

# Systematic and biostratigraphical interpretation of the equids from Qafzeh, Tabun, Shkul and Kebara (Acheuloyabrudian to Upper Paleolithic of Israel)

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## RÉSUMÉ

Les Equidés des grottes de Tabun, Qafzeh, Shkul et Kebara ont déjà fait l'objet de diverses publications. Leurs âges relatifs sont encore discutés, mais dans un cadre chronologique plus précis, à la fois biostratigraphique et radiométrique. En outre, leur interprétation systématique peut aujourd'hui bénéficier de comparaisons avec d'autres Equidés autrefois mal connus ou inédits.

Le matériel moustérien (niveaux VII à XIX) de Qafzeh se trouve au département de Zoologie de l'Université Hébraïque de Jérusalem. Il comprend 35 dents adultes, dont 10 jugales supérieures et 22 inférieures et 4 os des membres plus ou moins fragmentaires. Le matériel étudié en comparaison (Tabun, Shkul et Kebara) provient pour l'essentiel des collections du British Museum.

Trois ou quatre espèces d'*Equus* sont représentées dans les niveaux moustériens de Qafzeh, mais leur fréquence n'est pas la même (fig. 3, tabl. 3). La plupart des dents jugales appartiennent à un Equidé primitif de grande taille et pourraient être presque indifféremment rapportées à l'*E. grevyi* actuel, à l'*E. mauritanicus* du Pléistocène moyen de Tighenif (= Ternifine = Palikao, Algérie), à l'*Equus* du Pléistocène inférieur d'Oubeidiyeh, ou même à un *E. stenorhis* villafranchien. Toutes ces espèces ne se distinguent guère que par les proportions de leurs os des membres, notamment des métapodes, or ces données nous font défaut pour Qafzeh. J'attribue ces jugales à *Equus cf. tabeti* pour souligner leur ressemblance avec le matériel d'Oubeidiyeh (Pl. I: 2 et 3, 5 et 6, 17 et 18). Les dents d'*Equus mauritanicus* sont en moyenne plus grandes, plus plissées, avec un protocone plus long (Pl. I: 4 et 16). Les P<sub>2</sub> d'*E. grevyi* ont en général un pli-protostylide (Pl. I: 1). *E. cf. tabeti* se trouve essentiellement dans les niveaux anciens (XV-XIX), peut-être dans les niveaux récents (VII-XI). *E. caballus* (Pl. I: 15) est représenté peut-être par une dent dans les niveaux anciens, par 2 ou 3 dents dans les niveaux récents. Une dent des niveaux anciens (Pl. I: 11) pourrait provenir d'*E. hydruntinus* ou d'*E. cf. tabeti*. Une dent des niveaux supérieurs (Pl. I: 10) appartient à *E. africanus* ou *E. hydruntinus*.

D'après Tchernov, un net changement des micromammifères se manifeste à Tabun D (stade isotopique 4), époque à laquelle les Néandertaliens seraient arrivés en Israël, par rapport aux niveaux inférieurs de Qafzeh et à Tabun E (stade isotopique 5). Par la suite les faunes ne changent guère que durant le passage du stade 4 au stade 3, entre Tabun D et Tabun C. Par ailleurs, les datations récentes de Shkul suggèrent un âge semblable pour ce site et celui de Qafzeh.

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Malheureusement je ne dispose pas de données sur les Equidés de Tabun D, et celles sur Tabun C et Qafzeh VII-XI sont pauvres. Il apparaît toutefois (fig. 3, tabl. 3) que:

— *E. caballus* domine à Tabun E, *E. cf. tabeti* dans les niveaux inférieurs de Qafzeh; les faunes ne sont donc pas semblables, au moins par leurs Equidés. Le remplacement du Cheval par *E. cf. tabeti* pourrait correspondre à un réchauffement et/ou assèchement climatique (passage du stade 6 au stade 5 par exemple); ou bien le Cheval de Tabun E ne serait qu'une relique;

— Le Cheval réapparaît dans les niveaux supérieurs de Qafzeh et à Tabun C, accompagné d'un Equidé différent d'*E. cf. tabeti* (Ane? *E. hydruntinus*?); *E. cf. tabeti* est rare ou absent. Il pourrait s'agir d'un retour à des conditions plus froides ou plus humides;

— A partir de Shkul, l'Equidé dominant est *E. hydruntinus*; *E. caballus* et *E. cf. tabeti* se font rares à Shkul et disparaissent entre Kebara et Tabun B. On peut supposer que les détériorations climatiques en Eurasie ont «chassé» *E. hydruntinus* vers le Sud. En tout cas la différence entre Qafzeh et Shkul est notable et ne s'accorde pas bien avec une contemporanéité des deux sites; Shkul devrait être plus proche de Kebara.

Davis a proposé de rapporter les Equidés du Nord d'Israël à la lignée «zèbrine»: *E. mauritanicus-E. hydruntinus* dont les représentants diminueraient de taille entre Qafzeh et Kebara. Cette interprétation repose sur la présence de dents primitives chez les deux espèces (caractère partagé avec bien d'autres Equidés, notamment *E. stenonis* et *E. tabeti*), et ne tient pas compte des os des membres (trapus chez *E. mauritanicus*, graciles chez *E. hydruntinus*). En fait, les dents les plus proches de celles de Qafzeh se trouvent non pas chez *E. mauritanicus*, mais chez *E. cf. tabeti* d'Ou-beidiyeh qui présente des membres graciles. Mais la coexistence apparente d'*E. hydruntinus* et *E. cf. tabeti* n'est pas en faveur d'une évolution locale du premier à partir du second. Dans l'état actuel de nos connaissances, il est plus logique de considérer *E. hydruntinus* comme le descendant des *E. stenonis-E. altidens* d'Europe que comme celui d'*E. mauritanicus*, et comme un migrant chassé du Nord par un changement climatique, que comme l'aboutissement d'une lignée autochtone.

