97	19.1	20.7	0.75	3.75
	L _p	4	5.67	5.2	6.3	0.56	9.87		4	5.90	5.5	6.5	0.45	7.62
	B _p	4	4.62	4.5	4.7	0.09	1.94		4	4.25	4.1	4.4	0.13	3.05
	E.F.	4	<u>1.75, 6.25, 5.75, 1.50</u>							4	<u>1.00, 5.50, 4.75, 1.25</u>			
			1.00							1.00				
P ⁴	L _o	3	23.50	22.5	24.0	0.86	3.65	M ³	1	20.2	-	-	-	-
	B _o	3	22.23	21.2	23.0	0.93	4.18		1	17.7	-	-	-	-
	L _p	3	6.03	5.8	6.3	0.25	4.14		1	6.0	-	-	-	-
	B _p	3	4.56	4.5	4.7	0.11	2.41		1	3.4	-	-	-	-
	E.F.	3	<u>1.33, 6.33, 3.66, 1.00</u>							1	<u>1, 6, 5, 2</u>			
			1.00							1				

Table 5. *Hipparion mediterraneum*, Dytiko, Macedonia, upper permanent cheek teeth (III^d W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P2	L _o	-	-	-	-	-	-	M ¹	2	18.25	18.0	18.5	-	-
	B _o	-	-	-	-	-	-		1	21.0	-	-	-	-
	L _p	-	-	-	-	-	-		2	6.70	6.7	6.7	-	-
	B _p	-	-	-	-	-	-		2	5.10	5.0	5.2	-	-
	E.F.			-	-				1-2	<u>0.00, 4, 3.00, 1.00</u>				1.00
P3	L _o	2	22.85	22.7	23.0	-	-	M ²	2	18.85	18.8	18.9	-	-
	B _o	2	22.45	22.4	22.5	-	-		1	20.2	-	-	-	-
	L _p	2	6.70	6.6	6.8	-	-		2	6.60	6.5	6.7	-	-
	B _p	2	4.90	4.8	5.0	-	-		2	5.00	5.0	5.0	-	-
	E.F.	2	<u>1.00, 5.50, 4.00, 1.00</u>							2	<u>0.00, 5.00, 3.00, 1.00</u>			
P4	L _o	2	21.40	21.2	21.6	-	-	M ³	1	23.5	-	-	-	-
	B _o	2	22.95	22.8	23.1	-	-		1	19.4	-	-	-	-
	L _p	2	6.90	6.8	7.0	-	-		2	7.35	7.0	7.7	-	-
	B _p	2	5.25	5.0	5.5	-	-		2	4.50	4.4	4.6	-	-
	E.F.	2	<u>1.00, 5.00, 4.00, 1.00</u>							1-2	<u>0.00, 4.50, 3, 1</u>			
				2.00										

Table 6. *Hipparion mediterraneum*, Dytiko, Macedonia, upper permanent cheek teeth (VIth W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P2	L _o	5	23.66	23.0	24.8	0.67	2.83	M1	2	16.95	16.9	17.0	-	-
	B _o	3	18.23	17.8	18.2	0.45	2.46		2	17.65	17.6	17.7	-	-
	L _p	4	4.97	4.7	5.2	0.20	4.02		2	5.25	5.1	5.4	-	-
	B _p	4	3.75	3.6	3.9	0.13	3.46		2	3.40	3.3	3.5	-	-
	E.F.	4	<u>1.50, 2.25, 1.75, 0.75</u>				1.00		2	<u>1.00, 4.00, 2.00, 1.00</u>				1.00
P3	L _o	2	20.25	20.0	20.5	-	-	M2	2	18.20	18.0	18.4	-	-
	B _o	2	19.10	19.0	19.2	-	-		2	17.20	17.0	17.4	-	-
	L _p	2	5.40	5.3	5.5	-	-		2	5.05	5.0	5.1	-	-
	B _p	2	3.75	3.7	3.8	-	-		1	3.4	-	-	-	-
	E.F.	2	<u>1.00, 3.00, 2.00, 1.00</u>				1.00		2	<u>1.00, 4.50, 2.50, 1.00</u>				1.00
P4	L _o	2	19.60	19.5	19.7	-	-	M3	4	18.55	16.2	20.8	2.08	11.21
	B _o	2	18.60	18.5	18.7	-	-		4	15.47	14.0	17.0	1.54	9.95
	L _p	2	5.60	5.5	5.7	-	-		3	5.63	5.5	5.7	0.11	1.95
	B _p	2	3.55	3.5	3.6	-	-		3	3.43	2.8	4.0	0.60	17.49
	E.F.	2	<u>1.00, 3.50, 2.50, 1.00</u>				1.00		3	<u>0.33, 3.33, 2.66, 0.66</u>				1.00

Table 7. *Hipparion matthewi*, Dytiko, Macedonia, upper permanent cheek teeth (IInd W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v	
P ²	L _o	1	22.0	-	-	-	-	M ¹	2	16.00	16.0	16.0	-	-	
	B _o	1	16.8	-	-	-	-		2	16.60	16.0	17.2	-	-	
	L _p	1	4.6	-	-	-	-		2	5.30	5.1	5.5	-	-	
	B _p	1	3.8	-	-	-	-		2	3.60	3.5	3.7	-	-	
	E.F.	1	$\frac{1, 2, 1, 1}{1}$				-		-	2	$\frac{0.00, 4.50, 2.50, 0.50}{1.00}$				-
P ³	L _o	1	18.0	-	-	-	-	M ²	1	17.0	-	-	-	-	
	B _o	1	17.2	-	-	-	-		1	14.0	-	-	-	-	
	L _p	1	4.3	-	-	-	-		1	4.7	-	-	-	-	
	B _p	1	3.7	-	-	-	-		1	3.0	-	-	-	-	
	E.F.	1	$\frac{1, 3, 1, 1}{1}$				-		-	1	$\frac{0, 2, 1, 1}{0}$				-
P ⁴	L _o	2	17.50	17.2	17.8	-	-	M ³	-	-	-	-	-	-	
	B _o	2	16.90	16.8	17.0	-	-		-	-	-	-	-	-	-
	L _p	2	5.00	5.0	5.0	-	-		-	-	-	-	-	-	-
	B _p	1	3.6	-	-	-	-		-	-	-	-	-	-	-
	E.F.	2	$\frac{0.50, 3.50, 1.50, 1.00}{1.00}$				-		-	-	$\frac{-}{-}$				-

Table 8. *Hipparion periafricanum*, Dytiko, Macedonia, upper permanent cheek teeth (III^d W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ₂	L _o	2	27.10	27.0	27.2	-	-	M ₁	3	25.70	24.8	27.3	1.39	5.40
	B _o ant	2	9.85	9.7	10.0	-	-		3	10.16	9.7	10.8	0.56	5.51
	B _o post	2	12.10	12.0	12.2	-	-		3	9.73	9.2	10.0	0.46	4.72
	L _{prfl}	2	8.50	8.0	9.0	-	-		3	7.06	6.8	7.5	0.37	5.24
	L _{ptfl}	2	11.70	11.6	11.8	-	-		3	9.50	9.0	10.0	0.50	5.26
	E.F.	2	<u>0.00, 0.00, 1.00</u> 0.00						3	<u>0.33, 1.00, 0.00</u> 0.00				
P ₃	L _o	2	25.50	25.0	26.0	-	-	M ₂	2	26.50	26.5	26.5	-	-
	B _o ant	2	12.25	12.2	12.3	-	-		2	9.95	9.6	10.3	-	-
	B _o post	1	13.0	-	-	-	-		2	8.75	8.5	9.0	-	-
	L _{prfl}	2	6.70	6.7	6.7	-	-		2	6.70	6.5	6.9	-	-
	L _{ptfl}	1	10.8	-	-	-	-		2	9.50	9.0	10.0	-	-
	E.F.	2	<u>0.00, 0.50, 0.00</u> 0.00						2	<u>0.00, 1.00, 0.00</u> 0.00				
P ₄	L _o	2	24.60	24.2	25.0	-	-	M ₃	1	25.5	-	-	-	-
	B _o ant	2	11.15	11.0	11.3	-	-		-	-	-	-	-	-
	B _o post	2	11.15	11.0	11.3	-	-		-	-	-	-	-	-
	L _{prfl}	2	6.85	6.7	7.0	-	-		-	-	-	-	-	-
	L _{ptfl}	2	10.30	10.2	10.4	-	-		-	-	-	-	-	-
	E.F.	2	<u>0.00, 1.00, 0.00</u> 0.00						-	<hr/>				

