

**THE FOSSIL VERTEBRATES OF KSÂR'AKIL,
A PALAEOLITHIC ROCK SHELTER IN THE LEBANON**

by

D. A. HOOIJER

(Rijksmuseum van Natuurlijke Historie, Leiden)
With Plates I-II

CONTENTS

Introduction	4
Systematic part	5
Pisces	5
Amphibia	6
<i>Hyla arborea</i> (L.) subsp.	6
Reptilia	6
<i>Testudo</i> spec.	6
<i>Ophisaurus apodus</i> (Pallas)	8
<i>Chamaeleo chamaeleon</i> (L.) subsp.	8
Serpentes	9
Aves	9
<i>Gyps fulvus</i> (Hablizl)	9
Mammalia	11
Insectivora	11
<i>Crocidura</i> spec.	11
Rodentia	11
<i>Sciurus anomalus</i> Gldenstdt subsp.	11
<i>Microtus</i> cf. <i>machintoni</i> Bate	12
<i>Spalax</i> spec.	13
<i>Apodemus</i> cf. <i>mystacinus</i> (Danford et Alston)	14
<i>Apodemus</i> spec.	15
<i>Hystrix</i> cf. <i>indica</i> Kerr.	16
Carnivora	17
<i>Canis lupus</i> L. subsp.	17
<i>Canis aureus</i> L. subsp.	17
<i>Vulpes vulpes</i> (L.) subsp.	19
<i>Ursus arctos</i> L. subsp.	21
<i>Martes</i> cf. <i>martes</i> (L.)	24
<i>Meles meles</i> (L.) subsp.	24
<i>Crocuta crocuta</i> (Erxleben) subsp.	25
<i>Felis silvestris</i> Schreber subsp.	27
<i>Felis chaus</i> Schreber subsp.	29
<i>Felis pardus</i> L. subsp.	29
Perissodactyla	31
<i>Equus caballus</i> L. subsp.	31
<i>Dicerorhinus merckii</i> (Jger)	32
Artiodactyla	36
<i>Sus scrofa</i> L. subsp.	36

<i>Dama mesopotamica</i> (Brooke)	36
<i>Cervus elaphus</i> L. subsp.	39
<i>Capreolus capreolus</i> (L.) subsp.	40
<i>Bos</i> spec.	42
(?) <i>Alcelaphus</i> spec.	45
<i>Gazella</i> cf. <i>dorcas</i> L.	45
<i>Capra aegagrus</i> Erxleben.	48
Cave of Antelias (Mugharet el-Bileni), and Abri Bergy	56
General accounts of the successive mammalian assemblages	56
Literature cited	62
Explanation of the plates	68

INTRODUCTION

The rock shelter of Ksâr'Akil is a Palaeolithic site in the valley of Antelias near Beirut, Lebanon. Although the site was already known in the early twenties (Day, 1926) it was first scientifically excavated by a group of American Jesuits in 1937/38 and 1947/48. Because of the extraordinary depth and richness of the deposits it contains Ksâr'Akil may be considered a key site in the Near East (Garrod, 1953, p. 18), but unfortunately the results of these excavations have not been fully published even to date. Practically all the information available is contained in a few preliminary papers by Ewing (1947-1949); a brief report on the geologic setting was given by Dr. H. E. Wright (in Braidwood, Wright and Ewing, 1951). The faunal remains had been delegated to Miss D. M. A. Bate, which was a natural choice because of the most important work Miss Bate had been doing on the vertebrates from Palaeolithic sites in the Near East, culminating in the monograph on the fossil fauna of the Wady el-Mughara caves, Mount Carmel (1937, with several additional papers published between 1940 and 1945). When Miss Bate died in 1951, the Rev. J. Franklin Ewing, S.J., suggested that I describe the collection of vertebrates from Ksâr'Akil. The results of this study are presented below.

When the collection was received at the Leiden Museum I could not but appreciate the very careful packing. There were many hundreds of small boxes, each labelled with the level number and the square from which its contents had been obtained. The levels are numbered I to XXXVI, the last being the bottom level, at a depth of 23 meters. This material was collected in 1947/48. Further, there was a series of boxes on which the depth is indicated in meters only; these are from squares E5, F3 and F5, and range from 3.00 to 15.40 m, comparable to levels VI-XXV of the remaining squares; this was excavated in 1937/38. In general the 1937/38 material is in better shape than the 1947/48 material.

For the present study I have used both the pre- and the post-war col-

lections, notwithstanding the differing ways in which the depth of the samples is recorded, which hampers an exact correlation between the 1937/38 and the 1947/48 finds. However, it was soon found out that, apart from what happened during the time interval represented by levels XXVI A—XXIX B, there was a very gradual change in the composition of the fauna, which calls for correlation in broad bands only. In the final chapter of the present work I shall attempt to give an outline review of the "evolution" of the fauna as it suggested itself to me when working on the collections. Inasmuch as the teeth and bones of animals found in cultural deposits are the remains of human food, brought in by man (the remains of insectivores and small rodents are, however, most likely from owl pellets deposited among the refuse), they reflect the hunting abilities and food choice of the early inhabitants of the cave or rock shelter rather more than anything else. This should be kept in mind when the student of bones from archaeological sites is tempted to visualize the climate and environment at the time of deposition of the specimens sent to him for identification.

Miss Bate's papers on the fauna from the Mount Carmel caves (which in many respects resembles that of Ksâr'Akil) have been invaluable to the present study. Mention should also be made of Dr. R. Vaufreys work on the fauna of Umm Qatafa (1931, 1951), as well as of Dr. G. Haas's study of the microfauna of the latter site, and of the fauna from the Abu Usba cave (1951, 1952), papers that I have often consulted in the course of writing the present report.

I wish to record my indebtedness to the Rev. J. Franklin Ewing, S.J., for entrusting the Ksâr'Akil vertebrates to me, as well as to Dr. H. L. Movius, Jr., for various informations and kind advice.

As the present paper was going to press, I found a paper (Ewing, 1960), read in Philadelphia in 1956, that deals with the human remains of Ksâr'Akil (Neanderthaloid and sapient), and that further contains a section on the archaeology (supplied by Dr. J. Waechter) as well as one on the paleontology (supplied by me). This paper should be consulted for background information on the site.

SYSTEMATIC PART

PISCES

There are a small number of teleost vertebrae in the Ksâr'Akil collection, but these are so incomplete as to preclude specific identifications. There are two vertebrae from 9.75-10.00 m, F5, one from 11.00-11.50 m, E5, and one each from level VIII, F3, G4 (6.74 m), and from level IX, F3-4, G3

(7.25 m). Apparently, fish has never been an important source of food supply at Ksâr'Akil.

AMPHIBIA

Order SALIENTIA

Hyla arborea (L.) subsp.

A few bones in the Ksâr'Akil collection allow of a specific identification of a frog thanks to the presence of a right ilium (level XXXIV, E5) and Schaefer's 1932 paper on the identification of anurans on the basis of the skeleton. The complete absence of a vexillum on the ala ossis ilium, and of dorsoventral flattening cranially, combined with the presence of a processus superior, and the distinct separation of the limbus articularis from the cranial edge of the corpus ossis ilium (Schaefer, 1932, pp. 771-779) point to *Hyla arborea* (L.) one race of which (*H. a. savignyi* Audouin) inhabits Syria (Tristram, 1884, p. 160/61; Flower, 1933, p. 843/44; Mertens and Müller, 1940, p. 17/18).

Previous records of fossil toads or frogs from the same general region include "*Bufo* or *Rana*" as recorded by Bate (1927b, p. 28) from Mugharet ez-Zuttiyeh, and "*Pelobates syriacus* Boettger, *Bufo viridis* Laur., *Hyla arborea* Aud., and (?) *Rana* sp." as recorded by Haas (1952, p. 42) from the Natufian of Abu Usba cave, Mount Carmel.

Frog bones are further represented in the lots from levels XXVII B, F4 (radio-ulna), XXVIII, E4 (idem), XXXIII, E5 (right humerus), and XXXIV, E5 (the right ilium recorded above, and two radio-ulnae).

REPTILIA

Order TESTUDINIDES

Testudo spec.

In the Ksâr'Akil collection there are many fragments of shells and limb bones of tortoises; all of them apparently belong to the genus *Testudo* and not to *Emys*, to which Bate (1927 b, p. 34) refers the chelonian fragments found at Mugharet ez-Zuttiyeh. This is evident from the thickened anterior margin of the epiplastra, and from the fact that the groove indicating the separation of the abdominal from the femoral coincides with the hypo-xiphoplastral suture in the median line instead of the former being much more forward than the latter (as in *Emys*). Unfortunately not less than four species of *Testudo* are living today in or very near to Syria, and with the

fossil material on hand no decision can be made as to which of these species the Ksâr'Akil form (or forms) represent. These species are:

- Testudo graeca* L. (*ibera* auct.),
Testudo hermanni Gmelin (*graeca* auct.),
Testudo horsfieldii Gray (Caspian Sea to N.W. India), and
Testudo kleinmanni Lortet (*leithii* auct.) (Northern Sinai to Cyrenaica).

The relevant literature on these forms (Boulenger, 1889, pp. 175-178; Siebenrock, 1909, pp. 540-543; Flower, 1933, pp. 744-749; Smith, 1931, p. 146) nor the study of actual skeletons of the species *graeca* and *hermanni* reveal any distinguishing characters that can be checked in the fossil material. According to Böttger (1879, p. 81) "*Testudo pusilla* Shaw" (a synonym of *Testudo graeca* L. (*ibera* auct.)), see Boulenger, 1889, p. 176) is very common in the Lebanon. The only hint as to which species the Ksâr 'Akil *Testudo* belongs to might be derived from the pygals, of which there are some specimens in the collection. Two pygals, from level XXVIII A, F4, and level XXVIII, E4, show the supracaudal shield that covered them to have been undivided, while another pygal (level XXVIII, E4) has a median anteroposterior groove, indicating a divided supracaudal. The supracaudal of *T. horsfieldii* is undivided (Smith, 1931, p. 146), and so is that of *Testudo "leithii"* and *T. graeca*, while in *T. hermanni* the supracaudal is usually divided (Boulenger, l.c.; Siebenrock, l.c.). However, Flower (1933, p. 747), notes that in 38 individuals of both sexes of *T. "leithii"* the supracaudal is entire only in 25 cases, divided in two, and in various intermediate stages in the remaining 11 individuals. To this I may add that in a series of 9 individuals of *Testudo graeca* L. in the Leiden Museum (herp. reg. nos. 7236-7244) the supracaudal is entire but for two specimens, in which it is divided in its upper part (no. 7242) or in its lower part (no. 7240). Both of these two specimens are males.