**Mots-clés:** Paléolithique, Israël, équidés, systématique, biostratigraphie, Qafzeh, Tabun, Shkul, Kebara, *E. altidens*, *E. caballus*, *E. hydruntinus*, *E. mauritanicus*, *E. tabeti*.

## ABSTRACT

During the last 130,000 years, the equid "spectrum" of North Israelian hominid sites has changed several times, at least as to the relative frequencies of remains. Most of the teeth from Tabun E belong to *E. caballus*. *E. cf. tabeti*, if present, is rare. On the contrary, *E. cf. tabeti* is the dominant equid at Qafzeh and may be considered as characteristic of the isotopic stage 5. Later on, the progressive replacement of *E. cf. tabeti* by *E. hydruntinus* may be related to a climatic deterioration, inducing a N-S migration of *E. hydruntinus* which becomes the dominant equid at Shkul and in the Mousterian levels of Kebara and Tabun B. The difference between the lower Qafzeh and Shkul equids does not support a strictly identical age for both sites; Shkul seems intermediate between lower Qafzeh and Kebara. The apparent coexistence of *E. hydruntinus* and *E. cf. tabeti* does not support a local evolution of the first from the second. Possible systematic relations of these equids are discussed.

## Introduction

The equids from the Mousterian levels of the Caves of Qafzeh (= Kafza on fig. 1), Tabun, Shkul, and Kebara have been already studied and discussed by several authors (Bate 1937; Bouchud 1974; Davis 1980). Their interpretation may however benefit from a more precise chronological framework, as has been recently provided both by the the study of faunas (Faure & Guérin 1987; Guérin

& Faure 1988; Tchernov 1988), and by the radiometric datations (Valladas *et al.* 1988; Schwarcz *et al.* 1988; Stringer *et al.* 1989; Schwarcz *et al.* 1989). It may be also substantiated by comparisons with other equids that were poorly known or not yet described in detail till now.

The present study is not a comprehensive revision of the whole equid material found at Qafzeh, Tabun, Shkul, and Kebara because some old or new collections were temporarily not available to the study. Neither is it an exhaustive description of the studied and measured material. Numerous teeth have already been illustrated by Davis (1980), and several by Bate (1937), so that only few illustrations are given in the present paper. Nevertheless, these data seem sufficient to bring some new elements for the discussion of the evolution of equids in Israel during the Upper Pleistocene.

## Material

The *Equus* material from Qafzeh studied here belongs to the collections of the Zoological department of the Hebrew University, at Jerusalem. It is rather poor: 3 incisors, 10 adult upper cheek teeth, 22 adult lower cheek teeth (nearly all teeth are isolated), 4 limb bones including 2 fragments. All specimens come from Mousterian levels (VII to XIX). Several teeth were cut at different levels of the crown by J. Bouchud in order to better evidence their morphology.

Since the respective age of the Mousterian levels of Qafzeh, Tabun, Shkul and Kebara have been, and still are, the object of discussions (Meignen *et al.* 1989) the comparisons are centered on the equids from these localities. Most of the used material is stored in the British Museum (Natural History); I have also measured some teeth from Kebara belonging to the Hebrew University that Simon Davis kindly showed me while he was studying them, and photographed a few others at Jerusalem.

## Description

### 1. Adult upper cheek teeth (table 1)

The sample includes three (probable) P<sup>3</sup>P<sup>4</sup> and seven (probable) M<sup>1</sup>M<sup>2</sup>. The size is rather large, the plications are moderate, and the protocone length is average for the genus *Equus*. Two teeth are little worn; the probable P<sup>3</sup> or P<sup>4</sup> has a height of 79mm for a mid-shaft length of 28; the probable M<sup>1</sup> or M<sup>2</sup> has a height of 83mm for a mid-shaft length of about 25mm. The molar XIX C10-352 may belong to a caballine equid. There is no evidence for a specific heterogeneity in the rest of the sample.

### 2. Adult lower cheek teeth (table 2)

Two P<sub>3</sub> or P<sub>4</sub> from levels VII and XI (Pl. I: 15) have a typical caballine double knot. One damaged M<sub>3</sub>, also from level VII, may too have belonged to an *Equus caballus*.

The other cheek teeth (levels XV to XVII) have primitive, "stenonine" double knots; on the molars, the vestibular groove is deep and comes in contact with the lingual groove (Pl. I, fig. 14). One tooth from level VII (Pl. I: 10) has a shallow vestibular groove; if it is, as it may be, a  $M_1$  or  $M_2$ , the shallowness of the vestibular groove could point to another, ass-like species (*E. africanus*) or be an "exception"; if it is a  $P_3$  or a  $P_4$ , its relatively small size could point to an *Equus hydruntinus*. This tooth is one of those which have been cut and it is difficult to decide if it is a premolar or a molar. One  $P_3$  or a  $P_4$  (Pl. I: 11), could belong to a small *E. tabeti* or to a large *E. hydruntinus*. Otherwise, there is no indication of a specific heterogeneity in the "stenonine" sample.

### 3. Limb bones

Two fragments of proximal ends of MC III from level XVI have an antero-posterior diameter of more than 30mm. One second and one third phalanges, probably posterior, come from levels IX and XVI. They point to a middle to large, not caballine *Equus*, but do not allow a more precise determination.