Table 9. *Hipparion mediterraneum*, Dytiko, Macedonia, lower permanent cheek teeth (Ist W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ₂	L _o	6	25.93	25.0	27.5	0.92	3.54	M ₁	5	21.52	20.2	22.3	0.84	3.90
	B _{o ant}	6	10.23	9.5	10.5	0.37	3.61		5	11.30	11.2	11.5	0.12	1.06
	B _{o post}	6	12.23	12.0	12.7	0.30	2.45		5	10.02	9.7	10.2	0.20	1.99
	L _{prfl}	5	7.24	6.0	8.5	0.90	12.43		5	6.12	5.1	6.8	0.67	10.94
	L _{ptfl}	6	11.58	11.0	12.1	0.45	3.88		5	8.48	7.3	9.5	0.78	9.19
	E.F.	6	<u>0.00, 0.00, 0.66</u>			0.66			5	<u>0.00, 1.00, 0.00</u>			0.40	
P ₃	L _o	5	23.92	22.5	25.5	1.38	5.76	M ₂	5	21.16	20.2	22.3	0.75	3.54
	B _{o ant}	5	12.94	12.7	13.0	0.13	1.00		5	11.08	10.5	12.0	0.60	5.41
	B _{o post}	5	12.72	12.0	13.0	0.41	3.22		5	9.92	9.3	11.0	0.66	6.65
	L _{prfl}	5	6.74	5.3	7.4	0.82	12.16		5	6.02	5.5	7.0	0.57	9.46
	L _{ptfl}	5	11.92	11.0	12.4	0.60	5.03		5	8.56	7.5	9.3	0.66	7.71
	E.F.	5	<u>0.40, 0.80, 0.00</u>			0.60			5	<u>0.00, 1.00, 0.00</u>			0.00	
P ₄	L _o	4	23.50	22.6	25.2	1.16	4.93	M ₃	4	23.20	24.0	25.2	0.67	2.76
	B _{o ant}	3	12.80	12.5	13.1	0.30	2.34		4	9.37	9.0	10.0	0.47	5.01
	B _{o post}	4	12.17	11.7	12.6	0.40	3.28		4	8.05	7.7	9.0	0.63	7.82
	L _{prfl}	5	6.42	5.4	7.6	0.81	12.61		4	6.55	6.0	7.1	0.46	7.02
	L _{ptfl}	5	11.22	9.6	12.0	1.11	9.89		4	7.50	7.2	8.0	0.35	4.66
	E.F.	5	<u>0.40, 1.00, 0.00</u>			0.80			4	<u>0.00, 1.00, 0.00</u>			0.00	

Table 10. *Hipparion mediterraneum*, Dytko, Macedonia, lower permanent cheek teeth (IInd W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ₂	L _o	10	26.31	25.1	28.5	1.13	4.29	M ₁	10	20.25	19.2	21.2	0.62	3.06
	B _o ant	10	10.37	10.0	11.5	0.48	4.62		9	11.55	10.8	12.0	0.48	4.15
	B _o post	10	12.34	12.0	12.9	0.32	2.59		10	10.38	10.0	11.0	0.41	3.95
	L _{prfl}	10	7.51	6.0	9.0	0.74	9.85		10	5.39	5.0	6.0	0.44	8.16
	L _{ptfl}	10	11.11	9.0	13.3	1.23	11.07		10	6.34	4.3	8.6	1.23	19.40
	E.F.	10	<u>0.00, 0.00, 0.40</u>						10	<u>0.10, 0.20, 0.00</u>				
				0.20						0.00				
P ₃	L _o	11	22.45	21.3	23.5	0.59	2.62	M ₂	11	20.35	19.0	21.9	0.84	4.12
	B _o ant	11	13.39	12.4	15.0	0.73	5.45		9	11.37	10.7	12.0	0.50	4.39
	B _o post	11	13.07	12.1	13.8	0.53	4.05		11	9.83	9.3	10.0	0.27	2.74
	L _{prfl}	11	6.85	5.5	8.4	0.95	13.86		11	5.44	4.7	6.2	0.45	8.27
	L _{ptfl}	11	10.31	8.0	12.2	1.51	14.64		11	6.73	4.3	8.5	1.30	19.31
	E.F.	11	<u>0.18, 0.54, 0.18</u>						11	<u>0.09, 0.36, 0.00</u>				
				0.27						0.00				
P ₄	L _o	11	22.41	21.5	23.5	0.50	2.23	M ₃	6	24.40	22.8	26.0	1.40	5.73
	B _o ant	11	13.40	12.1	14.5	0.72	5.37		8	10.33	9.1	11.8	0.88	8.51
	B _o post	11	12.30	11.4	13.0	0.51	4.14		7	8.70	7.8	9.7	0.61	7.01
	L _{prfl}	11	6.49	5.3	7.2	0.48	7.39		8	5.60	4.4	6.5	0.59	10.53
	L _{ptfl}	11	10.33	9.0	12.7	1.24	12.00		7	6.52	4.7	9.2	1.62	24.84
	E.F.	11	<u>0.18, 0.72, 0.18</u>						8	<u>0.00, 0.50, 0.00</u>				
				0.27						0.00				

Table 11. *Hipparion mediterraneum*, Dyiko, Macedonia, lower permanent cheek teeth (III d W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ₂	L _o	1	26.8	-	-	-	-	M ₁	1	18.5	-	-	-	-
	B _{o ant}	1	9.6	-	-	-	-		1	12.5	-	-	-	-
	B _{o post}	1	12.0	-	-	-	-		1	10.4	-	-	-	-
	L _{prfl}	1	5.8	-	-	-	-		1	0.0	-	-	-	-
	L _{ptfl}	1	8.5	-	-	-	-		1	0.0	-	-	-	-
	E.F.	1		$\frac{0, 0, 0}{0}$					1		$\frac{0, 0, 0}{0}$			
P ₃	L _o	1	20.0	-	-	-	-	M ₂	1	18.0	-	-	-	-
	B _{o ant}	1	12.0	-	-	-	-		1	11.0	-	-	-	-
	B _{o post}	1	13.0	-	-	-	-		1	9.6	-	-	-	-
	L _{prfl}	1	4.3	-	-	-	-		1	4.0	-	-	-	-
	L _{ptfl}	1	0.0	-	-	-	-		1	0.0	-	-	-	-
	E.F.	1		$\frac{0, 0, 0}{0}$					1		$\frac{0, 0, 0}{0}$			
P ₄	L _o	1	19.3	-	-	-	-	M ₃	1	25.0	-	-	-	-
	B _{o ant}	1	13.5	-	-	-	-		1	10.3	-	-	-	-
	B _{o post}	1	12.0	-	-	-	-		1	8.8	-	-	-	-
	L _{prfl}	1	5.0	-	-	-	-		1	4.2	-	-	-	-
	L _{ptfl}	1	0.0	-	-	-	-		1	0.0	-	-	-	-
	E.F.	1		$\frac{0, 0, 0}{0}$					1		$\frac{0, 0, 0}{0}$			