Level XXVIII is particularly rich in chelonian remains; the sample from square E4 contains not less than seven hyoplastra, fourteen hypoplastra, and six xiphiplastra, all more or less fragmentary, while there are five nuchals which vary somewhat in the size of the small nuchal shield; in one it is so reduced as to be practically absent. *Testudo* is further represented in the following lots: 5.60-5.80, F5; 5.80-6.37, E5; 5.94-6.45, F5; 8.65-9.30, E5; 9.20-9.75, F5; 9.75-10.00, F5; 11.00-11.50, E5; 11.00-11.50, F5; 11.50-12.00, F5; 13.70-14.00, E5; 13.85-14.15, F5; levels VII, F2-4 and G2-4; VIII, F3; IX, E4; XI, F3-4; XVII, F4; XVIII, E4; XXII, F4; XXVI A, F4; XXVII A, F5; XXVII B, F5; XXVII B, E4; XXVII B, E5; XXVII B,

F4; XXVIII A, F4; XXVIII B, F4; XXXII, F5; XXXIII, F4, and XXXIV, F4.

Testudo "ibera" has been stated to occur at Abu Halka (Haller, 1946, p. 8); Haas (1952, p. 41/42) notes *Testudo* to be especially numerous in the Natufian of Abu Usba, Mount Carmel; the species is recorded as *Testudo graeca* L.

Order SAURIA

Family Anguidae

Ophisaurus apodus (Pallas)

A number of vertebrae as well as four dentaries and a portion of the skull appear to be indistinguishable from *Ophisaurus apodus* (Pallas), which today inhabits Syria and Palestine (Tristram, 1884, p. 151, as *Pseudopus apoda*; Mertens and Müller, 1940, p. 25). The dentaries (one right and one left (not of the same individual) from 5.80-6.37 m, E5; one right from level XVII, F3, and one left from level XXVIII, E4) are incomplete in front but match recent specimens closely. The solid, pleurodont teeth increase in size from back to front until the sixth and seventh teeth from behind which are the most robust, and from these on forward the teeth become more slender and pointed and less closely set. The skull fragment comprises the basioccipital with the condyle, most of the basisphenoid, the exoccipitals, and the supra-occipital; it was found at 11.00-11.50 m, E5. The vertebrae, most of which are isolated specimens, originate from:

5.80-6.37, E5 (2 thoracic vertebrae, associated),
 5.94-6.45, F5 (1 thoracic),
 11.00-11.50, E5 (6 thoracic, 1 caudal),
 11.00-11.50, F5 (5 thoracic, 1 caudal),
 11.60-12.25, E5 (2 thoracic),
 13.85-14.15, F5 (1 caudal),
 level VII, F2 (3 thoracic, associated),
 level VII, G2 (5 thoracic, associated), and
 level XVII, F4 (1 thoracic).

According to Haas (1952, p. 41, as *Ophisaurus* cf. *apus*) the present species occurs in the Natufian of Abu Usba cave, Mount Carmel.

Family Chamaeleontidae

Chamaeleo chamaeleon (L.) subsp.

A fragment of a right maxillary with some seven acrodont teeth from

level XXVII B, F5, has so much resemblance to that part in a chameleon that it is here tentatively referred to this species. It occurs in Syria and Palestine (Tristram, 1884, p. 154; Flower, 1933, p. 781/82; Mertens and Müller, 1940, p. 25), but has not yet been put on record for the fossil fauna of these regions, apart from Haas's record of the species from the Natufian of Abu Usba cave, Mount Carmel, where it is stated to be especially numerous (Haas, 1952, p. 41/42).

Order SERPENTES

Snake vertebrae occur in many levels throughout the Ksâr 'Akil sequence, as listed below :

3.00-3.10, E5, E5
 5.60-5.80, F5
 5.80-6.37, E5
 5.94-6.45, F5
 6.83-7.40, E5
 9.20-9.75, F5
 11.00-11.50, E5
 11.00-11.50, F5
 11.50-12.00, F5
 11.60-12.25, E5
 12.00-12.40, F5
 level VI, E4, F3-4, G3-4
 VII, D5-7, E4
 VII, G2-4
 VIII, F3, G4, 6.74
 VIII, F3, 6.75
 IX, E4, 7.24
 XVII, F4, 11.25
 XVII, E4, 11.55
 XXVIII, E4

These specimens have not been identified as to the species.

AVES

A large bird of prey is fairly common throughout the Ksâr 'Akil sequence. Most fortunately, besides ends of limb bones, there is the back part of a skull (9.30-9.85, E5) that proves to belong to the griffon vulture, *Gyps fulvus* (Hablizl). Other large vultures that may be expected to occur at Ksâr 'Akil

such as the cinereous vulture, *Aegyptius monachus* (L.), the lappet-faced vulture, *Torgos tracheliotus* (Forster), and the lammergeier, *Gypaëtus barbatus* (L.), differ from *Gyps fulvus* in being much wider at the occiput. Skeletons of all of these species have been examined in order to find out whether more than one species of vulture is represented at Ksâr 'Akil, but the ends of the limb bones are so very similar in the various forms that the remaining Ksâr 'Akil specimens cannot well be identified as to species. The list of material is as follows:

3.10-3.20, E5, F5	claw.
6.62-7.30, F5	claw.
6.83-7.40, E5	proximal end of humerus sin. distal end of femur sin. first phalanx of hallux of right pes.
8.65-9.30, E5	distal end of tibiotarsus dext.
9.30-9.85, E5	back part of skull, <i>Gyps fulvus</i> .
9.75-10.00, F5	distal part of humerus dext. proximal part of femur dext. idem (smaller portion). distal end of femur dext.
10.00-10.40, E5	distal end of humerus sin. distal end of femur sin.
11.00-11.50, E5	distal end of humerus sin.
13.05-13.50, E5	distal end of humerus sin.
level V, D5-7	distal end of humerus sin.
V, F3-6	claw.
V, G3-6, H4-5	proximal end of femur dext. claw.
IX, D5	part of claw.
IX, E4, 7.65	proximal end of femur sin.
X, F3, 8.10	distal end of humerus sin.
XI, F4, 8.95	proximal end of femur dext.
XI, F3, 9.10	distal end of ulna dext. distal end of femur dext. distal end of femur sin. distal end of tibiotarsus sin.
XI, F3, 9.30	proximal end of humerus dext.
XI, E4, 9.60	distal end of humerus dext. distal part of humerus sin. distal end of femur dext.

XII, E4, 10.00	distal end of ulna sin. proximal end of humerus dext.
XVII, F4, 11.25	claw.
XXIX A, F5	distal end of femur sin.
XXIII, E4, 14.40	claw.

According to Boule (1919, p. 307) *Gyps fulvus* has been recorded from various ossiferous caves in Italy; the species occurs at the Grimaldi caves (Boule, l.c., p. 305) as well as at the Mousterian rock shelter at Devil's Tower, Gibraltar (Bate, 1928, pp. 105-107). The griffon vulture is thus far known in the fossil state from one Palestine site only, viz., Umm Qatafa (identified by Boule, in Vaufrey, 1931, p. 262); its recent distribution (Meinertzhagen, 1954, p. 382) ranges from the Mediterranean to the Himalayas.

MAMMALIA

Order INSECTIVORA

Crocidura spec.

A small shrew is represented by a portion of a left mandibular ramus without the ascending portion but with M_{1-2} in situ, originating from level XXVII B, F5. It is undoubtedly a *Crocidura*, and in all probability the same as *Crocidura katinka* Bate (1937b, p. 164), which occurs at Tabûn, Mount Carmel, level E-D (transition Acheulean-Levalloiso-Mousterian).

Both in structure and in size the resemblance of the Ksâr'Akil fragment to the corresponding portion of the left ramus of *C. katinka* (Bate, l.c., p. 161 fig. 2j) is complete. The length M_{1-2} in our specimen is 2.8 mm; the height of the ramus at M_2 , 1.7 mm.

Another very similar specimen of small shrew is mentioned by Haas (1951, p. 218); this originates from level f (Middle Acheulean) of Umm Qatafa. Level XXVII B of Ksâr'Akil contains an industry that is a late form of Levalloiso-Mousterian. It remains possible, of course, that more complete specimens from Ksâr'Akil will reveal differences from the fossil Palestine shrew mentioned above; for the present it seems advisable not to attach a specific name to the fossil shrew of Ksâr'Akil.

Order RODENTIA

Sciurus anomalus Gùldenstàdt subsp.

Fossil remains of tree squirrels have been recorded as *Sciurus* cf. *anomalus* Gùldenstàdt from the Upper Acheulean of Tabûn, the Middle Au-

rignacian to the Natufian (levels E-B) of Mugharet el-Wad (Bate, 1937b, p. 186), and from the Natufian of the Shukbah cave (Bate, 1942b, p. 18) as well as of the Abu Usba cave (Haas, 1952, p. 37). In the Ksâr'Akil collection this species appears to be represented by three mandibular rami, two from 7.40-8.40 m, F5, and one from level IX, F3. Of the rami from 7.40-8.40 m, F5, that of the right side has M_{2-3} in situ, while that of the left side holds P_4 and M_{1-2} . The best preserved specimen is the left ramus from level IX, F3, which has the full complement of teeth, with crowns in a splendid condition. Except for the slightly more narrowed anterior portion of the P_4 there is nothing in the fossil specimen that distinguishes it from the largest of four recent specimens of "*Sciurus syriacus*" in the Leiden Museum (cat. ost. c). The length P_4 - M_3 (crowns) is 10.9 mm, and the incisor is 3.0 by 1.3 mm in diameters at its proximal end. The living tree squirrel of Syria is regarded as a subspecies of *Sciurus anomalus* Gldenstdt: *S. a. syriacus* Ehrenberg (Ellerman and Morrison-Scott, 1951, p. 477). While the Ksâr'Akil specimens may not be subspecifically the same as the living Lebanon tree squirrel, there seems to be no doubt that they belong to the same species, perhaps representing a large temporal race. It is of interest to note that the specimens from the Wady el-Mughara caves studied by Bate (1937b, p. 186), too, cannot be distinguished from large examples of recent *Sciurus anomalus*.