### Taxonomy

Two *Equus* are poorly represented in the Mousterian levels of Qafzeh: *Equus caballus* by two lower premolars, possibly one  $M_3$ , and maybe an upper molar; *Equus hydruntinus* or an ass-like *Equus* by one or two lower cheek teeth.

The rest of the material belonged to a rather large primitive *Equus*. Teeth of this size and morphology may be found in the modern *Equus grevyi*, as well as in the Middle Pleistocene *Equus mauritanicus*, the Lower Pleistocene *Equus* from Ubeidiyeh, or even in some Pliocene *Equus stenonis*. The distinction of all these species with primitive teeth is greatly helped by the proportions of the limb bones, specially the metapodials. *Equus mauritanicus* from Ternifine has rather robust metapodials (Eisenmann 1979b) while they are slender in the *Equus cf. tabeti* from Ubeidiyeh (Eisenmann 1986). Unfortunately this character is unknown for the Qafzeh equid. In the present conditions the best fit is the *Equus cf. tabeti* from Ubeidiyeh which has almost the same teeth dimensions and shapes (Pl. I: 2 and 3; 5 and 6; 17 and 18). On the average, the teeth of *Equus mauritanicus* (Pl. I: 4 and 16) are larger, more plicated, and have a longer protocone. In *E. grevyi*, the  $P_2$  have usually a pronounced pli-protostylid (Pl. I: 1) not found in *E. cf. tabeti* (Pl. I: 2 and 3). Therefore the Qafzeh equid will be referred to as *Equus cf. tabeti*, although this attribution is very far from certain.

### Comparisons with other Northern Israelian sites

#### 1. Kebara

All teeth I have measured from Mousterian levels of Kebara but two are very small, with short wooden-shoe-shaped protocones on the upper cheek teeth (on fig. 2 of the present paper, upper molars and premolars are clustered in the

lower left part of the diagram), stenonine double knots and deep vestibular grooves on the lower molars (Pl. I: 7, 8); these characters are also very well shown by the many illustrations given by Davis (1980, fig. 3, 4, 7). Their reference to *E. hydruntinus* seems perfectly justified. Three distal fragments of MC III and two from MT III may be referred to the same small species.

One lower molar (Pl. I: 12) is much larger and caballine, but its exact origin is unknown. One upper molar is also much larger (27,7mm) and has a much longer protocone (12,7mm). It may have belonged to a caballine form or to *E. cf. tabeti*.

On the whole, 24 out of 25 fossils from the certainly Mousterian levels of Kebara may be referred to *E. hydruntinus*.

## 2. Tabun B

The material I have seen at the British Museum consists of 9 cheek teeth (5 upper and 4 lower premolars and molars) which certainly belong to the same microdont and primitive species. On fig. 2, the upper premolars and molars cluster in the lower left corner of the diagram.

## 3. Tabun C

The material is poor. One lower premolar is typically caballine. One upper molar may also belong to a caballine *Equus*. On the fig. 2, it may be seen in the middle of the cluster at the right upper corner. One upper premolar is smaller (27mm), with a shorter protocone (10mm) and could be either a large *E. africanus* or a small *E. cf. tabeti* tooth (middle part of fig. 2). Two lower premolars probably belonged to *E. cf. tabeti*.

## 4. Shkul

Most of upper (Pl. I, fig. 13) and lower premolars and molars may be referred to *E. hydruntinus*. On fig. 2, the upper teeth cluster in the left lower corner along with the teeth from Tabun B and Kebara.

Three lower premolars, one lower molar and one upper premolar (upper right part of fig. 2) belong to an *E. caballus*. Two lower premolars, two upper premolars and two upper molars look like *E. cf. tabeti* teeth. Two upper molars could as well belong to *E. caballus* as to *E. cf. tabeti* (occlusal length around 25mm, protocone length around 13mm).

## Taxonomical discussion

Davis (1980) proposed to refer the North Israelian Mousterian equids including those of Qafzeh, Tabun, and Kebara to the "zebra" lineage *Equus mauritanicus-Equus hydruntinus*, while the South Israelian equids of the same period would belong to "ass-hemione", arid-zone adapted, equids. In the "zebra" lineage, a mere diminution of size during the Mousterian would account for the differences between the large teeth of Qafzeh and the small teeth of Kebara.

Davis model rests mostly on the lower teeth morphology: *Equus hydruntinus* cannot be an ass-hemione, nor can it be related to *Equus stenonis*, because of its primitive, deep, molar vestibular grooves; these deep vestibular grooves and the shape of the protocone are supposed to point to a relation with modern zebras and *E. mauritanicus*. Although Davis attempt to clarify both the origin of *Equus hydruntinus* and the evolution of Middle East equids is interesting, it may rise several objections.

It is true that *E. hydruntinus* has "primitive" lower cheek teeth, and that some old *E. stenonis* (La Puebla de Valverde, Saint-Vallier) seem more evolved by that point (the same is true of *E. mauritanicus* whose molars have occasionally shallow vestibular grooves (Eisenmann 1981)). However, there are also more recent stenonid horses with deep vestibular grooves on the molars like in Senèze (Eisenmann 1981), Pirro and Selvella (De Giuli *et al.* 1987; De Giuli 1987).