Table 12. *Hipparion mediterraneum*, Dytiko, Macedonia, lower permanent cheek teeth (IVth W.S.).

		n	\bar{x}	min	max	s	v		n	\bar{x}	min	max	s	v
P ₂	L _o	4	20.77	20.3	21.2	0.40	1.92	M ₁	4	18.15	17.0	19.3	1.07	5.89
	B _o ant.	4	8.27	8.0	8.5	0.22	2.66		4	8.75	8.5	9.0	0.20	2.28
	B _o post.	4	9.70	9.3	10.0	0.35	3.60		4	8.20	8.0	8.3	0.14	1.70
	L _{prfl}	4	5.80	5.5	6.2	0.35	6.03		4	4.87	4.7	5.6	0.48	9.85
	L _{ptfl}	4	8.65	8.0	9.5	0.76	8.78		4	6.12	5.5	6.8	0.62	10.13
	E.F.	4	<u>0.00, 0.00, 0.00</u>			0.00			4	<u>0.00, 0.25, 0.00</u>			0.25	
P ₃	L _o	4	19.25	18.6	20.0	0.66	3.42	M ₂	4	18.30	17.5	19.3	0.81	4.42
	B _o ant.	4	9.95	9.6	10.0	0.25	2.51		4	8.87	8.7	9.2	0.22	2.48
	B _o post.	4	9.95	9.6	10.2	0.30	3.01		4	8.25	8.1	8.4	0.13	1.57
	L _{prfl}	4	6.10	6.0	6.2	0.11	1.80		4	5.50	5.0	5.7	0.35	6.36
	L _{ptfl}	4	9.67	9.0	10.5	0.78	8.06		4	6.72	5.8	7.5	0.90	13.40
	E.F.	4	<u>0.50, 0.00, 0.00</u>			0.50			4	<u>0.00, 0.50, 0.00</u>			0.25	
P ₄	L _o	4	19.45	18.7	20.1	0.70	3.59	M ₃	4	20.10	19.2	21.0	0.80	3.98
	B _o ant.	4	9.65	9.2	10.0	0.41	4.24		4	7.72	7.5	8.0	0.20	2.59
	B _o post.	4	9.50	9.2	10.0	0.47	4.94		4	7.32	7.0	7.5	0.22	3.00
	L _{prfl}	4	5.70	5.0	6.2	0.53	9.29		4	5.57	5.5	5.6	0.05	0.89
	L _{ptfl}	4	8.80	7.7	10.0	1.12	12.72		4	5.67	5.5	5.8	0.15	2.64
	E.F.	4	<u>0.50, 0.50, 0.00</u>			0.50			4	<u>0.00, 0.25, 0.00</u>			0.25	

Table 13. *Hipparion matthewi*, Dytiko, Macedonia, lower permanent cheek teeth (Iid W.S.).

		n	\bar{x}	min	max	s	v
<i>Hipparion mediterraneum</i>	1	2	269.00	264.0	274.0	-	-
	2	4	255.00	249.0	268.0	8.75	3.43
	3	2	35.25	32.0	38.5	-	-
	4	2	22.85	22.0	23.7	-	-
	5	8	55.97	55.0	57.0	3.32	5.93
	6	9	30.24	28.2	32.0	1.26	4.16
	7	5	61.74	57.5	67.0	4.00	6.47
	8	11	49.00	46.5	52.3	1.57	3.20
	9	13	28.78	27.0	31.3	1.42	4.93
	10	13	54.40	50.3	60.0	2.68	4.92
	11	12	18.67	17.8	19.5	0.45	2.41
	12	9	11.36	10.6	12.0	0.62	5.45
<i>Hipparion matthewi</i>	1	1	255.0	-	-	-	-
	2	1	244.0	-	-	-	-
	3	1	28.0	-	-	-	-
	4	1	22.1	-	-	-	-
	5	1	47.0	-	-	-	-
	6	1	27.0	-	-	-	-
	7	1	51.0	-	-	-	-
	8	1	41.0	-	-	-	-
	9	1	27.0	-	-	-	-
	10	1	45.0	-	-	-	-
	11	1	16.7	-	-	-	-
	12	1	11.0	-	-	-	-
<i>Hipparion periafricanum</i>	1	2	221.50	220.0	223.0	-	-
	2	2	214.00	213.0	217.0	-	-
	3	2	25.00	25.0	25.0	-	-
	4	2	16.70	16.6	16.8	-	-
	5	2	44.35	44.2	44.5	-	-
	6	2	21.50	21.5	21.5	-	-
	7	2	47.45	47.1	47.8	-	-
	8	2	36.65	36.5	36.8	-	-
	9	2	22.10	(22)	22.2	-	-
	10	2	41.85	41.5	42.2	-	-
	11	1	14.0	-	-	-	-
	12	1	7.3	-	-	-	-

Table 14. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytko, Macedonia, radius.

1. Maximal length; 2. Internal length; 3. Minimal breadth of diaphysis; 4. DAP of the diaphysis at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Proximal maximal breadth; 8. Distal articular breadth; 9. Distal articular DAP; 10. Distal maximal breadth; 11. Diameter of the articular facet for navicular; 12. Idem for triquetrum.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	6	29.12	28.2	31.0	1.26	4.32
	2	6	31.10	29.5	32.3	0.94	3.02
	3	6	15.95	14.5	17.6	1.09	6.83
	4	3	11.16	9.7	12.0	1.27	11.38
	5	5	19.14	17.4	22.0	2.00	10.45
	6	6	4.56	4.3	5.0	0.34	7.45
	7	6	27.96	26.8	28.7	0.67	2.39
<i>H. periafricanum</i>	1	2	23.10	22.7	23.5	-	-
	2	2	24.80	24.6	25.0	-	-
	3	2	12.45	12.4	12.5	-	-
	4	2	8.35	8.2	8.5	-	-
	5	2	13.55	13.5	13.6	-	-
	6	2	4.25	4.0	4.5	-	-
	7	2	21.85	21.7	22.0	-	-

Table 15. *Hipparion mediterraneum* and *Hipparion periafricanum*, Dytiko, Macedonia, os magnum.

1. DAP; 2. Anterior breadth; 3. Anterior height; 4. Distal posterior breadth; 5. Posterior height; 6. Diameter of the articular facet for McII; 7. Idem for McIII.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	7	32.78	30.4	35.3	1.95	5.95
	2	7	22.68	20.0	25.0	1.59	7.01
	3	7	19.07	17.5	21.0	1.17	6.13
	4	7	22.92	22.0	24.3	0.85	3.70
	5	7	24.37	23.0	25.3	0.81	3.32
<i>H. periafricanum</i>	1	2	25.40	25.0	25.8	-	-
	2	2	16.80	16.6	17.0	-	-
	3	2	14.60	14.0	15.2	-	-
	4	2	18.00	18.0	18.0	-	-
	5	2	18.25	18.2	18.3	-	-

Table 16. *Hipparion mediterraneum* and *Hipparion periafricanum*, Dytiko, Macedonia, os navicular (carpal).

1. DAP; 2. Anterior breadth; 3. Posterior breadth; 4. Anterior height; 5. Posterior height.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	5	26.20	24.0	28.8	1.72	6.56
	2	6	23.05	21.3	25.5	1.72	7.46
	3	5	23.68	22.5	25.4	1.22	5.15
	4	6	8.81	8.0	10.4	1.00	11.35
	5	6	12.68	11.2	14.3	1.22	9.62
<i>H. periafricanum</i>	1	2	20.10	19.5	20.7	-	-
	2	2	15.05	14.3	15.8	-	-
	3	2	16.85	16.7	17.0	-	-
	4	1	6.2	-	-	-	-
	5	1	9.5	-	-	-	-

Table 17. *Hipparion mediterraneum* and *Hipparion periafricanum*, Dytiko, Macedonia, os lunatum.