Microtus cf. machintoni Bate

In the Ksâr'Akil collection *Microtus* is less well represented than is *Apodemus*. There are thirteen mandibular rami, as follows: one from level XXVII A, F5, two from level XXXII, F4, three from level XXXII, F5, three from level XXXIII, E5, and four from level XXXIII, F5. These specimens are fragmentary, and M_3 is only rarely in place.

As far as this material permits judgment, the species represented at Ksâr'Akil appears to be *Microtus machintoni* Bate, a form of the Upper Acheulean and Lower Levalloiso-Mousterian of the Wady el-Mughara caves. The first lower molar has the anterior loop shaped exactly as in that species, with a deep re-entrant angle on its inner side (the fourth from behind), and a shallow re-entrant angle on its outer side (likewise the fourth from behind) placed more forward than the inner angle. In front of the fourth inner re-entrant angle from behind the anterior loop is only slightly indented, less markedly so than in *Microtus agrestis* (L.) or in *M. arvalis* (Pallas). As noted even in the brief diagnosis of the fossil species (Bate, 1937a, p. 400), the anterior loop of M_1 in *M. machintoni* is noticeably long. Comparison

with published figures of the lower dentitions of the last-named species (Bate, 1937b, p. 202 fig. 5p (M_{1-3} dext.); Haas, 1951, p. 226 fig. 78d (M_{1-3} sin.)) does not reveal even the slightest difference.

Microtus güntheri (Danford et Alston, 1880, p. 62, fig. 7b), abundant today in Palestine (Bodenheimer, 1949), like the recent species mentioned above, has the anterior loop of M_1 more deeply indented than is the case in the Ksâr'Akil specimens. It is to *M. güntheri* that Haas (1952, p. 38) provisionally refers the Natufian remains from the Abu Usba cave. *Microtus* cf. *güntheri* is also abundantly represented at the Wady el-Mughara caves, ranging in time from the Upper Acheulean to the Mesolithic layers, and, as Bate (1937b, p. 195) notes, it does not seem possible at present to separate these specimens from this recent species, although if more complete material, such as entire skulls, were available it is probable that further species and evolutionary stages would be recognized. There is further *Microtus mccowni* Bate (1937b, p. 194), from the Upper Acheulean of Tabûn, but this form is based on a portion of the calvarium, and the mandible has not been described.

The fossil voles of Umm Qatafa (Haas, 1951, p. 288) represent *Microtus* cf. *agrestis*, and *Microtus machintoni*, the former from Middle and Upper Acheulean, the latter from Middle Acheulean levels only. It should be noted, however, that Vaufreÿ (1951, p. 204) records *Microtus* cf. *güntheri* from the Upper Acheulean of Umm Qatafa, based on mandibles stated to be identical to those previously (Vaufreÿ, 1931, p. 261) recorded as *Microtus agrestis*.

The *Microtus* remains of Ksâr'Akil are confined to levels XXVII A down to XXXIII, which contain an industry that is a late form of Levalloiso-Mousterian. If the species represented in reality is *Microtus machintoni*, as is most likely, its appearance at Ksâr'Akil is later than that at the Palestine sites, in which *Microtus machintoni* is associated with Middle Acheulean to Lower Levalloiso-Mousterian industries.

Spalax spec.

The Ksâr'Akil collection contains material from three different levels, as follows:

level XXVI A, F5	part of left lower I,
level XXVII B, E4	left horizontal ramus of the mandible with I and M_1 in situ; also two isolated lower I,
level XXXIII, F5	left ramus of the mandible with

I, broken off behind the empty
 alveoli of M_{1-3} , and a right lower
 I apparently of the same individual.

The mole rat has been recorded from Mugharet ez-Zuttiyeh (Bate, 1927b, p. 41), and from Umm Qatafa (Vaufrey, 1931, p. 261) as *Spalax* cf. *fritschi* Nehring, but later finds from the Wady el-Mughara caves (Bate, 1937b, p. 185), and from the Shukbah cave (Bate, 1942b, p. 18) have been left specifically undetermined. More recently, Haas (1951, p. 221) referred a ramus from a Middle Acheulean level (f) of Umm Qatafa to a distinct species, *Spalax newvillei* Haas. The Abu Usba cave material (Natufian) (Haas, 1952, p. 37), however, is tentatively referred to the living mole rat of Syria and Palestine, *Spalax ehrenbergi* Nehring (cf. Bate, 1945, p. 146).

Our small amount of material is insufficient for specific determination. The best preserved specimen, the ramus from level XXVII B, E4, is broken off vertically just behind the mandibular foramen. The coronoid process is entire, and resembles that of *Spalax newvillei* Haas (1951, p. 220, fig. 75e) rather than that of *Spalax* cf. *fritschi* Nehring (Haas, l.c., fig. 75b) in being longer anteroposteriorly, and in tapering more rapidly toward the tip than that in Nehring's species. The only molar present, M_1 , has a deep outer fold, and two folds on the inner side, the anterior abruptly bent forward, and the posterior slightly curved backward, as in the living species. The fossil M_1 measures 2.8 mm anteroposteriorly, and 2.4 mm transversely. The total length of the alveoli for M_{1-3} is 7.8 mm (8.0 mm in the ramus from level XXXIII, F5). The height of the ramus at the coronoid process is 13.5 mm, that at M_1 , 7.0 mm. The incisor is 1.8 mm in width. The lower incisors from level XXXIII, F5, are 1.7 mm wide, as are those associated with the ramus from level XXVII B, E4. The isolated lower I from level XXVI A, F5, has a width of 2.3 mm. These measurements agree well with those of recent specimens from the vicinity of Beirut described by Miller (1903, pp. 162-164) as *Spalax berytensis*, a synonym of *Spalax ehrenbergi* Nehring (Ellerman and Morrison-Scott, 1951, p. 556). In the absence of material for more particular determination of this mole rat, the present specimens have to be left specifically undetermined.

Apodemus* cf. *mystacinus (Danford et Alston)

There are two forms of *Apodemus* in the Ksâr'Akil collection. The larger of these is the most common, and will be dealt with first.

The collection contains forty-six mandibular rami, ten from level XXVII B, E4, twenty-five from level XXVII B, F5, three from level XXVIII,

E4, two from level XXXII, F4, four from level XXXII, F5, and two from level XXXIII, E5. Most of these rami are in a very fragmentary condition, however, and lack one or two molars. Six specimens have the full set of molars, M_{1-3} , in situ, with a combined length varying from 4.9 to 5.1 mm.

It is evident that these specimens are not *Apodemus caesarinus* Bate (1942a, p. 468), from levels F-C of Tabûn, Mount Carmel, which is not only smaller (length M_{1-3} slightly less than 4 mm) but, moreover, has a small antero-external tubercle in M_3 not shown in any of the Ksâr'Akil specimens. *Apodemus levantinus* Bate (l.c., p. 470), from levels E-D of Tabûn, although larger than the preceding species (length M_{1-3} just over 4.5 mm), can be excluded for the same reason.

The Ksâr'Akil *Apodemus* teeth are much too large for *Apodemus sylvaticus* (L.), the length M_{1-3} of which varies from 3.4 to 4.2 mm (Miller, 1912b, pp. 814-823) (3.7-4.2 mm in fossil specimens: Schaub, 1938, p. 35), but agree with those of *Apodemus mystacinus* (Danford et Alston, 1877, p. 279), the broad-toothed field mouse from the Balkan Peninsula, Asia Minor (Neuhäuser, 1936, p. 179), as well as from Palestine (Allen, 1915, p. 10)¹), which has a length M_{1-3} of 4.8-5.2 mm.

Bate (1942a) records only one fossil *Apodemus* spec. of the *mystacinus* group; it is from levels E-D of Tabûn (transition Acheulean-Levalloiso-Mousterian). Lower dentitions of this form have not yet been determined with certainty (Bate, l.c., p. 474).

Apodemus spec.

A second, smaller form of *Apodemus* is known only from one (right) mandibular ramus originating from level XXVII A, F5. There are no further *Apodemus* specimens in the collection from the same level and square. Most unfortunately, M_3 is gone. The combined length of M_{1-2} is only 3.0 mm, as opposed to 3.7-3.8 mm in eight mandibles of the larger form mentioned above.

The present form represents a species closely comparable to *Apodemus caesarinus* Bate as to size, but it might represent *A. sylvaticus* as well. The

1) Allen (1915) is not cited by Aharoni (1932, p. 183), who records only one form of *Apodemus* (*A. flavicollis pohlei* Aharoni) for Syria, and none for Palestine. However, Allen's Mount Hermon (Jebel esh Sheikh) material includes three species, *A. sylvaticus*, *A. flavicollis*, and *A. mystacinus* (see also Bate, 1945, p. 152). Neuhäuser (1936, p. 179) lists *A. flavicollis pohlei* as a synonym of *A. mystacinus mystacinus*, but according to Ellerman and Morrison-Scott (1951, p. 568) it lacks the unusually wide upper molars which are characteristic of *A. mystacinus*. *A. mystacinus* is included in the fauna of Palestine by Bodenheimer (1935, p. 97; 1937, p. 49).

structure of the first and second lower molars does not appear to be sufficiently characteristic in these forms to admit of specific determination, the development of the outer cingular tubercles being too variable.

Haas (1951, p. 225) records three forms of *Apodemus* from the Acheulean of Umm Qatafa, a representative of the *mystacinus* group, *A. cf. caesarinus*, and *A. cf. levantinus*. The mandibular left toothrow referred to the last-named species (Haas, l.c., p. 224 fig. 77h) has a length of 4.4 mm; the critical antero-external tubercle of M_3 is not evident from the figure, however.

Of the *Apodemus* mandibles from the Natufian of the Abu Usba cave, Haas (1952, p. 40) refers the smaller to the *sylvaticus* group, and the bigger to the *mystacinus* group of the genus.

***Hystrix* cf. *indica* Kerr**

Porcupines must have been rare at Ksâr'Akil, only three specimens having been found, as follows:

14.15-14.40, F5	front part of left mandibular ramus with I but without P or M,
14.40-14.80, F5	isolated M_2 sin., and
level XXVI A, E5	central portion of left ramus of the mandible with P_4 - M_3 .