The depth of the vestibular groove may be a valuable evolutive character at a high systematic level, but it may be not so reliable when dealing with the evolution of species or subspecies if it is subject to reverse evolution, just as the protocone development. Let us remind that protocones of relatively recent *E. stenonis* seem to diminish in length (Eisenmann 1980), although the general trend in equids is certainly an elongation of the protocone. We cannot be sure that the vestibular groove depth was not a similarly "plastic" character, to use the term coined by Gromova. Whatever the case, if we consider the upper cheek teeth, *E. hydruntinus* with its very short and wooden-shoe-shaped protocones is rather close to some *E. stenonis*; similar lower cheek teeth may also be found in some *E. stenonis*. In *E. burchelli* and in its close relative *E. mauritanicus* the depth of the vestibular groove is variable and the protocone length is much larger (Eisenmann 1980, 1981). Thus, if we must choose between *E. stenonis* and *E. mauritanicus* for the closest relative to *E. hydruntinus* on teeth characters alone, in my opinion *E. stenonis* remains the best choice.

But *E. hydruntinus* is not only defined by its primitive teeth, but also by its small size and by its extremely elongated and antero-posteriorly thick metapodials (although differences in slenderness and/or size will probably justify the distinction of different taxa). Such proportions are unusual in *Equus*; they are uncommon in caballine equids, modern zebras (with the exception of *E. grevyi*), and typical stenonine horses. *E. mauritanicus* also has quite wide metapodials (Eisenmann 1979b). Only modern ass-hemione-like equids adapted to arid conditions, show similar size and proportions. A few fossils like *E. altidens* from Süssenborn, *E. cf. altidens* from Pirro, *E. tabeti* and *E. melkiensis* from North Africa, *E. cf. tabeti* from Ubeidiyeh, have similar proportions but are much larger. In *E. tabeti* this shape is associated with middle sized teeth, short protocones, and deep vestibular grooves on the molars (Eisenmann 1979b, 1980, 1981); in *E. cf. tabeti* with larger teeth, longer protocones and deep vestibular grooves (Eisenmann 1987); in *E. melkiensis* with short vestibular grooves (Bagtache *et al.* 1984). At this point, the question arises what relative importance should be given to skull, teeth, and limb bones to define a species,

when their characters are not associated in the way usual for modern forms. And, in the case of *E. hydruntinus*, whether this species is better "characterized" by its primitive teeth or by its specialized limb bones.

To sum up, what we know of *E. hydruntinus* suggests that it may be an arid adapted equid, resembling *E. tabeti* in which primitive teeth, upper and lower, are also associated with elongated limb bones. If *E. hydruntinus* evolved from an African form, *E. tabeti* would be the more probable ancestor. The hypothesis of an evolution from *E. mauritanicus* to *E. hydruntinus* seems much less economical. Moreover, there is no strong indication of an African origin for *E. hydruntinus*; on the contrary, this equid, or group of equids, seems to have evolved in Europe or in Eurasia from some Lower-Middle Pleistocene equids, like the (not very well known) *E. altidens* of Süssenborn, itself probably related to late stenorine equids (Forsten 1986). At Voigstedt, there is already one M<sup>1</sup> (1966/5096-1770) whose occlusal and protocone lengths (22mm and 10mm) are very close to *E. hydruntinus* although the tooth has been referred to *E. altidens* (Musil 1965). A typical *E. hydruntinus* (small, microdont, primitive as to the tooth morphology, and slender) is present at Lunel-Viel, in the Middle Pleistocene (Bonifay 1991). On ratio diagrams, its MC III (kindly showed to me by M.F. Bonifay) look like reduced copies of those of *E. altidens* from Süssenborn and *E. cf. altidens* of Pirro. Slenderer, hemippe-like metacarpals are present in the Upper Pleistocene of Binagady and Staroselie, Soviet Union (measurements communicated by De Giuli). In summary, *E. hydruntinus* already known at least since the Middle Pleistocene in Europe, may well have migrated to the Middle East rather than evolved there during the Upper Pleistocene.

The ultimate relation of all the non-caballine equids to the *E. stenonis* group seems presently far from clarified (Azzaroli 1979, 1982) even if there is some evidence relating the *E. mauritanicus*-*E. burchelli*-*E. quagga* group to classical *E. stenonis* (Eisenmann, 1979a), and the *E. hemippus*-*E. hydruntinus* group to some late "stenonids" like *E. altidens* from Süssenborn or *E. cf. altidens* from Pirro.

### Chronology and biostratigraphical implications

According to Tchernov (1988) the micromammal fauna underwent a notable transformation between the times of deposition of the lower levels (XV-XXIV) of Qafzeh and those of Tabun D. The assemblage of Qafzeh, close but not quite identical to Tabun E, was replaced at Tabun D by a fauna where European species are suddenly introduced and where some archaic African elements are no longer present. This turnover is believed to have occurred at the limit between stages 5 and 4, at the same time when Neanderthals arrived in Israel. In Tchernov's opinion, later intra-Mousterian faunal changes are scarce; they mainly occur between Tabun D and C during the passage of stage 4 to 3 (Tchernov 1988, p.160 and fig. 1). Moreover, the larger mammals of the Levantine province are only rarely useful for biostratigraphical purposes (Ibidem, p.156).

How the present study fits in this framework? Admittedly, the studied equid material is poor, and this may account for the difficulty to use large Mammals for biostratigraphy in Israel, but it may still bring some elements in the discussion (fig. 3, table 3).