1. DAP; 2. Maximal length; 3. Maximal height; 4. Diameter of the articular facet for hamatum;
5. Idem for magnum (at the anterior border).

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	3	36.00	35.5	36.5	0.50	1.38
	2	3	24.56	22.7	27.0	2.20	8.95
	3	2	6.25	5.0	7.5	-	-
<i>H. periafricanum</i>	1	2	25.65	25.3	26.0	-	-
	2	2	18.25	18.0	18.5	-	-
	3	2	4.60	4.4	4.8	-	-

Table 18. *Hipparion mediterraneum* and *Hipparion periafricanum*, Dytiko, Macedonia, os pisiform.

1. Maximal length; 2. Maximal height; 3. Minimal distance between proximal and distal facet for os triquetrum.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	1	29.0	-	-	-	-
	2	1	28.2	-	-	-	-
	3	1	12.6	-	-	-	-
	4	1	16.1	-	-	-	-
	5	1	7.0	-	-	-	-
<i>H. periafricanum</i>	1	2	21.75	21.5	22.0	-	-
	2	2	18.20	18.0	18.4	-	-
	3	2	9.50	9.0	10.0	-	-
	4	2	11.50	11.5	11.5	-	-
	5	2	2.10	2.0	2.2	-	-

Table 19. *Hipparion mediterraneum* and *Hipparion periafricanum*, Dytiko, Macedonia, os triquetrum.
 1. Oblivue height; 2. Anterior height; 3. Maximal breadth; 4. Maximal DAP (in projection); 5.
 Distance between articular facets for hamatum and pisiform.

		n	\bar{x}	min	max	s	v
<i>Hipparion mediterraneum</i>	1	7	208.71	204.0	212.0	3.25	1.55
	2	8	204.12	198.0	210.0	4.12	2.01
	3	8	25.47	24.0	28.0	1.48	5.81
	4	7	21.12	20.2	22.4	0.72	3.40
	5	19	34.66	32.5	37.0	1.12	3.23
	6	19	23.79	21.0	26.3	1.15	4.83
	7	19	29.76	27.8	31.7	1.05	3.52
	8	19	8.85	7.7	10.6	0.63	7.11
	9	-	-	-	-	-	-
	10	13	33.59	32.0	35.7	1.15	3.42
	11	13	31.64	30.3	33.0	0.74	2.33
	12	13	26.14	24.5	27.7	0.93	3.55
	13	13	21.80	20.3	22.7	0.76	3.48
	14	11	23.64 ^o	23.0	24.5	0.48	2.03
	15	11	106.8 ^o	100 ^o	115 ^o	4.52	4.23
	16	12	4.83	2.0	7.0	1.43	29.60
<i>Hipparion matthewi</i>	1	1	184.0	-	-	-	-
	2	1	180.0	-	-	-	-
	3	1	25.0	-	-	-	-
	4	1	(19)	-	-	-	-
	5	3	30.46	28.6	32.8	2.13	6.99
	6	3	20.26	19.0	21.0	1.10	5.42
	7	2	26.00	25.0	27.0	-	-
	8	2	9.50	8.5	10.5	-	-
	9	-	-	-	-	-	-
	10	3	30.50	29.5	31.3	0.91	2.98
	11	3	29.46	28.0	30.4	1.28	4.34
	12	3	23.90	23.1	25.0	0.98	4.10
	13	3	20.00	19.5	20.5	0.50	2.50
	14	3	22.13	21.4	23.0	0.80	3.61
	15	3	106.33	105 ^o	109 ^o	2.30	2.16
	16	1	6.2	-	-	-	-
<i>Hipparion periafricanum</i>	1	2	193.00	192.0	194.0	-	-
	2	2	188.50	187.0	190.0	-	-
	3	2	18.40	18.3	18.5	-	-
	4	2	17.35	17.2	17.5	-	-
	5	3	26.20	25.8	26.8	0.53	2.02
	6	3	17.43	17.2	17.6	0.20	1.14
	7	3	22.50	22.0	23.0	0.50	2.22
	8	3	6.93	6.5	7.3	0.40	5.77
	9	-	-	-	-	-	-
	10	3	25.00	25.0	25.0	0.00	0.00
	11	3	23.36	22.8	23.8	0.51	2.18
	12	3	19.40	19.0	19.7	0.36	1.85
	13	3	16.10	15.4	16.8	0.99	6.15
	14	3	18.16 ^o	17.0	18.8	1.01	5.56
	15	3	99.66 ^o	95 ^o	106 ^o	5.68	5.69
	16	1	2.5	-	-	-	-

Table 20. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, third metacarpal.

1. Maximal length; 2. Internal length; 3. Breadth of the diaphysis (in the middle); 4. DAP idem at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Maximal diameter of the articular facet for supra; 8. Diameter of the anterior facet for hamatum; 9. Idem for McIV; 10. Distal maximal supra-articular breadth; 11. Distal maximal articular breadth; 12. Distal maximal DAP of the keel; 13. Distal minimal DAP of the lateral condyle; 14. Distal maximal DAP of the medial condyle; 15. Keel angle: angle between the lines connecting the centers of the

		n	\bar{x}	min	max	s	v
<i>Hipparion mediterraneum</i>	1	1	328.0	-	-	-	-
	2	1	316.0	-	-	-	-
	3	1	37.0	-	-	-	-
	4	1	29.5	-	-	-	-
	5	1	70.0	-	-	-	-
	6	1	58.0	-	-	-	-
	7	17	58.87	56.0	64.0	2.19	3.72
	8	16	40.36	37.6	43.5	1.32	3.27
	9	1	45.00				
<i>Hipparion matthewi</i>	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
	4	-	-	-	-	-	-
	5	-	-	-	-	-	-
	6	-	-	-	-	-	-
	7	9	53.00	49.0	55.0	2.15	4.05
	8	9	36.28	34.5	38.0	1.12	3.08
	9	-	-	-	-	-	-
<i>Hipparion periafricanum</i>	1	1	261.0	-	-	-	-
	2	1	254.0	-	-	-	-
	3	1	29.3	-	-	-	-
	4	1	22.0	-	-	-	-
	5	1	54.5	-	-	-	-
	6	1	-	-	-	-	-
	7	2	40.6	40.2	(41)	-	-
	8	1	28.5	-	-	-	-
	9	-	-	-	-	-	-

Table 21. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, tibia.

1. Maximal length; 2. Internal length; 3. Minimal breadth of the diaphysis; 4. DAP of the diaphysis at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Maximal distal breadth; 8. Maximal distal DAP; 9. Length of the groove on the tibial (proximal) tuberosity.

		n	\bar{x}	min	max	s	v
H. mediterraneum	1	15	31.86	29.5	35.0	1.45	4.55
	2	15	38.14	35.5	41.0	1.61	4.22
H. matthewi	1	2	30.75	29.0	32.5	-	-
	2	1	32.0	-	-	-	-
H. periafricanum	1	4	24.37	23.0	26.0	1.25	5.13
	2	4	28.12	27.0	30.0	1.43	5.08

Table 22. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, os navicular (tarsal).