Unidentified *Hystrix* remains have been recorded from various Mount Carmel levels ranging from Upper Acheulean up into the Aurignacian (Bate, 1937b, p. 185) as well as from the Upper Acheulean of Umm Qatafa (Vaufrey, 1931, p. 261; 1951, p. 199). The present fossils appear to belong to *Hystrix indica* Kerr, olim *Hystrix leucura* Sykes, which is the species at present inhabiting Syria and Palestine. As stated by Ellerman and Morrison-Scott (1951, p. 519) this species cannot be divided into subspecies in a satisfactory manner. I have compared the Ksâr'Akil fossils with three specimens of the Indian crested porcupine (Leiden Museum, cat. ost. a-c). Apart from a slight difference in tooth size (table 1) there do not appear to be structural differences between the fossil and the recent mandibles. In the fossil ramus from level XXVI A, E5, M_1 is incomplete anteriorly. The parafoesetid of P_4 is imperfectly divided into two parts: those of M_{2-3} are single. P_4 as well as M_{1-2} have a subdivided mesofossettid. The most worn element, M_1 , has the hypoflexid closed buccally, but it is still open in P_4 and in the remaining molars. The recent mandibles of *Hystrix indica* available for comparison are in less advanced stages of tooth wear, but in

view of the amount of variation with wear seen in the species *Acanthion brachyurus* (L.) (Hooijer, 1946b) no specific distinction of the fossil from the living species appears justified.

TABLE I

Measurements of the teeth of *Hystrix indica* Kerr

	Ksâr'Akil		Leiden Museum		
			cat. ost. a	cat. ost. b	cat. ost. c
P ₄ , length	10.9		8.4	9.3	9.0
width	8.2		6.7	7.2	7.4
M ₁ , length	—		8.2	7.6	8.9
width	7.0		6.3	6.4	7.0
M ₂ , length	10	10.3	8.4	8.1	10.1
width	7.7	7.9	7.3	6.7	7.8
M ₃ , length	9.6		—	—	9.0
width	7.8		—	—	7.5
I, transverse	6.5		5.5	5.5	5.8

Order CARNIVORA

Canis lupus L. subsp.

Wolves are not very common at Ksâr'Akil, but range down to almost the lowest level. The variation in size, notably in the lower carnassial, is considerable (table 2), but that in the recent form is hardly less. I have found no differences in structure between the fossil and the recent specimens. One of the lower carnassials (level XXIII, F₄) is larger than any of the recent specimens seen by me, but Mottl (1940, p. 46) records even larger specimens from the late Mousterian of the Mussolini cave (Subalyuk) in Hungary (length of M₁, 27-32 mm; width, 10.3-13.3 mm).

The wolf has not been recorded before from any Syrian cave, and of all the Palestine sites it has been obtained only from Mugharet el-Wad (Aurignacian) and from Tabûn (Upper Levallois-Mousterian) (Bate, 1937 b, p. 177). The Tabûn M₁ mentioned by Bate is as long as that from 11.50 m, F₅, of Ksâr'Akil (29.5 mm).

Canis aureus L. subsp.

The occurrence of the Asiatic jackal at Ksâr'Akil is attested only by an incomplete right lower carnassial from level I, E₇. The species has already been recorded from Mugharet ez-Zuttiyeh (Bate, 1927b, p. 37), Umm Qatafa (Vaufrey, 1931, p. 259; 1951, p. 203, pl. XX fig. 12), Tabûn, Mount Carmel (Bate, 1937b, p. 177), and the Abu Usba cave, Mount Carmel (Haas, 1952, p. 37). Our specimen might well belong to *Canis aureus syriacus*

TABLE 2
Measurements of the teeth of *Canis lupus* L.

	P ₃		P ₄		M ₁		M ₂		P ₃		P ₄		M ₁		M ₂	
	length	width	length	width	length	width	length	width	length	width	length	width	length	width	length	width
Ksar' Akil	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11.00, F5	—	—	—	—	—	—	—	—	15.0	6.6	ca. 24	13.5	14.8	19.3	—	—
11.00, F5	—	—	—	—	—	—	—	—	15.5	6.8	—	12.7	14.5	19.0	8.7	12.3
11.50, F5	13.1	—	15.8	8.5	29.5	12.1	—	—	—	—	—	—	—	—	—	—
12.65, E5	—	—	—	—	—	—	—	—	—	—	—	—	16.0	20.6	—	—
13.25, F3	—	—	15.1	8.7	25.4	10.0	—	—	—	—	—	—	—	ca. 19	—	—
VIII, F2	14.4	6.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
XVII, F3	13.7	7.1	15.3	8.0	—	—	—	—	—	—	—	—	—	—	—	—
XXIII, F4	—	—	—	—	31.8	12.6	12.6	9.2	—	—	—	—	—	—	—	—
XXVII B, F5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
XXXVI, E5	—	—	—	—	28.3	10.7	11.1	8.9	—	—	23.7	13.5	15.4	18.8	—	—
Recent, Leiden Museum																
cat. ost. b	13.0	6.5	15.2	7.6	28.9	11.8	12.0	9.0	14.6	6.6	24.8	12.7	17.4	19.9	8.7	12.6
cat. ost. c	14.5	6.8	16.3	8.5	30.0	12.3	11.6	8.8	16.7	7.3	25.2	14.0	17.5	20.3	9.0	13.2
cat. ost. d	12.0	6.0	14.1	6.5	26.4	11.0	10.8	7.5	13.7	5.7	21.8	11.5	14.6	17.3	7.7	12.0
cat. ost. e ♀	14.4	6.0	16.2	7.7	29.4	11.5	11.5	9.4	15.5	6.3	23.4	13.5	16.2	20.0	9.6	13.8
cat. ost. f	12.5	6.8	14.8	8.4	26.7	11.3	12.8	8.7	14.9	7.3	22.4	12.3	17.2	18.5	9.4	12.8
cat. ost. g ♂	11.7	6.4	13.7	7.0	28.2	11.1	10.8	8.3	13.5	6.8	22.0	12.3	15.7	19.5	8.7	12.7
cat. ost. h ♀	12.8	6.3	13.7	7.5	26.7	10.6	11.3	8.6	14.0	6.5	20.7	12.4	14.8	17.5	8.5	12.1
cat. ost. l ♀	11.8	5.2	13.2	6.4	25.0	10.0	10.0	7.8	13.6	5.3	20.7	11.9	15.3	16.8	8.8	11.6

Hemprich et Ehrenberg, first described from the coast of Lebanon between Beirut and Tripoli, and ranging over Syria and Palestine (Ellerman and Morrison-Scott, 1951, p. 221). The Ksâr'Akil tooth is incomplete anteriorly, and only the width can be given, which is 7.6 mm. In seven specimens of *Canis aureus* L. (Leiden Museum, cat. ost. a-g) the width of M₁ varies from 6.7 to 7.8 mm.

With the exception of the jackal from the Abu Usba cave (Natufian), the jackals from the Palestine sites cited above range from Upper Acheulean to Lower Levallois-Mousterian; their absence from higher levels seems to be accidental, as the jackal is living today in the same region.

***Vulpes vulpes* (L.) subsp.**

The fox is represented in the Ksâr'Akil collection mainly by parts of mandibular rami with one or more teeth in situ. In her description of the common fox from Mount Carmel, Bate (1937b, p. 182) notes that it represents a definitely smaller form than the typical northern European *V. vulpes*; hence she tentatively employed the name *Vulpes vulpes palaestina* Thomas. This subspecies, however, does not appear to be smaller-toothed than typical *Vulpes vulpes vulpes* (L.); the few dental measurements of the type, a female, given by Thomas (1920, p. 122), viz., length of P⁴ on outer surface, 12.2 mm; width of M¹, 11.4 mm; are within the variation limits of ten females of *V. v. vulpes* from the Netherlands (table 3), although the Palestine upper carnassial is rather small indeed. A lower carnassial (M₁) from Tabûn D is stated by Bate (l.c.) to be only 14 mm long, and this is the

TABLE 3
Range of variation of tooth dimensions in *Vulpes vulpes* (L.)

	<i>Vulpes vulpes vulpes</i>		<i>Vulpes vulpes</i> subsp.
	males	females	Ksâr'Akil
P ₂ , length	8.1-9.0	7.3-8.9	7.0-8.2
width	3.0-3.6	2.8-3.4	2.8-3.2
P ₃ , length	9.0-9.9	8.2-9.6	8.0-9.6
width	3.2-4.0	3.1-3.6	2.9-3.7
P ₄ , length	9.4-10.5	8.8-10.1	8.3-10.6
width	3.8-4.9	3.7-4.3	3.4-4.3
M ₁ , length	14.4-16.4	14.0-16.0	13.9-16.7
width	5.6-6.8	5.5-6.3	5.0-6.8
M ₂ , length	6.7-7.8	6.7-7.4	6.4-7.3
width	4.9-6.0	5.0-5.7	5.0-5.7
P ⁴ , length	12.5-14.3	12.1-14.0	12.0-13.0
width	5.8-8.3	6.3-7.1	6.2-6.7
M ¹ , length	8.7-10.4	8.2-10.5	9.0-9.6
width	10.4-12.6	10.0-12.7	11.0-12.1

minimum I found for this measurement in the series of ten females of *V. v. vulpes*; one Ksâr'Akil specimen (level XI, E₄) only is smaller still (13.9 mm). The variation ranges in tooth dimensions found for 8 males and for 10 females of *Vulpes vulpes vulpes* (L.), derived from table 4, is given beside that found for the Ksâr'Akil material in table 3.

The Ksâr'Akil specimens often are below the minima even of the females of *V. v. vulpes*, and hardly ever exceed the maxima of the males. It is evident that the Ksâr'Akil fox averages smaller in tooth size than the common Palearctic red fox, as does the common fox of the Wady el-Mughara caves.

TABLE 4
Measurements of the teeth of *Vulpes vulpes* (L.)