The first point to consider is Tchernov's statement of a great similarity between micromammals of Tabun E and lower Qafzeh. It is not corroborated by equid remains: *E. caballus*, already present at Oumm Qatafa, seems the dominant species at Tabun E (Pl. I, fig. 9); it is rare, if present (1 tooth?), in the older levels of Qafzeh. The dominant species of Qafzeh, *E. cf. tabeti*, is rare or absent in Tabun E. This replacement of a horse, usually a component of cold faunas, by *E. cf. tabeti*, a species with zebroid or asino-hemionid affinities, could be explained by some climatic shift from cold and/or humid to warm and/or dry, as may be expected during the passage from isotopic stage 6 to 5. Alternatively, *E. caballus*, a stage 6 species, "lingered" in the beginning of stage 5, before *E. cf. tabeti* took over.

As stated earlier, the *E. cf. tabeti* of lower Qafzeh is poorly defined because of the lack of diagnostic limb bones. If the "zebra connection" postulated by Davis (1980) cannot be excluded for *E. cf. tabeti*, the "ass-hemione" connection seems more probable, because of the tooth similarities with the Ubeidiyeh equid whose metapodials are slender. But from the equid remains at hand, the "strong interpluvial stamp" found by Tchernov in the old Qafzeh fauna cannot be really confirmed.

Unfortunately, I have no data on Tabun D, so that the faunal turnover found by Tchernov on the micromammals, and correlated with the transition from stage 5 to 4, cannot be discussed for the equids. But the small sample from the upper Mousterian levels of Qafzeh (level VII) may well differ from the older levels: *E. caballus* has returned, and a lower cheek tooth (Pl. I, fig. 10), different from *E. cf. tabeti*, could belong to a wild Ass or to an *E. hydruntinus*. The return of the horse could be related to colder or more humid conditions.

The material from Tabun C is also very poor. The presence of a horse, associated with a few teeth of *E. cf. tabeti*, and the possible presence of a wild Ass distinguish both Tabun C and the level VII of Qafzeh from the older levels of Qafzeh on one side, and the sites discussed next (Shkul, Kebara, Tabun B) on the other.

The hominid site of Shkul has for a long time been believed to be about 40,000 years old but has recently been dated by electron spin resonance (ESR) at 81 or 101,000 years (Stringer *et al.* 1989). These dates are "indistinguishable from, or only slightly younger than those previously obtained for anatomically similar hominids from Qafzeh" (Ibidem), the dates found for Qafzeh being 92,000 years (thermoluminescence) or 115,000 years (ESR), (Schwarcz *et al.* 1988). Tchernov does not discuss the relative ages of Shkul and Qafzeh, so that we do not know if the micromammals are different in these sites. The equid material however does show important differences. Judging from the collections of the British Museum, the dominant equid at Shkul is *E. hydruntinus* (fig. 3, table 3) associated with a few remains of *E. caballus* and of *E. cf. tabeti*.



Although *E. hydruntinus* is represented already in Oumm Qatafa D2 at least by one M<sup>2</sup> (occlusal length: 20mm; protocone length: 7,2mm), and possibly by a few remains in other sites, its first "massive" appearance in Israel is at Shkul. The ecological implications are not immediately clear: in Europe, *E. hydruntinus* is considered as a dry and warm marker (Bonifay 1991); its occurrence in Israel in apparent replacement of *E. cf. tabeti*, which we have assumed to be a dry-warm marker also, seems contradictory. It may be however understood if we suppose that cold climatic fluctuations in Eurasia "chased" *E. hydruntinus* in a southern direction, in particular toward the Middle East. Whatever the case, the differences between Shkul and lower Qafzeh equids are not in accordance with their supposedly similar ages; Shkul should be closer to Kebara.

Incidentally, the presence at Shkul of a few teeth that can belong to a "lingering" *E. cf. tabeti* is not in accordance with Davis's model of a progressive transformation of the Qafzeh equid into *E. hydruntinus*. Another evidence against this hypothesis is the presence of a small *E. hydruntinus* already at Oumm Qatafa.

If *E. hydruntinus* is already a dominant equid at Shkul, it seems to become even more dominant at Kebara (recently dated at 60 or 64,000 years, Schwarcz *et al.* 1989), and even more so at Tabun B where it is apparently the only equid species.

## Conclusion

Although rather poor, the equid material from Tabun, Qafzeh, Shkul, and Kebara does bring some evidence that may complement the biostratigraphical framework proposed by Tchernov (1988).

Three or four equids are present in Israel from the Acheulo-Yabrudian of Tabun E to the Upper-Epi Palaeolithic of Tabun B: *E. caballus*, *E. cf. tabeti*, *E. hydruntinus*, and possibly *E. africanus* (wild Ass). Their frequencies are quite different in the studied sites (fig. 3, table 3).

*E. caballus*, known since the stage 6 at Oumm Qatafa, is the dominant species at Tabun E. It nearly disappears in the lower Mousterian levels of Qafzeh. It seems to reappear in level VII of Qafzeh, at Tabun C, and at Shkul. It is often associated with *E. hydruntinus* or a small Ass (Oumm Qatafa, Qafzeh VII, Tabun C, Shkul).

*E. cf. tabeti* is the dominant species in the lower levels of Qafzeh; after that, it disappears to be replaced by *E. hydruntinus*. The replacement is progressive through the sequence Tabun C-Shkul-Kebara, till at Tabun B *E. hydruntinus* is the only equid present.

On the whole, the present data agree with the biochronology proposed by Tchernov (1988, and pers. comm.). *E. cf. tabeti*, dominant in the lower Mousterian levels of Qafzeh, is very rare before and after; it may be considered as the characteristic equid of stage 5. The presence of *E. caballus* at Tabun E, and its reappearance at Qafzeh VII point to probably different climatic conditions (moister and/or cooler) also present at Tabun C.