1. Maximal DAP; 2. Breadth.

		n	\bar{x}	min	max	s	v
H. mediterraneum	1	9	36.52	34.6	38.8	1.31	3.58
	2	8	17.72	16.5	20.7	1.31	7.39
	3	8	22.02	20.0	23.6	1.09	4.95
	4	10	8.71	7.8	10.0	0.72	8.26
	5	8	11.50	10.8	12.5	0.54	4.69
	6	8	7.16	5.3	9.2	1.14	15.92
	7	8	11.95	11.0	13.7	0.93	7.78
H. matthewi	1	3	31.16	29.5	33.0	1.75	5.61
	2	3	15.26	13.3	16.5	1.72	11.27
	3	3	18.26	18.2	18.3	0.05	0.27
	4	3	7.76	7.6	8.0	0.20	2.57
	5	3	10.03	8.9	11.0	1.06	10.29
	6	2	4.95	4.2	5.7	-	-
	7	2	8.05	6.6	9.5	-	-
H. periafricanum	1	1	26.2	-	-	-	-
	2	1	12.8	-	-	-	-
	3	1	16.2	-	-	-	-
	4	-	-	-	-	-	-
	5	-	-	-	-	-	-
	6	-	-	-	-	-	-
	7	-	-	-	-	-	-

Table 23. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, cuboid.

1. DAP (in projection across the axis of the proximal articulation surface); 2. Anterior breadth (in projection); 3. Posterior breadth (in projection); 4. Diameter of the articular facet for astragalus; 5. Idem for calcaneum; 6. Idem for navicular; 7. Length of the articular facet for navicular.

		n	\bar{x}	min	max	s	v
H. mediterraneum	1	11	36.75	33.5	41.6	2.13	5.79
	2	9	29.35	27.2	31.0	1.16	3.95
	3	8	9.66	9.0	10.2	0.58	6.00
H. matthewi	1	2	29.90	29.0	30.8	-	-
	2	3	27.10	25.6	29.7	2.26	8.33
	3	3	9.36	8.8	10.0	0.60	6.41
H. periafricanum	1	1	26.0	-	-	-	-
	2	1	20.8	-	-	-	-
	3	1	7.5	-	-	-	-

Table 24. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, os cuneiform I.

1. Breadth; 2. Distal DAP; 3. Breadth of the posterior part of the proximal articular facet.

		n	\bar{x}	min	max	s	v
H. mediterraneum	1	8	101.56	97.0	109.0	3.90	3.84
	2	8	63.83	61.0	67.0	1.93	3.02
	3	12	19.29	18.0	21.0	0.96	4.97
	4	8	29.50	27.5	31.0	1.34	4.54
	5	7	43.54	41.0	48.4	2.93	6.72
	6	12	45.90	43.4	51.0	2.77	6.03
	7	13	45.14	41.7	49.0	2.00	4.43
H. matthewi	1	2	91.75	91.0	92.5	-	-
	2	2	59.50	59.0	60.0	-	-
	3	3	15.43	13.2	17.3	2.07	13.41
	4	3	24.83	23.0	26.5	1.75	7.04
	5	3	38.83	35.8	41.7	2.95	7.59
	6	2	39.50	36.0	43.0	-	-
	7	1	42.0	-	-	-	-
H. periafricanum	1	1	73.0	-	-	-	-
	2	1	50.0	-	-	-	-
	3	1	13.7	-	-	-	-
	4	1	20.0	-	-	-	-
	5	1	31.0	-	-	-	-
	6	1	31.0	-	-	-	-
	7	1	31.7	-	-	-	-

Table 25. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, calcaneum.

1. Maximal length; 2. Length of the proximal part: middle of tuber calcaneum - articulation surface below coracoid process; 3. Minimal breadth of the diaphysis; 4. Maximal breadth of the tuber calcaneum; 5. Maximal DAP idem; 6. Distal maximal breadth (in projection); 7. Distal maximal DAP (in projection).

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	21	52.84	50.0	56.0	1.71	3.23
	2	17	52.67	49.0	56.1	1.92	3.64
	3	19	23.46	22.0	25.5	1.00	4.26
	4	20	50.82	47.3	54.5	1.93	3.79
	5	17	39.27	36.0	42.0	1.48	3.76
	6	16	29.58	26.7	32.0	1.49	5.03
	7	18	43.90	40.0	47.0	1.91	4.35
<i>H. matthewi</i>	1	6	49.30	47.3	51.0	1.52	3.08
	2	5	47.58	45.7	49.2	1.64	3.44
	3	6	22.43	19.0	24.0	1.74	7.75
	4	4	44.50	42.5	47.0	2.12	4.76
	5	4	35.20	32.3	37.2	2.18	6.19
	6	4	26.90	26.0	27.6	0.70	2.60
	7	4	39.12	36.5	42.0	2.28	5.82
<i>H. periafricanum</i>	1	1	37.3	-	-	-	-
	2	1	37.7	-	-	-	-
	3	1	19.0	-	-	-	-
	4	1	33.5	-	-	-	-
	5	1	28.0	-	-	-	-
	6	1	21.0	-	-	-	-
	7	1	31.0	-	-	-	-

Table 26. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytko, Macedonia, astragalus.

1. Maximal length (height): articulation surface for navicular - top of the internal condyle; 2. Maximal diameter of the internal condyle; 3. Troclear breadth: middle of the internal - middle of the external condyles; 4. Maximal breadth (in projection); 5. Distal articular breadth; 6. Distal articular DAP; 7. Maximal DAP of the internal condyle.

		n	\bar{x}	min	max	s	v
<i>Hipparion mediterraneum</i>	1	10	244.90	231.0	255.0	7.24	2.96
	2	10	238.70	225.0	250.0	7.32	3.06
	3	9	26.15	24.0	28.8	1.61	6.51
	4	7	25.80	25.3	26.4	0.41	1.59
	5	20	38.11	36.0	40.0	0.94	2.46
	6	19	29.73	26.2	32.5	1.82	6.12
	7	18	35.85	33.2	38.0	1.05	2.92
	8	20	8.49	5.5	10.0	1.09	12.83
	9	19	4.68	3.0	7.0	1.14	24.35
	10	26	35.68	32.5	39.0	1.98	5.55
	11	23	33.57	31.0	36.0	1.52	4.52
	12	22	28.96	27.0	31.6	1.06	3.66
	13	24	22.65	20.5	24.0	1.07	4.72
	14	26	25.43 ^o	24.0	27.6	1.03	4.05
	15	18	105.94 ^o	95 ^o	116 ^o	5.97	5.63
<i>Hipparion matthewi</i>	1	3	238.33	227.0	250.0	11.50	4.82
	2	3	234.33	222.0	248.0	13.05	5.56
	3	3	22.13	21.0	23.4	1.20	5.42
	4	3	24.43	24.0	25.0	0.51	2.08
	5	7	34.11	33.0	35.8	1.05	3.07
	6	6	28.86	27.7	30.0	3.56	1.03
	7	9	30.87	28.0	32.4	1.89	6.12
	8	8	7.83	6.5	10.2	1.29	16.47
	9	8	4.83	3.8	6.2	0.70	14.49
	10	13	30.66	27.5	34.0	1.64	5.34
	11	12	29.45	27.4	30.8	0.93	3.15
	12	12	26.55	24.0	28.8	1.25	4.70
	13	12	21.22	20.0	22.6	0.78	3.67
	14	12	23.46 ^o	21.0	25.0	1.18	5.02
	15	10	108.30 ^o	102 ^o	111 ^o	2.86	2.64
<i>Hipparion periafricanum</i>	1	2	208.50	206.0	211.0	-	-
	2	2	204.50	202.0	207.0	-	-
	3	2	18.60	18.0	19.2	-	-
	4	2	19.75	19.5	20.0	-	-
	5	4	27.60	27.0	28.8	0.81	2.93
	6	4	21.67	21.0	22.5	0.62	2.86
	7	4	25.70	25.0	26.3	0.57	2.21
	8	4	6.65	5.5	7.7	0.93	13.90
	9	3	3.60	2.5	5.0	1.27	35.27
	10	2	24.30	24.2	24.4	-	-
	11	2	23.15	24.0	24.3	-	-
	12	2	21.35	21.2	21.5	-	-
	13	2	16.90	16.8	17.0	-	-
	14	2	19.50 ^o	19.0	20.0	-	-
	15	2	103.50 ^o	100 ^o	107 ^o	-	-

Table 27. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, third metatarsal.