Ksâr'Akil	P ₂		P ₃		P ₄		M ₁		M ₂		P ₄		M ₁	
	length	width	length	width	length	width	length	width	length	width	length	width	length	width
3.00, E ₅	—	—	9.6	3.7	—	—	—	—	—	—	—	—	—	—
3.90, E ₅	—	—	—	—	—	—	15.1	6.0	—	—	—	—	—	—
5.10, E ₅	7.7	3.0	8.5	3.1	9.3	4.0	—	—	—	—	—	—	—	—
5.30, F ₅	—	—	—	—	8.9	3.8	15.7	5.8	—	—	—	—	—	—
5.40, F ₅	7.1	3.2	8.0	3.1	8.5	3.6	—	—	—	—	—	—	—	—
5.94, F ₅	—	—	—	—	—	—	14.6	5.5	—	—	—	—	—	—
6.83, E ₅	7.9	3.0	8.5	3.2	—	—	—	5.8	7.3	5.2	—	—	—	—
6.83, E ₅	—	—	—	—	—	—	15.8	6.7	—	—	—	—	—	—
6.83, E ₅	—	—	—	—	—	—	13.6	5.5	—	—	—	—	—	—
7.40, F ₅	—	—	—	—	8.5	3.5	13.9	5.0	—	—	—	—	—	—
7.40, F ₅	—	—	—	2.9	—	—	14.4	5.5	6.8	5.1	—	—	—	—
7.40, F ₅	—	—	—	—	—	—	14.8	5.6	—	—	—	—	—	—
7.60, E ₅	—	—	—	—	9.0	3.9	15.8	6.3	6.6	5.0	—	—	9.4	11.4
7.90, E ₅	7.0	3.0	8.0	3.1	8.3	3.5	15.3	5.7	—	—	—	—	—	—
9.20, F ₅	—	—	—	—	—	—	15.5	5.8	—	—	—	—	—	—
9.75, F ₅	8.2	3.0	9.0	3.2	—	—	—	—	—	—	—	—	—	—
12.00, F ₅	7.9	2.8	—	—	8.6	3.4	—	—	—	—	—	—	—	—
12.40, F ₅	—	—	—	—	—	—	14.9	5.5	—	—	—	—	—	—
14.65, E ₅	—	—	—	—	9.6	—	14.4	6.3	6.4	5.2	—	—	—	—
I, E ₇	—	—	—	—	—	—	—	—	—	—	12.0	6.2	—	11.0
V, F ₃	—	—	—	—	—	—	—	5.9	—	—	—	—	—	—
VI, E ₄	—	—	—	—	—	—	—	—	—	—	—	—	9.0	12.1
VII, F ₂	—	—	—	—	—	—	15.4	5.8	—	—	—	—	—	—
VIII, E ₄	—	—	—	—	—	—	14.5	5.5	7.3	5.7	—	—	—	—
IX, 7.25	—	—	—	—	—	—	16.3	6.0	—	—	13.0	6.7	—	—
IX, 7.25	—	—	—	—	—	—	15.6	5.9	—	—	—	—	—	—
IX, 8.10	—	—	—	—	—	—	—	—	—	—	—	6.4	—	11.5
IX, 7.75	—	—	—	3.7	10.6	4.3	16.7	6.8	—	—	—	—	—	—
XI, E ₄	—	—	—	—	—	—	13.9	5.5	7.1	5.6	—	—	—	—
XVII, E ₄	—	—	—	—	—	—	—	—	—	—	—	6.4	9.6	11.3
XXII, F ₄	—	—	—	—	—	—	15.3	5.8	7.0	5.5	—	—	—	—
XXVIII, E ₄	—	—	9.3	3.2	—	—	15.6	6.1	—	—	—	—	—	—

Recent, Leiden Mus. reg. no.	P ₂		P ₃		P ₄		M ₁		M ₂		P ₄		M ₁	
	length	width	length	width	length	width	length	width	length	width	length	width	length	width
804 ♂	8.2	3.6	9.0	4.0	9.8	4.9	16.0	6.7	7.8	6.0	14.3	7.8	9.9	12.4
932 ♂	8.4	3.5	9.3	3.6	10.0	4.4	15.3	6.4	7.5	5.5	13.8	7.2	9.8	12.0
1016 ♂	8.4	3.5	9.3	3.7	9.9	4.7	15.4	6.8	7.3	5.1	13.4	7.6	10.0	12.6
1019 ♂	9.0	3.5	9.9	3.8	10.5	4.9	15.6	6.1	7.7	5.4	14.2	7.5	10.4	12.1
1032 ♂	8.2	3.1	9.4	3.4	10.0	4.3	15.8	6.0	6.7	5.5	14.1	7.0	9.6	12.5
1049 ♂	8.9	3.6	9.4	3.7	10.4	4.8	16.4	6.4	7.3	5.5	14.0	8.3	9.6	12.4
6732 ♂	8.5	3.1	9.2	3.2	9.4	3.8	16.3	6.0	7.2	5.7	14.0	7.2	9.9	11.5
11770 ♂	8.1	3.0	9.0	3.2	9.4	4.0	14.4	5.6	6.9	4.9	12.5	5.8	8.7	10.4
842 ♀	8.2	3.3	8.9	3.4	9.7	4.1	15.7	5.8	7.4	5.7	13.6	6.9	9.5	12.1
850 ♀	8.4	3.1	9.3	3.6	9.6	4.0	15.4	6.0	7.0	5.5	13.4	7.0	9.6	11.4
877 ♀	8.1	3.0	9.0	3.3	9.6	4.1	16.0	6.3	7.4	5.7	14.0	6.5	9.8	12.4
1057 ♀	7.8	3.4	9.0	3.5	9.6	4.3	14.8	6.1	6.8	5.0	13.0	7.1	9.2	11.3
1255 ♀	8.9	3.4	9.6	3.5	10.1	4.2	15.9	6.3	7.1	5.7	14.0	6.8	10.5	12.7
1582 ♀	7.3	2.8	8.2	3.1	8.8	4.0	14.9	5.5	7.2	5.0	12.8	6.3	9.9	11.3
4201 ♀	7.5	3.2	8.4	3.2	9.4	4.3	14.0	6.2	6.7	5.4	12.1	7.0	9.4	11.4
4203 ♀	8.1	3.0	8.4	3.2	8.8	3.7	14.2	5.5	7.0	5.5	12.2	6.3	8.2	10.0
6691 ♀	8.0	3.0	8.4	3.4	9.0	3.9	14.5	6.3	7.0	5.0	13.2	7.1	8.7	11.0
11645 ♀	7.8	3.1	8.7	3.2	9.1	4.0	15.0	5.7	6.9	5.3	13.0	6.8	9.8	11.4

***Ursus arctos* L. subsp.**

In 1922 Professor A. E. Day secured remains both of large and of small bears from the rock shelter of Ksâr'Akil, at a depth of eleven meters; *U. syriacus* was represented by an imperfect right mandibular ramus, and *U. arctos* by two canines, one in a fragment of the premaxilla (Bate, 1927b, p. 38). Originally it was thought that the two canines probably belonged to the cave bear (Day, 1926, p. 95). Previous to this fossil bear remains had been recorded from a cave on the Nahr el-Kelb, the Antelias cave, and from various other cave sites in the Lebanon (Weber, 1875; Fraas, 1878, p. 374; Fritsch, 1893, p. 31). All of these finds represent a small variety of the brown bear, apparently identical with the living brown bear of the region (*Ursus arctos syriacus* Hemprich et Ehrenberg). The length of the mandible from front to condyle (19 cm), and the height of the ramus at P₄ (44 mm) (Fraas, l.c., p. 375) agree with those of small recent female specimens of *U. arctos* (Leiden Museum, reg. nos. 3119 and 4876).

Remains from Mugharet ez-Zuttiyeh were described by Miss Bate in 1927; these indicate individuals of large size. The lower layers of the Zuttiyeh cave from which these specimens came correspond with level Ed of Tabün (Bate, 1937b, p. 184), Lower Micoquian, older than any of the deposits in the Ksâr'Akil sequence. The large size of the Zuttiyeh specimens is indicated by two last upper molars (M²) that measure 39.5 by 21 mm, and

44 by 23 mm respectively (Bate, 1927b, p. 37); this is just about the record for M^2 size in the living *Ursus arctos* (43 by 21.7 mm; Degerbøl, 1933, p. 516). Brown bear remains from Umm Qatafa (Vaufrey, 1931, p. 260; 1951, p. 203) are not especially large. According to Bate (1937b, p. 183) both a large and a small form of *Ursus arctos* seem to be represented in the Mount Carmel caves; the large one from levels D and E of Mugharet el-Wad (Aurignacian), and the small one from levels D and C of Tabūn (Lower Levalloiso-Mousterian) as well as from levels E and B of M. Wad. Consequently, the small *U. arctos* occurs both below and above the large form in the Mount Carmel sequence. Measurements of M^{1-2} of the small form given by Bate (l.c., p. 184), viz., M^1 , 19.5 by 14 mm, M^2 , 28.5 by 15 mm, are within the variation range of recent *U. arctos* (see table 5), although none of the Ksâr'Akil upper molars are as small as these. None of the Ksâr'Akil teeth of *U. arctos* are as large as those recorded by Miss Bate from the lower layers of Mugharet ez-Zuttiyeh either; they keep well within the limits found for thirteen recent specimens (table 5), except for the last lower molar (M_3), not less than six out of ten Ksâr'Akil specimens of which exceed the maximum found for the recent specimens. The Ksâr'Akil form of *Ursus arctos* appears to have had less reduced last lower molars than the living, a difference of a kind to be expected in the comparison of a fossil with a living form.

Notwithstanding its larger average size of M_3 , the Ksâr'Akil bear is undoubtedly conspecific with the living brown bear; the cave bear is decidedly larger¹⁾ (cf., e.g., Heller, 1939, tables II-V). Moreover, the left maxillary from level XXVII B, E4, figured on pl. II fig. 3 has the alveoli of at least two premolars between the canine and P^4 ; the anterior three premolars do not normally occur in the adult cave bear. Pocock (1932b, p. 791) gives dental measurements of Syrian specimens one of which has unusually small teeth; on the whole, however, the bears of Asia Minor and Syria do not

1) The cave bear, *Ursus spelaeus* Rosenmüller et Heinroth, has recently been found for the first time in a prehistoric site in the Near East. Among a collection from Abri Zumoffen, Adlun, Lebanon, sent to me by Miss D. A. E. Garrod, there are a few incisors unquestionably representing the cave bear, which is known from Late Pleistocene deposits over an area reaching from Britain to the Black Sea, and southward into Italy, Spain, and North Africa (Boule, 1919, p. 252, fig. 39). There are a fairly complete I^3 dext. and part of an I^1 from the Jabrudian (= early Last Glacial) level of Adlun, and fragments of an I^3 sin. and of an (?) I^1 from the pre-Aurignacian (now called Amudian) level, which is considered late Last Interglacial by Miss Garrod. The fauna associated with *Ursus spelaeus* at the Abri Zumoffen consists of *Equus* cf. *hydruntinus* Regalia, *Rhinoceros* spec., probably *merckii* (Jäger), *Sus* spec., *Dama mesopotamica* (Brooke) (fairly abundant), *Bos* spec., *Gazella* spec., and *Capra* spec. (Garrod, 1961).