The massive appearance of *E. hydruntinus* at Shkul and its dominance at Kebara and at Tabun B point to similar climatic conditions in those three sites. Since Kebara and Tabun B probably belong to stage 3, the ESR dates for Shkul (Stringer *et al.* 1989) are surprising. If they are correct, the "dominance" of *E. hydruntinus* in Israel may not begin with the stage 4, as would seem logical, but somewhat earlier. Anyway, from the equid evidence it is difficult to accept the same age for Qafzeh and Shkul.

Our present knowledge of primitive, non caballine, equids is not in agreement with the model proposed by Davis (1980). The *E. hydruntinus*-*E. hemionus* group is more probably related to stenonine equids through European or Eurasiatic Lower-Middle Pleistocene forms (like *E. altidens*) than to African equids. If any relation exists with African forms, it is with the slender, rather asino-hemionine *E. tabeti*, than with the robust zebra-like *E. mauritanicus*. The systematic relations of all these non caballine forms, should be rather discussed in the light of their evolved metapodials than in the light of their primitive dentitions.

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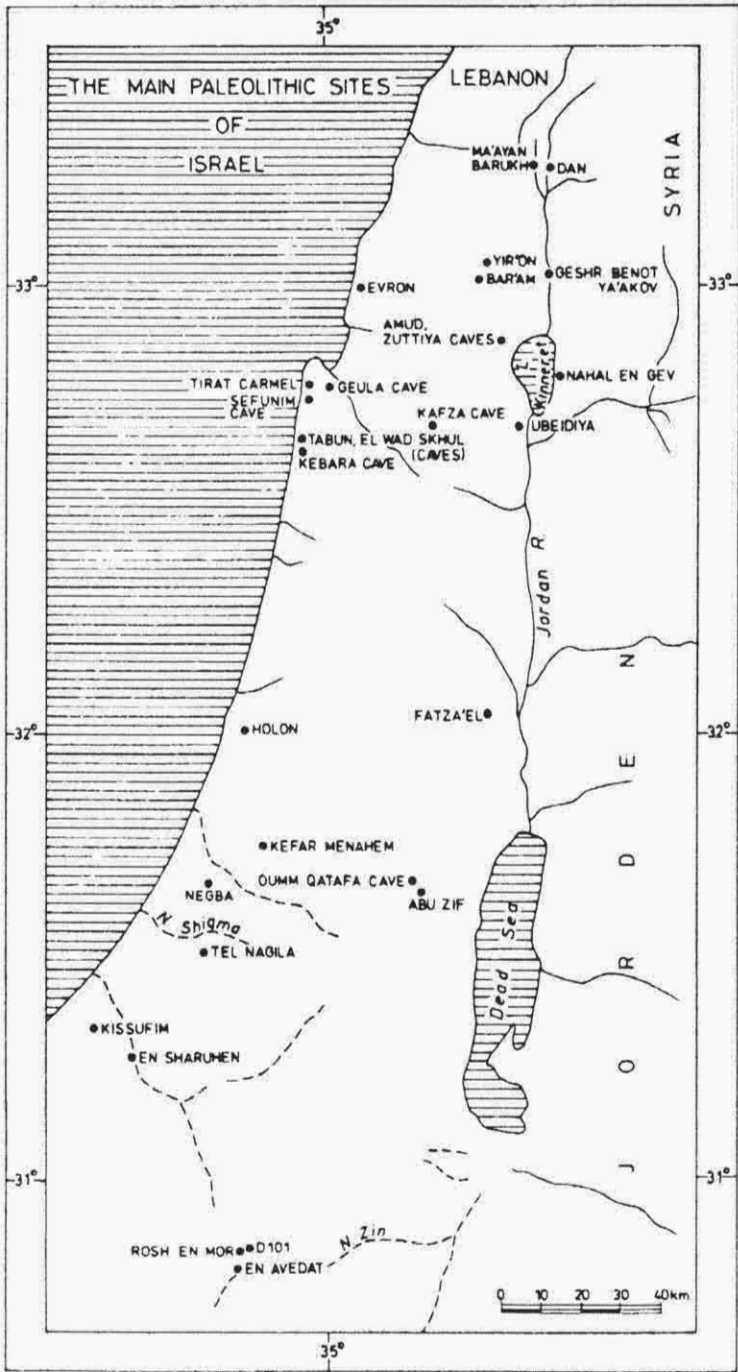


Figure 1. Location map of the main Paleolithic sites in Israel (from A. Horowitz, 1979).