1. Maximal length; 2. Internal length; 3. Breadth of the diaphysis (in the middle); 4. DAP of the diaphysis at the level of 3; 5. Proximal articular breadth; 6. Proximal articular DAP; 7. Maximal diameter of the articular facet for cuneiform I; 8. Diameter of the articular facet for cuboid; 9. Idem for cuneiform II; 10. Distal maximal supra-articular breadth; 11. Distal maximal articular breadth; 12. Distal maximal DAP of the keel; 13. Distal minimal DAP of the lateral condyle; 14. Distal maximal DAP of the medial condyle; 15. Keel angle: angle between the lines connecting the center of the condyle (in medial view) with the anterior and posterior ends of the keel.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	12	56.06	52.0	58.5	1.94	3.46
	2	11	50.54	46.5	54.0	2.11	4.17
	3	10	25.44	23.0	28.0	1.69	6.64
	4	10	36.53	34.2	38.5	1.32	3.61
	5	10	28.45	26.2	32.0	1.68	5.90
	6	10	29.74	26.5	33.6	2.08	6.99
	7	11	28.70	27.5	30.8	0.94	3.27
	8	9	18.31	17.5	19.3	0.55	3.00
	9	11	21.24	14.5	30.5	5.12	24.10
<i>H. matthewi</i>	1	1	52.0	-	-	-	-
	2	1	48.7	-	-	-	-
	3	1	23.3	-	-	-	-
	4	1	34.5	-	-	-	-
	5	1	27.8	-	-	-	-
	6	1	27.3	-	-	-	-
	7	1	26.0	-	-	-	-
	8	1	17.1	-	-	-	-
	9	1	24.0	-	-	-	-
<i>H. periafricanum</i>	1	2	48.75	47.5	50.0	-	-
	2	2	45.75	45.5	46.0	-	-
	3	1	(17)	-	-	-	-
	4	2	24.90	24.3	25.5	-	-
	5	2	19.10	17.5	20.7	-	-
	6	1	20.7	-	-	-	-
	7	1	20.4	-	-	-	-
	8	2	13.35	13.0	13.7	-	-
	9	2	14.25	14.0	14.5	-	-

Table 28. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, first phalanx.

1. Maximal length; 2. Anterior length; middle of the proximal articular facet - middle of the distal facet; 3. Minimal breadth of the diaphysis; 4. Proximal breadth; 5. Proximal DAP; 6. Distal breadth at the tuberosities; 7. Distal articular breadth; 8. Distal articular DAP; 9. Minimal length of the trigonum phalngis.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	13	35.50	33.5	37.5	1.16	3.26
	2	13	27.87	25.0	29.7	1.16	4.16
	3	12	28.29	26.0	31.3	1.43	5.05
	4	13	35.23	31.5	37.8	1.78	5.05
	5	12	24.48	23.6	25.5	0.55	2.24
	6	12	30.43	27.7	32.7	1.40	4.60
	7	11	19.07	18.0	20.5	0.67	3.51
<i>H. matthewi</i>	1	1	34.0	-	-	-	-
	2	1	26.3	-	-	-	-
	3	1	24.0	-	-	-	-
	4	1	31.5	-	-	-	-
	5	1	22.7	-	-	-	-
	6	1	28.0	-	-	-	-
	7	1	17.0	-	-	-	-
<i>H. periafricanum</i>	1	2	27.55	27.5	27.6	-	-
	2	2	22.70	22.6	22.8	-	-
	3	2	22.80	20.6	21.0	-	-
	4	2	24.15	24.0	24.3	-	-
	5	1	17.4	-	-	-	-
	6	2	23.10	23.0	23.2	-	-
	7	2	13.45	13.4	13.5	-	-

Table 29. *Hipparion mediterraneum*, *Hipparion matthewi* and *Hipparion periafricanum*, Dytiko, Macedonia, second phalanx.

1. Maximal length; 2. Anterior length (as in the first phalanx); 3. Minimal breadth of the diaphysis; 4. Maximal proximal breadth; 5. Proximal DAP; 6. Maximal distal articular breadth; 7. Distal articular DAP.

		n	\bar{x}	min	max	s	v
<i>H. mediterraneum</i>	1	2	48.40	48.0	48.8	-	-
	2	2	54.60	53.0	56.2	-	-
	3	2	48.00 ⁰	46 ⁰	50 ⁰	-	-
	4	2	47.00	41.0	53.0	-	-
	5	6	17.96	16.3	20.1	1.35	7.51
	6	2	31.50	31.0	32.0	-	-
	7	4	33.87	33.0	34.5	0.62	1.83
	8	1	120 ⁰	-	-	-	-

Table 30. *Hipparion mediterraneum*, Dytiko, Macedonia, third phalanx.

1. Length (in anterior view); 2. DAP; 3. Angle between the anterior line and the horizontal one; 4. Maximal breadth; 5. Proximal articular length; 6. Proximal articular breadth; 7. Maximal height; 8. Length of margo solearis: from the point below the external limit of the articular facet to the point below the internal one.

LEGENDS OF PLATES

PLATE 1

Hipparion mediterraneum, Dytiko, Macedonia, piece of the skull, DTK-6; a: lateral view, b: ventral view.
1/2 nat. size.

PLATE 2

Hipparion mediterraneum, Dytiko, Macedonia, piece of the skull, DIT-19; a: lateral view, b: ventral view.
1/2 nat. size

PLATE 3

Hipparion matthewi, Dytiko, Macedonia, skull, DKO-36; a: lateral view, b: ventral view.
1/2 nat. size.

PLATE 4

Fig. 1. *Hipparion mediterraneum*, Dytiko, Macedonia, mandible DIT-19 (associated with the skull DIT-19, Pl. II).

Fig. 2. *Hipparion matthewi*, Dytiko, Macedonia, mandible, DKO-36 (associated with the skull DKO-36, Pl. III).

1/2 nat. size.

PLATE 5

Fig. 1. *Hipparion mediterraneum*, Dytiko, Macedonia, right upper toothseries, DIT-19.

Fig. 2. *Hipparion matthewi*, Dytiko, Macedonia, right upper toothseries, DKO-36.

Fig. 3. *Hipparion periafricanum*, Dytiko, Macedonia, left upper toothseries, DTK-1.

Fig. 4. *Hipparion mediterraneum*, Dytiko, Macedonia, left lower toothseries, DIT-19.

Fig. 5. *Hipparion matthewi*, Dytiko, Macedonia, left lower toothseries, DKO-36.

Nat. size

PLATE 6

Fig. 1. Third metacarpals, Dytiko, Macedonia.

a: *Hipparion cf. periafricanum*, DKO-24

b: *Hipparion cf. matthewi*, DTK-144.

c: *Hipparion mediterraneum*, DTK-47.

Fig. 2. Third metatarsals, Dytiko, Macedonia.

a: *Hipparion cf. periafricanum*, DTK-138.