Recent, Leiden Mus.	P ₄		M ₁		M ₂		M ₃		P ⁴		M ¹		M ²	
	length	width	length	width	length	width	length	width	length	width	length	width	length	width
cat. ost. a	11.7	6.3	21.2	10.4	22.7	12.6	17.7	14.0	14.0	10.5	19.5	14.8	31.4	16.0
cat. ost. b	12.8	7.1	22.2	10.3	22.8	13.6	16.8	14.0	15.5	10.7	20.7	15.8	32.2	17.0
cat. ost. d	11.3	6.5	22.0	10.5	23.2	14.2	17.9	14.3	12.9	9.6	19.4	15.1	34.5	16.7
cat. ost. e	11.7	6.4	23.2	11.0	23.1	13.4	—	—	15.3	10.8	22.0	16.0	31.6	16.0
cat. ost. f	12.3	6.4	23.0	10.8	23.2	14.5	—	—	—	—	22.3	16.4	34.2	17.5
cat. ost. h	12.7	7.4	23.0	11.5	24.0	14.2	18.6	13.9	15.6	12.2	21.9	16.1	34.5	17.3
reg. no. 3119	—	—	—	—	19.3	12.7	16.0	12.0	—	—	18.4	14.8	29.5	14.8
reg. no. 4120	14.4	7.7	25.7	12.8	25.0	15.7	—	—	18.3	12.9	23.0	19.5	36.8	18.7
reg. no. 4127	—	—	—	—	23.2	15.5	17.7	13.4	15.7	11.9	22.4	16.3	34.5	17.6
reg. no. 4875	—	6.8	22.8	10.7	—	—	—	—	—	—	21.3	15.0	33.6	17.5
reg. no. 4876	—	—	—	—	21.0	—	16.3	12.5	—	10.9	20.0	14.6	29.0	16.7
reg. no. 9735	12.0	7.0	—	10.9	20.8	—	19.7	13.4	14.7	11.5	20.0	14.9	32.4	16.0
reg. no. 4877	—	—	19.5	9.0	18.9	11.4	16.1	11.6	12.3	10.0	16.8	12.9	27.7	14.8

Martes cf. martes (L.)

A marten is represented by various mandibular rami which range from 5.60 m to 9.30 m in squares E5 and F5, and from level VII down to XVII. Never plentiful, these specimens are inadequate to a specific determination. Both *Martes martes* (L.) and *Martes foina* (Erxleben) may be expected (Aharoni, 1930, p. 335; Ellerman and Morrison-Scott, 1951, pp. 245 and 246). Bate (1937b, p. 183) notes that the fossil remains from M. Wad, Mount Carmel, appear to resemble *M. martes latinorum* (Barrett-Hamilton) of the Mediterranean region, but abstains from a species determination. A left mandibular ramus from the Antelias cave near the Dog river, first recorded by Fritsch (1893, p. 38) as *Mustela cf. martes* L., according to Nehring (1902a) deserves a new specific name, *Mustela palaesyriaca*; the length of its M₁ (10.5 mm) is within the variation limits of the Ksâr'Akil M₁'s (table 6).

The recent specimens, in particular the females of *M. martes*, and *M. foina*, have teeth that are smaller than most of the Ksâr'Akil specimens. The Ksâr'Akil mandibles do not enable us to distinguish between the two species, their distinction being based upon the characters of skin, skull, and upper teeth (Rode and Didier, 1944).

Meles meles (L.) subsp.

There is not much of the badger in the Ksâr'Akil collection: one incomplete left ramus of the mandible with part of M₁ (level VIII, E4), and a small ramus fragment holding an incomplete M₁, and M₂ (level XX, F4).

TABLE 6
Measurements of the teeth of *Martes* spec.

	P ₃		P ₄		M ₁	
	length	width	length	width	length	width
Ksâr'Akil						
5.94, F5	—	—	—	—	10.2	4.1
5.94, F5	—	—	6.1	3.1	10.2	4.3
7.40, F5	5.4	3.0	6.2	3.4	10.8	4.5
7.40, E5	—	—	—	—	10.4	4.9
9.30, E5	—	—	—	3.1	11.0	4.5
VII, F2	—	—	6.4	3.5	—	—
VII, F2	—	—	6.2	3.1	10.1	4.3
VIII, E4	—	—	5.4	2.8	9.3	4.0
VIII, 6.75	5.4	2.8	6.5	3.3	11.2	4.7
IX, 7.39	—	—	—	—	10.0	4.4
IX, 8.10	5.3	2.8	6.4	—	9.8	4.4
IX, 8.10	—	—	—	—	10.2	4.5
XVII, F4	—	—	5.7	3.2	—	—
Recent, Leiden Museum						
<i>Martes martes</i>						
cat. ost. a (♂)	5.3	3.0	5.8	3.5	10.0	4.5
cat. ost. b (♂)	5.2	2.7	6.0	3.4	10.5	4.2
reg. no. 4744 (♂)	5.4	2.7	6.1	3.3	10.2	4.4
reg. no. 4745 (♀)	4.9	2.5	5.3	2.7	9.3	3.6
reg. no. 4746 (♀)	5.3	2.7	5.8	3.0	9.4	4.0
reg. no. 4747 (♀)	5.0	2.5	5.8	3.4	9.3	3.7
reg. no. 4748 (♀)	4.7	2.5	5.2	2.8	8.6	3.7
<i>Martes foina</i>						
cat. ost. a	4.9	2.8	6.0	3.0	10.0	4.3
cat. ost. b	4.9	2.6	5.9	2.8	9.7	3.7
cat. ost. c	5.0	2.5	5.8	3.0	9.8	4.2
cat. ost. d	4.6	2.5	5.5	2.8	9.7	3.8
cat. ost. e	4.7	2.4	5.4	3.0	9.6	4.0
reg. no. 4750	5.0	2.5	5.4	2.9	9.8	4.1

The widths of these M₁s, 7.2 mm and 7.0 mm, respectively, fall within normal limits, and so do the height and the width of the ramus behind M₁, which are 14.7 mm and 7.3 mm, respectively (cf. Miller, 1912b, p. 353; Kormos, 1914, p. 244; Degerbøl, 1933, pp. 561-564).

The badger has already been recorded from Mugharet el-Wad (Bate, 1937b, p. 182), from the Shukbah Cave (Bate, 1942b, p. 17), and from M. Abu Usba, Mount Carmel (Haas, 1952, p. 37), but never in large numbers. As Bate (1937b, p. 182) notes, this is an Eurasiatic animal that appears not to have reached more southerly regions.

Crocuta crocuta (Erxleben) subsp.

It is the spotted hyaena, *Crocuta crocuta* (Erxleben), nowadays confined

to Africa, south of the Sahara, that left its remains in the rock shelter of Ksâr'Akil. There are as yet no indubitable records of Pleistocene *Hyaena hyaena* (L.) from Syria or Palestine, while this animal lives there at present (cf. Bate, 1927b, p. 28; 1937b, p. 173).

The first evidence of the occurrence of *Crocota crocuta* in the Pleistocene of Syria or Palestine was obtained at Mugharet ez-Zuttiyeh (Bate, 1927b, pp. 38-40, figs. 7-8); afterwards it has been recorded also from Umm Qatafa (Vaufrey, 1931, p. 260), from the Shukbah Cave (Bate, 1942b, p. 17), from Erq el-Ahmar (Vaufrey, 1951, p. 212), and from M. Abu Usba, Mount Carmel (Haas, 1952, p. 37). At Ksâr'Akil the remains, mostly jaw fragments with teeth, and isolated teeth, range from level XIX down to XXXIII, most of the material coming from level XXVII A and B. As is evident from the inspection of table 7 most of the Ksâr'Akil teeth are above the variation limits of the recent available to me, as is also the case with Pleistocene remains of *Crocota crocuta* from Europe and Asia (cf. Hooijer, 1952). The measurements or remarks given by Bate and by Vaufrey indicate that at their sites the spotted hyaena was either similar in size to the living, or slightly larger. The proximal end of a tibia obtained from Umm Qatafa by Vaufrey (1931, p. 260) is stated to be as large as that of the French cave hyaena (*C. crocuta spelaea* (Goldfuss)), and Haas (1952, p. 37) also

TABLE 7
Measurements of the teeth of *Crocota crocuta* (Erxleben)

	P ₂		P ₃		P ₄		M ₁		P ²		P ³		P ⁴	
Ksâr'Akil	length	width	length	width	length	width	length	width	length	width	length	width	length	width
14.40, F ₅	—	—	—	—	—	—	—	—	—	—	—	17.0	—	21.7
XXVI A F ₄	16.8	12.9	—	—	—	—	—	—	—	—	—	16.9	—	—
XXVII B E ₄	—	—	—	—	—	—	30.3	13.5	—	—	—	—	—	—
XXVII B E ₅	—	11.0	22.5	15.0	—	—	—	—	—	—	—	—	—	—
XXVII B E ₅	16.8	12.5	22.3	15.9	—	—	—	—	—	—	—	—	—	—
XXVII B F ₄	—	—	—	—	—	—	—	—	—	—	—	—	39.7	23.3
XXVIII A F ₄	—	—	—	—	—	—	—	—	—	—	22.6	16.7	38.0	20.0
XXX, F ₅	—	11.4	—	16.5	—	—	—	—	—	13.1	—	—	—	—
XXX, E ₅	—	—	24.3	16.6	—	—	—	—	16.3	10.7	—	—	—	—
XXXI, E ₅	—	—	—	—	—	—	29.4	13.4	—	—	—	—	—	—
Recent, Leiden Museum.														
cat. ost. a	—	—	—	—	22.4	—	28.4	12.5	14.8	12.0	20.8	16.9	34.7	19.8
cat. ost. b	17.6	11.7	21.8	15.5	22.4	13.9	28.0	12.0	17.8	12.8	23.6	17.7	39.0	20.0
cat. ost. c	16.3	11.2	21.0	15.0	22.5	14.0	29.6	11.9	17.2	12.6	22.5	17.4	35.8	20.4
cat. ost. e	15.2	9.8	20.8	14.4	21.5	12.3	26.4	12.0	14.8	10.3	22.3	15.8	36.3	19.4
cat. ost. f	15.3	10.8	21.6	15.3	22.5	14.0	29.4	12.0	15.2	11.7	22.2	17.6	37.8	20.5
reg. no. 1953	13.4	8.9	20.7	14.6	22.4	12.1	26.9	11.3	14.3	10.4	21.2	15.5	35.8	19.1

remarks upon the large size of the bones of the extremities, the proximal end of a second metatarsal being almost double the size of that of *Hyaena hyaena*.