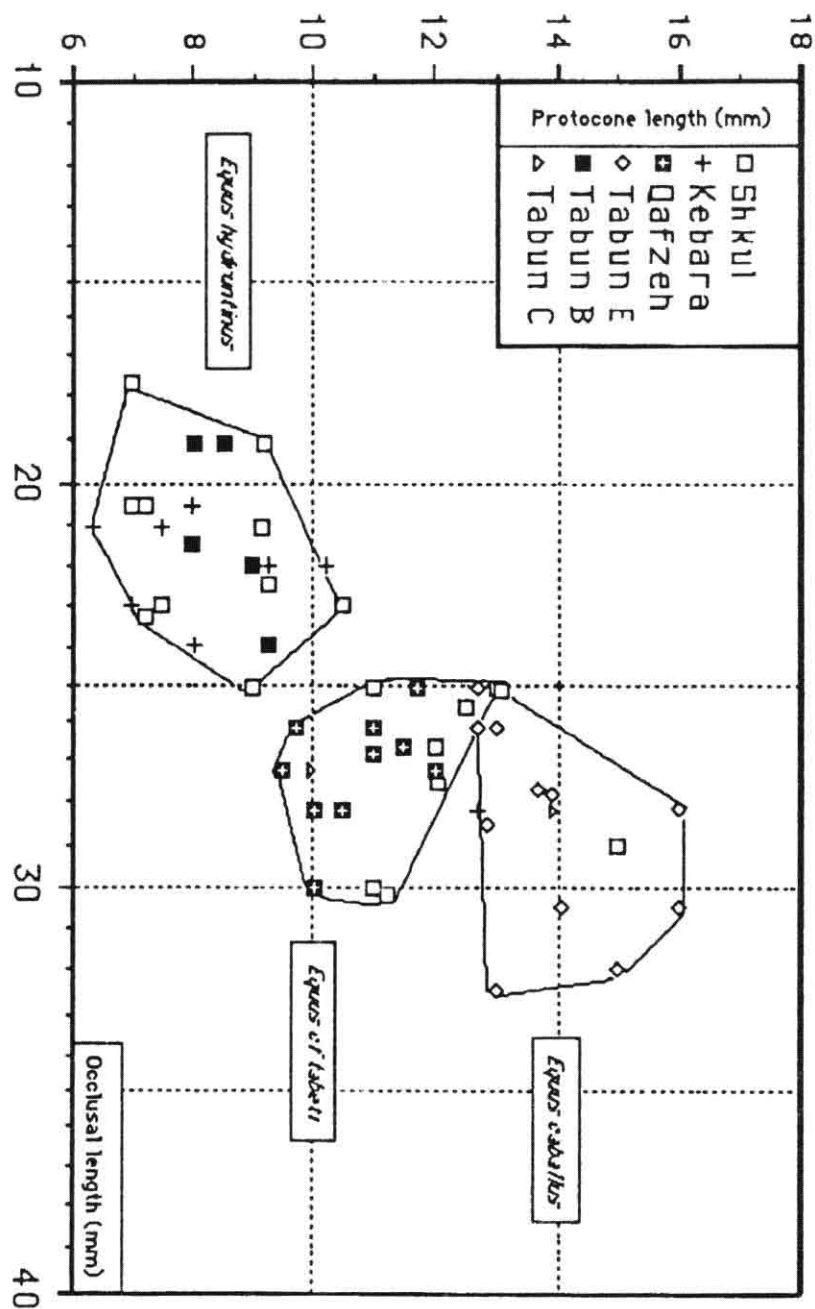


Figure 2. Scatter diagram of protocone and occlusal lengths of adult equids from North Israeli sites.



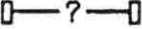



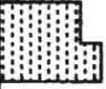



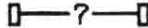


	 n = 5	<i>E. caballus</i>	<i>E. cf. tcheti</i>	<i>E. hydruntinus</i>	<i>E. africanus</i>
TABUN B					
KEBARA					
SHKUL					
TABUN C					?
QAF. VII-XI			?		
QAF. XV-XIX	?				
TABUN E			?		

Figure 3. Frequency of fossils of different species of *Equus* in North Israelian Pleistocene sites.

Table 1

Upper Cheek teeth	Length	Protocone L.	Width	Height
P3-P4	VIIa D15-65	10,3	29	41
	XVII A13-293	28	27,7	24
	XIX c10-353	28	[29]	79
M1-M2	XVF C11-174	26	27	75
	XVI A11-78	26	27	36
	XVII A13-293	27	[26]	22
	XVII C10-284	26,6	26,3	63
	XVIII A A12-48	26,9	27	67
	XIX C10-352	[25]	[28]	83
	XIX C10-354	26,5	27	-

Table 1. Adult upper cheek teeth of equids from Qafzeh. Measurements in millimeters. Length and width occlusal or at mid-crown for little worn teeth and M<sup>3</sup>.

	Table 3				Total
	<i>E. africanus</i>	<i>E. hydruntinus</i>	<i>E. cf tabeti</i>	<i>E. caballus</i>	
Tabun B	0	9	0	0	9
Kebara	0	19	0 or 1	1 or 0	20
Shkul B	0	22	8 or 6	5 or 7	35
Tabun C	0 or 1	0	3 or 2	2	5
Qafzeh VII-XI	0 or 1	1 or 0	0 or 1	3 or 4	5
Qafzeh XV-XI	0	0	23 or 24	0 or 1	24
Tabun E	0	0	0 or 3	13 or 10	13

Table 3. Occurrence of different species of *Equus* in North Israeli Pleistocene sites.



Table 2

Lower Cheek teeth	Length	Postflexid L	Double knot L	Width	Height
P2	32	16,8	16,7	16	51
P3-P4	27,5	9,8	17	17,1	22
	27,3	10,5	16	17,1	-
	27	11,8	16,5	16	51
	26	11	16	16	35
	27,1	14	16	16	66
	27,7	15,5	16,2	17,3	57
	28	15	16,6	15,9	68
	29	14,5	16,9	15	75
	29	14,7	18,5	[17]	-
	30	15,3	18	15	40
	28	12,5	17	16	-
27,7	11,8	15,6	16,3	-	
P or M ?	25	10,3	13	16,3	40
M1-M2	25,3	10	15	15	61
	26	9,7	14,7	14	-
	26	10,1	15	15	73
	25,6	8,2	14,5	14,5	67
	25,2	10	13,2	14	42
M3	32	-	-	-	[35]
	33	9,5	14	13	26
	33,2	8	13	13	26

Table 2. Adult lower cheek teeth of equids from Qafzeh. Measurements in millimeters. Length and width occlusal or at mid-crown for little worn teeth.