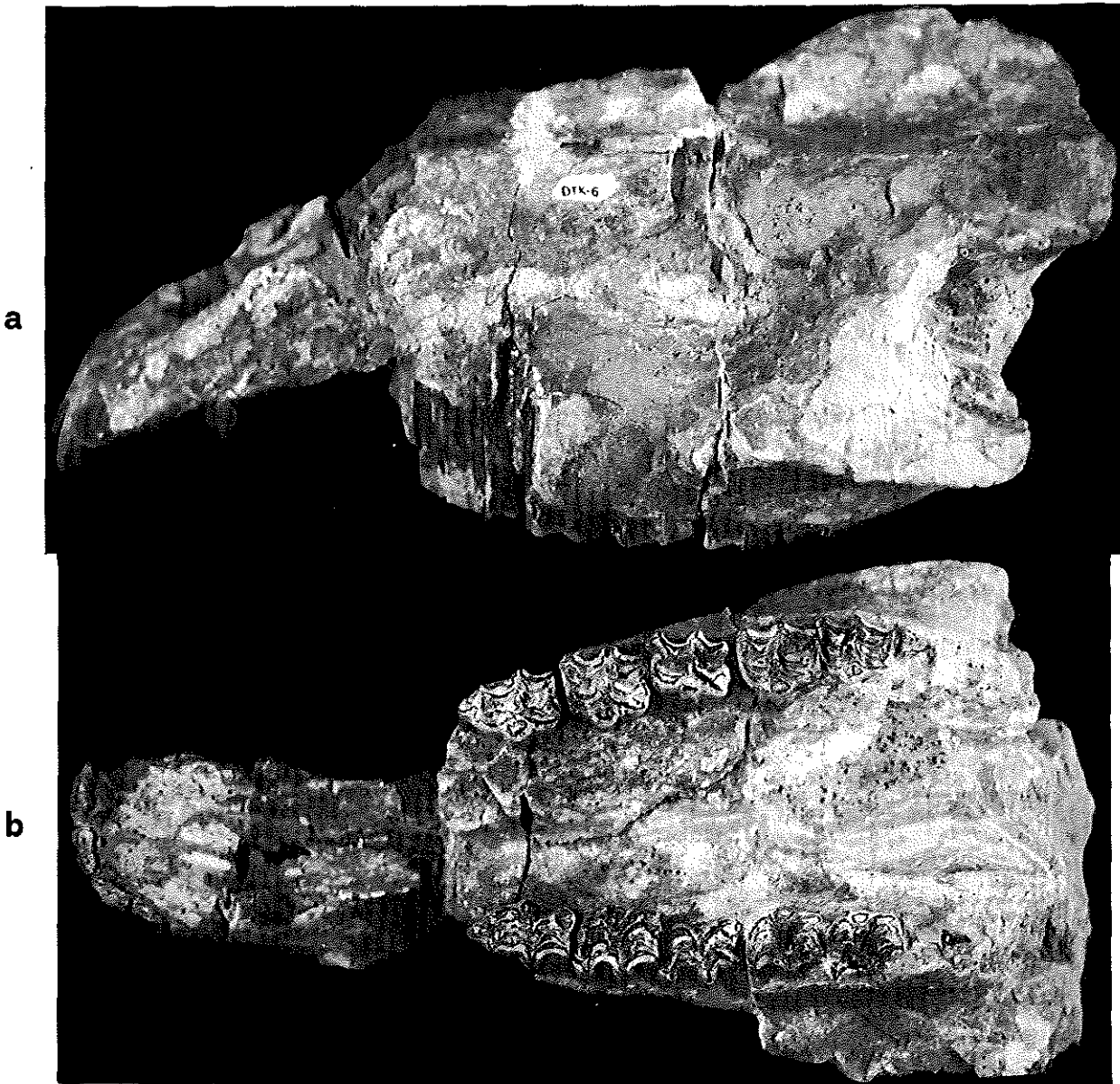
b: *Hipparion cf. matthewi*, DTK-120.

c: *Hipparion mediterraneum*, DTK-154.

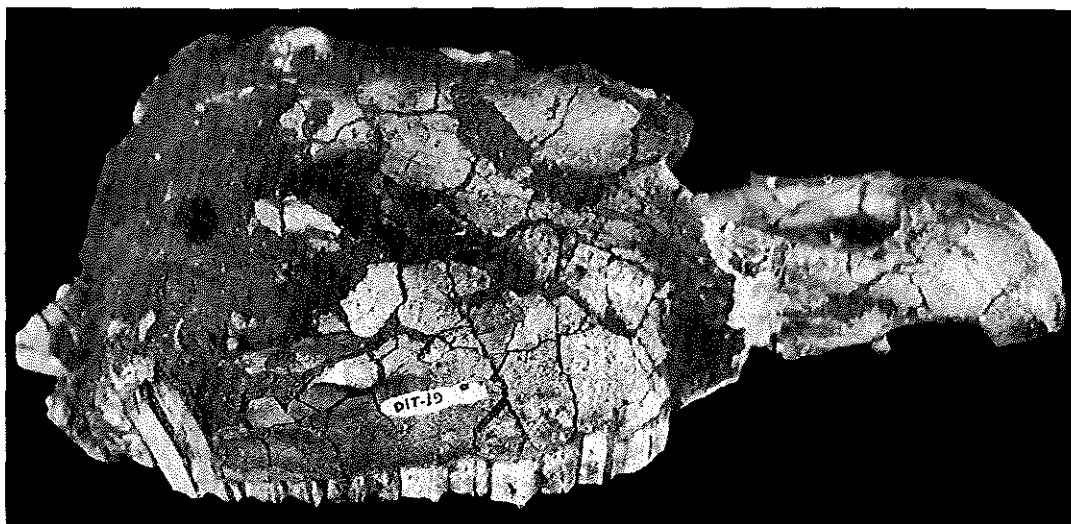
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PLATE 7

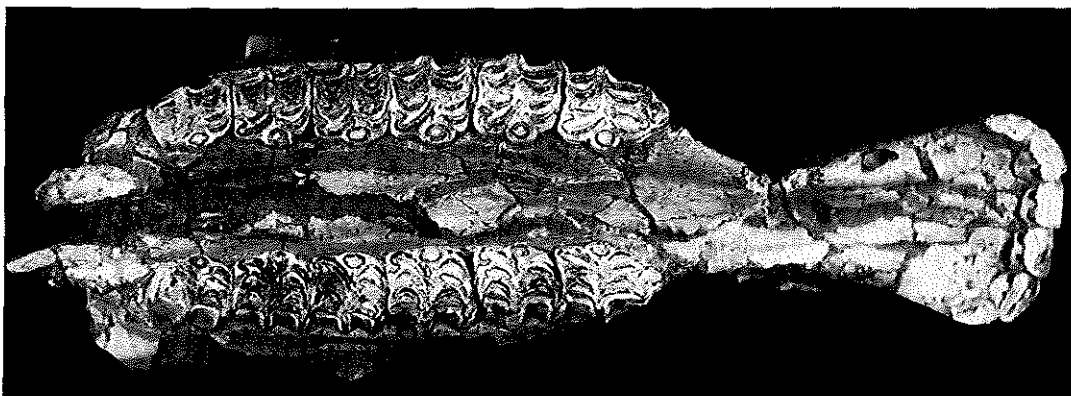
- Fig. 1. Calcaneum and astragalus, Dytiko, Macedonia.
a, b: *Hipparion mediterraneum*, DTK-78, DTK-26.
c: *Hipparion* cf. *matthewi*, DTK-81.
d: *Hipparion* cf. *periafricanum*, DKO-37.
- Fig. 2. First, second and third phalanges, Dytiko, Macedonia.
a: *Hipparion mediterraneum*, DTK-171.
b: *Hipparion* cf. *matthewi*, DTK-127.
c: *Hipparion* cf. *periafricanum*, DKO-24.
1/2 nat. size.