Felis silvestris Schreber subsp.

Remains of the European wild cat occur sparsely throughout the Ksâr'Akil deposits from 3.50 m down to 13.85 m in squares E5 and F5, and from level V to and including XVII. Apart from some fragments of limb and foot bones the collection contains chiefly mandibular rami with one or more teeth in situ; there also are a few maxillae with teeth. The measurements recorded in table 8 show that the Ksâr'Akil wild cat averages larger than the living form; this was also the experience of Degerbøl (1933), who studied European fossil wild cats.

TABLE 8
Measurements of the teeth of *Felis silvestris* Schreber

	P ₃		P ₄		M ₁	
	length	width	length	width	length	width
Ksâr'Akil						
6.83, E5	—	—	—	—	9.2	4.5
7.40, F5	6.8	3.5	—	—	—	—
7.90, E5	—	—	8.6	4.2	9.7	4.6
8.40, F5	—	—	8.2	3.8	—	4.3
11.00, E5	5.5	3.0	7.1	3.5	—	—
12.40, F3	—	—	8.0	3.8	10.2	4.6
13.85, F5	—	—	8.0	3.9	—	4.4
V, G3	6.7	3.0	7.8	3.6	9.6	4.2
VI, E4	—	—	—	—	8.8	4.0
VI, E4	—	—	7.5	3.4	9.0	4.0
VII, G2	5.9	2.9	7.8	4.0	9.2	3.9
VII, G2	—	—	—	—	—	4.1
VII, F2	6.0	2.7	7.4	3.2	—	—
VII, D5	7.1	3.4	8.4	3.7	9.7	3.8
VIII, E4	6.2	2.8	8.2	3.4	9.6	3.9
VIII, 6.74	6.3	3.0	7.6	3.4	—	—
VIII, 6.74	7.0	3.5	9.2	3.8	9.3	4.3
IX, 7.75	6.4	3.0	—	3.7	9.8	4.2
IX, 7.75	6.3	3.0	7.6	3.7	—	—
IX, 8.10	—	—	8.5	3.9	10.0	4.3
IX, D5	—	—	—	—	2.9	4.1
Recent, Leiden Museum						
cat. ost. a	—	—	—	—	7.3	3.5
cat. ost. c	6.0	2.8	7.4	3.3	8.4	3.8
cat. ost. d	4.8	2.8	7.3	3.0	8.3	3.5
reg. no. 383	6.7	3.3	7.7	3.7	9.0	4.0
reg. no. 1577	6.0	2.7	7.6	3.4	8.6	3.7

	P ₃		P ₄	
	length	width	length	width
Ksâr' Akil				
5.60, E5	—	—	12.0	5.9
5.60, F5	7.3	3.7	—	—
VIII, 674	7.9	3.8	12.2	5.6
Recent, Leiden Museum				
cat. ost. a	7.3	3.5	11.2	5.6
cat. ost. c	6.9	3.7	11.6	5.8
cat. ost. d	6.8	3.4	10.7	5.2
reg. no. 383	8.0	4.5	11.8	6.0
reg. no. 1577	7.6	3.6	11.3	5.7

The ranges of variation and the means for the length of the lower teeth of *Felis silvestris* from Ksâr' Akil, from Europe (Degerbøl, 1933, pp. 408-411), and of the living form (L.M.) will be found in table 9. Also included in this table are the observations by Helbing (1935) on a particularly powerful mandible of *Felis silvestris* from the Magdalenian of the Freudenthal

TABLE 9

Felis silvestris Schreber subsp.

	Ksâr' Akil		Europe		Helbing,	recent
	range	mean	range	mean	1935	
P ₃ , length	5.5-7.1	6.4	5.4-6.8	6.2	7.4	4.8-6.7
P ₄ , length	7.1-9.2	8.0	6.8-8.5	7.5	8.7	7.3-7.7
M ₁ , length	8.8-10.2	9.5	7.5-10.0	8.9	10.2	7.3-9.0

cave near Schaffhausen, Switzerland; its teeth are above the variation limits of the living European wild cat. One of the mandibles from level VIII, 6.74 m, even exceeds Helbing's specimen in the length of its P₄; another (12.40 m, F3) equals the latter in the length of M₁. The Lebanon material of *Felis silvestris* averages larger than that from various Pleistocene localities in Europe assembled by Degerbøl (1933, pp. 408-411).

One of the Ksâr' Akil mandibles (level VII, F2) has a small extra pre-molar (P₂) between the C and P₃; this anomaly was noticed only twice among 67 recent specimens of *Felis silvestris* (Colyer, 1936, p. 68).

According to Ellerman and Morrison-Scott (1951, p. 303) *Felis silvestris* does not occur today either in Syria or in Palestine. There are Pleistocene and Natufian records from Mugharet ez-Zuttiyeh (Bate, 1927b, p. 40), from Umm Qatafa (Vaufrey, 1931, p. 260; 1951, p. 203), from the Wady el-Mughara caves (Bate, 1937b, p. 184), from the Shukbah cave (Bate, 1942b, p. 17), and from the Abu Usba cave (Haas, 1952, p. 37).

Felis chaus Schreber 1) subsp.

Three specimens only: a maxilla sin. with P³, a P⁴ dext., and a mandibular ramus dext. with M₁ (table 10). The jungle cat has already been recorded from the Mugharet ez-Zuttiyeh (Bate, 1927b, p. 29) but it was not specifically identified from the material of the Wady el-Mughara caves (Bate, 1937b,

TABLE 10
Measurements of the teeth of *Felis chaus* Schreber

	P ³		P ⁴		M ₁	
	length	width	length	width	length	width
Ksâr' Akil						
11.00 F5	10.0	4.9	—	—	—	—
11.60, E5	—	—	15.5	8.5	11.7	4.9
Recent, Leiden Museum						
cat. ost. b	10.3	4.5	15.7	7.2	11.4	4.6
cat. ost. c	9.4	4.9	15.5	9.0	10.5	4.8
cat. ost. d	8.6	4.5	13.6	6.2	10.0	4.4

p. 184). Our specimens from Ksâr' Akil are within the size limits of recent specimens except for the M₁ which is slightly larger than its homologue in the skulls used for comparison.

Felis chaus is known in the recent state from Syria and Palestine (Ellerman and Morrison-Scott, 1951, p. 306). The specimen from the Antelias cave near the Dog river recorded as *Felis chaus* by Fritsch (1893, p. 38), however, belongs to the sacred cat of the ancient Egyptians, *Felis lybica bubastis* Hemprich et Ehrenberg (Nehring, 1902b, p. 148). Material from Abu Halka (Tripoli) is recorded as "*Felis* sp. Plus grande que *sylvestris*, peut-être *Felis pardium* ou *Catolynx chaos* Güld." (Haller, 1946, p. 8).

Felis pardus L. subsp.

The leopard, of which there are a small number of jaw fragments with teeth, isolated teeth, and a left astragalus in the Ksâr' Akil collection, is remarkable for its size. In fact, the single upper carnassial (in a fragment of a right maxillary from level XXII, F4) is as large as the largest P⁴ of a recent panther known to me, viz., a specimen from Kumaun Hills, India, recorded by Pocock (1939, p. 236) under the name *Panthera pardus per-nigra* (Hodgson). The teeth of this male skull are stated to be unusually large (Pocock, l.c., p. 232). Neither among the panthers of Asia (Pocock, 1930) nor the leopards of Africa (Pocock, 1932a) there are specimens with

1) Not *Güldenstädt*; see Allen (1920).

upper carnassials longer than 28 mm (this maximum is shown in male skulls from Kashmir and United Provinces (Pocock, 1930, p. 314), from W. of Peking (l.c., p. 322), Morocco (Pocock, 1932a, p. 545), Upper Welle river (l.c., p. 567), and from Diwai, Okavango river (l.c., p. 587); in an earlier paper, Pocock (1909, p. 208) records a male skull from Cete Cama, Gaboon, and one from the French Congo with P⁴ lengths of 1 1/8 in., 28.6 mm). The Ksâr'Akil specimen of P⁴, as well as that in the Kumaun Hills skull of Pocock, have lengths of 29 mm, however. Although this observation falls between the variation limits of P⁴ in female lions (*Felis leo*, Leiden Museum, cat. ost. d, ♀, has a P⁴ length of 28.7 mm only) it is evident that the Ksâr'Akil maxillary does not belong to the lion: the fossil P⁴ has a well-developed protocone, and the distance from the alveolus of P³ to that of the C is very short (7 mm) as in panther skulls in contradistinction to lion skulls in which the protocone of P⁴ is weaker developed and the diastema C-P³ is longer (cf. Haltenorth, 1936, fig. 121 (panther) and fig. 3 (lion)). In the fossil maxillary the small anterior premolar (P²) is missing, as often happens in *Felis pardus* (Haltenorth, 1936, p. 63).

The leopard has already been recorded from Ksâr'Akil (an upper carnassial obtained by Day; Bate, 1927b, p. 40), Mugharet ez-Zuttiyeh (Bate, l.c.), Umm Qatafa and Erq el-Ahmar (Vaufrey, 1931, p. 261; 1951, p. 212), Tabūn, and M. Wad (Bate, 1937b, p. 184/85), and the Shukbah cave (Bate, 1942b, p. 18). The length of the astragalus from Erq el-Ahmar (Vaufrey, 1951, p. 212, pl. XIX fig. 5) is given as 40 mm; our specimen from level XVII, E4, of Ksâr'Akil is 39 mm long. Bate (1937b, p. 185) states that most of the Mount Carmel remains are those of animals equalling in size the largest recent examples available for comparison.

Even larger specimens have been reported from the Pleistocene of China as *Felis* cf. *pardus*; these fossils originate from locality 1 of Choukoutien (Pei, 1934, p. 137), locality 12 of Choukoutien (Teilhard de Chardin, 1938, p. 13), the Upper Cave of Choukoutien (Pei, 1940, p. 33) and from locality 13 of Choukoutien (Teilhard de Chardin and Pei, 1941, p. 42); the data on the teeth have been entered in table 11. With the dimensions of the fossils, Pei (1934, p. 137) and Teilhard de Chardin and Pei (1941, p. 42) also give the measurements of a recent leopard (locality not stated) which likewise considerably exceed those of the recent leopards available to me, and those recorded by Pocock in his comprehensive studies on the African and Asiatic races of *Felis pardus* (Pocock, 1930, 1932a, see above). It would be of great interest to establish the provenance of this skull, as it appears to be fully within the variation limits of small tigers like those of Java and Sumatra, and even Southern China (cf. table 3, p. 6, in Hooijer, 1947). I strongly

suspect the recent specimen used by Pei and Teilhard de Chardin to have belonged to a tiger instead of to a leopard or panther, a point to be decided upon the recovery of the specimen. I have provisionally added the data on this specimen in table 11.