Plate I. Occlusal views of Equid teeth from Israelian sites compared with the modern *E. grevyi* and the Middle Pleistocene *E. mauritanicus*.

1. *E. grevyi*, Zürich 16656, P/2; 2. and 3. *E. cf. tabeti*, P/2: Qafzeh XVI A 13-25 and Ubeidiyeh 180.

4. *E. mauritanicus*, Ternifine 769, P/3 or P/4; 5 and 6. *E. cf. tabeti*, P/3 or P/4: Qafzeh XV B 12-344 and Ubeidiyeh 66 d.

7. and 8. *E. hydruntinus*, Kebara, M/3: A 2 6 711-22 7-65 (98), M<sup>1</sup> or M<sup>2</sup>: A' 4 65; 9. *E. caballus*, Tabun Eb, probably M/1 or M/2.

10. Qafzeh, C VIIa D15 65: *E. africanus* if M/1 or M/2, *E. hydruntinus* if P/3 or P/4; 11. Qafzeh, XV B 11-235, P/3 or P/4, small *E. tabeti* or large *E. hydruntinus*; 12. Kebara "mousterian", *E. caballus*, probably P/3 or P/4.

13. *E. hydruntinus*, Shkul, M<sup>1</sup>/or M<sup>2</sup>; 14. Qafzeh, *E. cf. tabeti*: XVII B 10-348, M/1 or M/2; 15. Qafzeh, *E. caballus*: XI 65, P/3 or P/4.

16. *E. mauritanicus*, P3/ or P4/, Ternifine 1285; 17. and 18. *E. cf. tabeti* P3/ or P4/, Qafzeh XVII A 13-293 and Ubeidiyeh 203.

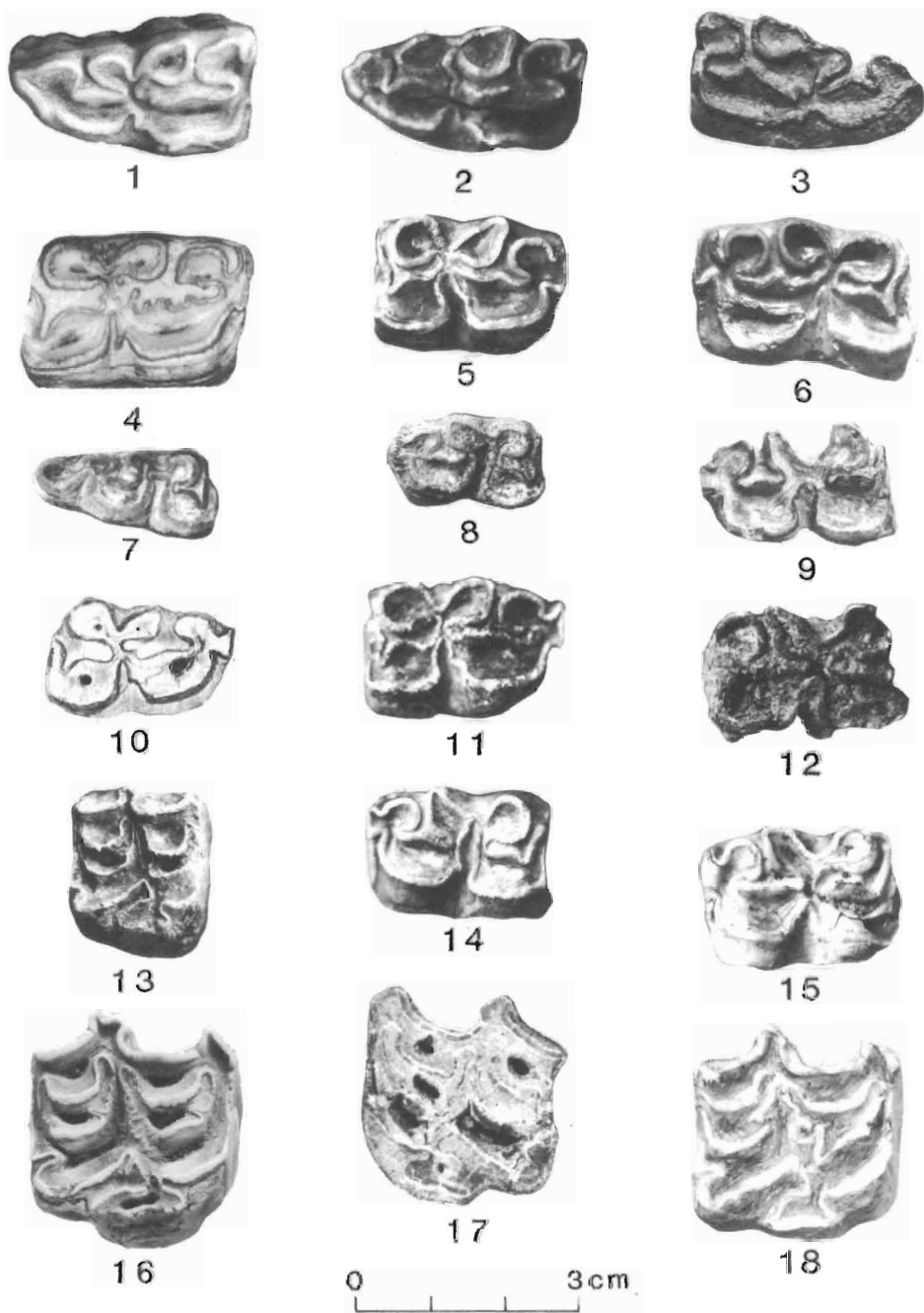


Plate 1