a

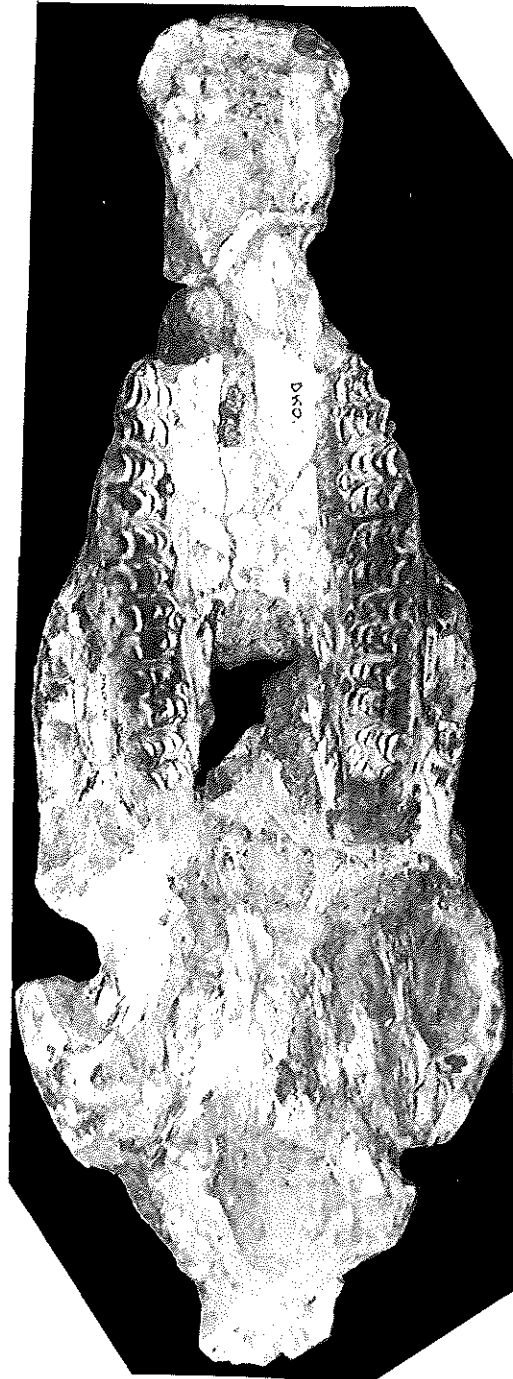


b





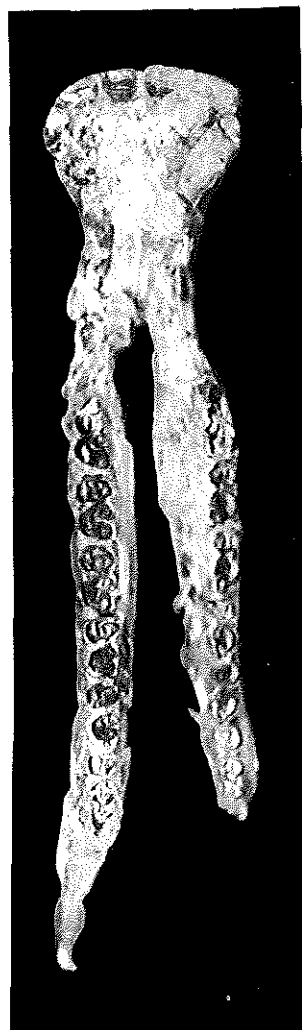
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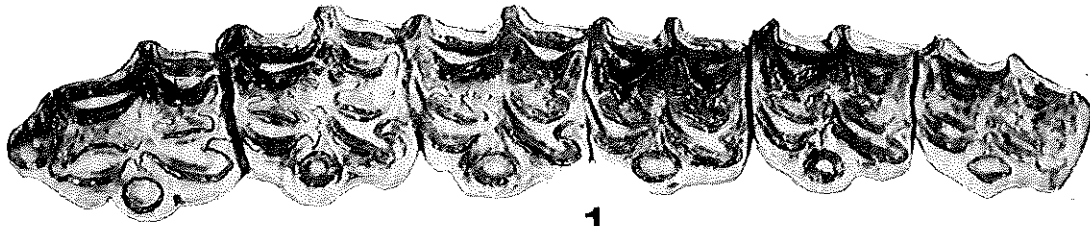
b



1



2



1



2



3



4



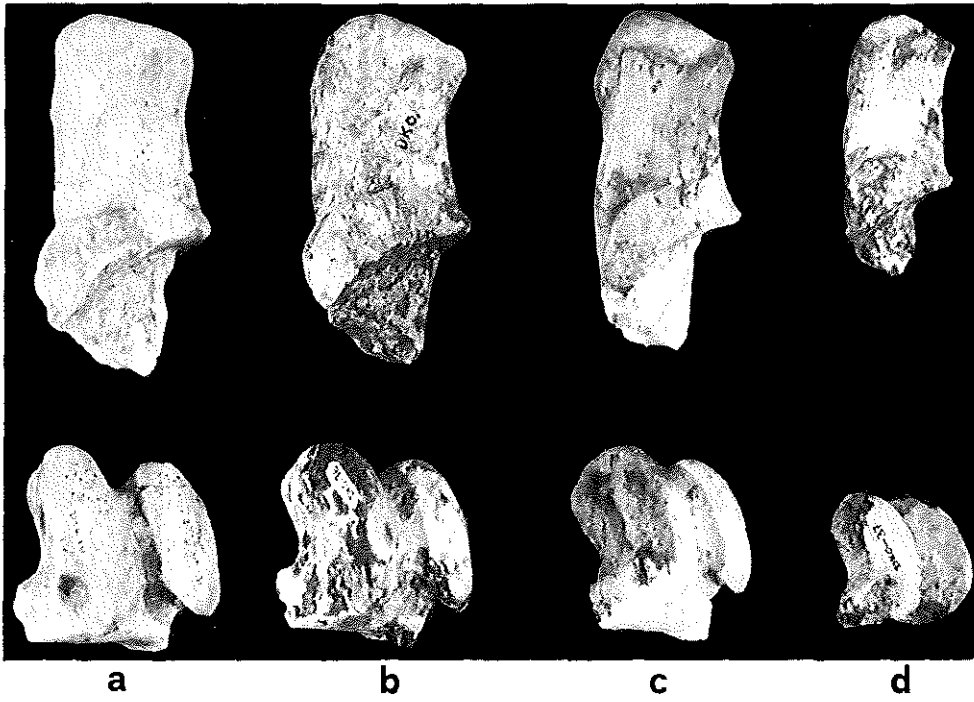
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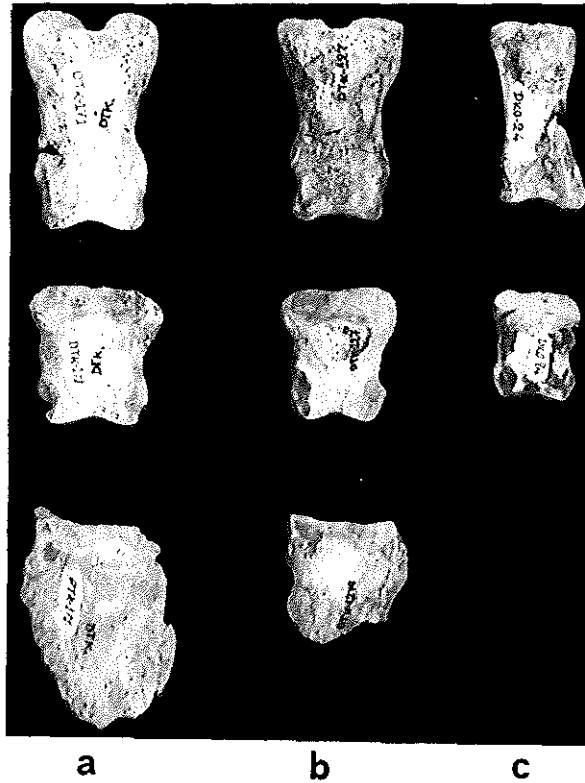
a b c
2



a b c
1



1



2