In European Pleistocene deposits the panther is represented by comparatively large specimens too, as shown by finds from England (Bleadon cave, Dawkins and Sanford, 1866-72, p. 178, pl. XXIV fig. 2), France (Grimaldi caves, Boule, 1919, p. 266, pl. XXXI figs. 9-11), and Germany (Mauer and Mosbach, Rüger, 1928, p. 26). These measurements will also be found in table 11.

TABLE 11
Measurements of the teeth of *Felis pardus* L.

	P ₃		P ₄		M ₁		P ₃		P ₄	
	length	width	length	width	length	width	length	width	length	width
Ksâr' Akil										
5.80, F5	—	—	17.8	8.4	18.5	8.6	—	—	—	—
11.50, F5	—	—	—	—	—	—	15.4	8.0	—	—
11.60, E5	—	—	19.8	10.4	—	—	—	—	—	—
13.30, F5	—	—	—	—	—	—	—	8.4	—	—
XXII, F4	—	—	—	—	—	—	20.5	10.7	29.0	15.2
XXIII, F4	—	—	20.6	9.8	—	—	—	—	—	—
Europe										
Bleadon cave	—	—	—	—	20.5	10.5	—	—	—	—
Grimaldi cave	14	—	20	—	21.5	—	18	—	25	—
Mosbach	—	—	—	—	21.8	11.4	—	—	—	—
Mauer	13.2	6.9	17.5	9.2	18.3	8.4	—	—	—	—
Choukoutien										
loc. 1	16.3	9.0	23.2	12.0	24.0	12.2	20.0	11.2	30.0	15.5
loc. 1	—	—	21.5	11.1	22.0	10.7	—	—	—	—
loc. 12	18.5	10	22.5	10.5	—	—	—	—	—	—
Upper Cave	—	—	—	—	22.6	11.8	—	—	31.9	16.2
Upper Cave	—	—	—	—	22.9	11.2	—	—	32.1	16.5
loc. 13	16	7.5	21	10	21	10	20.5	10	28	16
Recent										
" <i>F. pardus</i> ," Pei,										
1934 (? <i>tigris</i>)	14.6	8.2	21.4	11.3	23.0	12.1	21.6	11.2	32.1	15.2
Leiden Museum										
cat. j (Angola)	12.6	5.4	18.1	7.8	18.6	8.6	16.5	8.3	25.2	12.7
reg. 645 (Senegambia)	11.4	5.0	15.7	7.1	16.5	7.8	14.9	6.7	22.5	10.7

Order PERISSODACTYLA

Equus caballus L. subsp.

A fragment of the left ramus of the mandible with P₂₋₃, found at 11.50-12.00 m, F5, belongs to a rather large horse. P₂ measures 36 by 19 mm,

P₃ 30.5 by 20.5 mm. That this specimen represents a true horse is evident from the metaconid-metastylid which is U-shaped internally (pl. I, fig. 1) instead of V-shaped as in zebras and asses (cf. Hopwood, 1936, p. 898; McGrew, 1944, p. 60/61). There also are two isolated upper incisors, a left I¹ from level VIII, 6.74 m, F₃, G₄, and a right I³ from level IX, 7.24 m, E₄, the specific identity of which is less certain although they appear to belong to individuals of much the same size as the lower premolars.

Bate (1937b, p. 218 and p. 220) records both large and small horses from the Mount Carmel caves. The large form, identified as *Equus caballus* L., is very rare; although it has a caballine fold (cf. Bate, l.c., fig. 8 i) its specific identity with *Equus caballus* seems somewhat doubtful since the more characteristic lower P or M have not been described. The Ksâr'Akil true horse must have been scarce, for the above mentioned specimens are the only equine remains in the present collection.

Dicerorhinus merckii (Jäger) 1)

The rhinoceros remains at Ksâr'Akil are confined to levels XXVI A down to XXIX A, inclusive; none were found above or below this section. The material is very uniform, and it can unhesitatingly be referred to Merck's rhinoceros, *Dicerorhinus merckii* (Jäger). The rhinoceros from Mugharet el-Emireh (Bate, 1927a, pp. 12-13), and from Tabūn and Skhūl (Bate, 1937b, p. 221, fig. 8 j-m) has been referred to *Rh. cf. hemitoechus* Falconer, but specimens figured under this name are *Rh. merckii* (cf. Schroeder, 1903, p. 105; Bernsen, 1927, p. 25; Schroeder, 1930, p. 7; Arambourg, 1958, p. 185). The rhinoceros from Umm Qatafa is recorded by Vaufrey (1931, p. 254; 1951, p. 199) as *Rh. merckii*.

Both young and adult individuals are represented; the measurements are recorded in table 12. These measurements are taken at the base of the crown; the anteroposterior diameter at the base of the ectoloph in all upper molars and premolars except for M³ in which it is taken lingually.

Even the smallest milk molar, DM¹, is represented in the Ksâr'Akil collection; its outer surface is broken off, and the metaloph is a continuous crest with a small crochet; there is no crista. One of the specimens of DM² (pl. I fig. 4) is anomalous in having a deep transverse cleft in its ectoloph just in front of the mesostyle; this is a variation worth while recording since to my knowledge it is not yet known in the milk teeth of rhinoceroses. There are both a crochet and a crista, which form a medifossette, and there is further a weak projection from the protoloph into the medisinus which joins the crochet,

1) Usually referred to as *Rhinoceros mercki*.

thus cutting off the buccal extremity of the medisinus in front of the medi-fossette. The last-named projection does not show in DM² of *D. merckii* as figured by Falconer (1868 II, pl. 25 figs. 2 and 3, as *Rh. hemitoechus*) and Schroeder (1903, pl. IX fig. 1b), but it develops sometimes in *Rh. sondaicus* and *D. sumatrensis* (Hooijer, 1946a, p. 31, pl. IV fig. 7). In DM³ there is also a weak crista. The lingual extremity of the protoloph is pinched in anteriorly and posteriorly by vertical grooves, and there is a similar vertical groove lingually on the anterior surface of the metaloph; this is characteristic of *D. merckii* (Falconer, 1868 II, pl. 25 figs. 2 and 4; Schroeder, 1903, pl. IX fig. 1b).

The upper premolars and molars are, above all, characterized by the great amount of cement on the crown, and by the absence of a cingulum on the lingual surface. The crochet is duplicated in the premolars, and single in the molars. There is no true crista. The molars are characterized further by the steepness of the anterior cingulum, the presence of a protocone fold (Hooijer, 1946a, p. 11), the V-shaped entrance to the medisinus, and by the marked convexity of the outer surface of the M³, all characters that point to *D. merckii* (Falconer, 1868 II, pl. 16; Schroeder, 1903; Boule, 1910, p. 168; Bernsen, 1927, p. 47; Arambourg, 1958, p. 186). A left P³ and M¹⁻³ in association, and an isolated left M³ are figured on pl. I figs. 3-6; they show the distinctive characters quite clearly.

Lower teeth are less well preserved in the collection than the upper; the cement and the slight development of anterior and posterior cingula have to be noted. These are, again, *merckii* characters.

TABLE 12

Measurements of the upper teeth of *Dicerorhinus merckii* (Jäger)

		XXVII B, F4		
DM ¹ , ant. post.		ca. 24		
		XXVII B,	XXVIII B,	
		F5	F5	
DM ² , ant. post.		ca. 31	ca. 29	
	ant. transv.	33	—	
	post. transv.	36	—	
		XXVII B,	XXVII B,	XXVII B,
		E5	F4	F5
DM ³ , ant. post.		ca. 38	ca. 35	ca. 37
	ant. transv.	—	40	42
	post. transv.	—	42	41

	XXVIII B,					
	F ₅					
P ² , ant. post.	ca. 30					
ant. transv.	33					
post. transv.	35					
	XXVI B,	XXVII B,	XXVII B,	XXVII B,		
	E ₅	E ₄	E ₅	F ₄		
P ³ , ant. post.	ca. 36	ca. 37	ca. 36	ca. 35		
ant. transv.	49	—	52	51		
post. transv.	ca. 48	—	49	48		
					(M ¹⁻³)	
	XXVII B	XXVII B	XXVIII A	XXVIII B	XXVIII B	XXVIII
	F ₄	F ₄	E ₅	F ₄	F ₄	E ₄
M ¹ , ant. post.	ca. 44	—	—	ca. 45	ca. 42	ca. 46
ant. transv.	58	58	57	61	60	62
post. transv.	53	—	53	55	55	58
					(M ²⁻³)	
	XXVII B,	XXVII B,		XXVIII B,		
	E ₄	E ₅		F ₅		
M ² , ant. post.	ca. 56	—		ca. 53	ca. 50	
ant. transv.	64	66		65	62	
post. transv.	—	61		59	55	
	XXVI A	XXVII B	XXVIII A			
	E ₄	F ₄	F ₅			
M ³ , ant. post.	—	—	51	48	49	
ant. transv.	—	51+	62	63	57	
length outer surface	69	—	67	64	63	

Dicerorhinus merckii already occurs in the Middle Pleistocene fauna of Jisr Banat Yaqub, south of Lake Huleh, Israel (Hooijer, 1960 a and b). In the older Bethlehem fauna, which is Villafranchian in age, the only rhinoceros is *Dicerorhinus etruscus* (Falconer) (Hooijer, 1958 a).

It will be seen from table 13 that the Ksâr'Akil molars agree rather well with those from northern and central Germany as recorded by Schroeder (1903, 1930, table I). *Dicerorhinus merckii* ranges in Europe from the Cromerian upward into the Riss-Würm Interglacial, to which most of the well-identifiable remains belong (Dubois and Stehlin, 1932-1933, p. 165). Its extension into the Würm Glacial and association with the woolly rhinoceros (*Coelodonta antiquitatis* (Blumenbach)) is open to doubt, at least for northern Germany (Schroeder, 1930, p. 7). However, in southern Europe *D. merckii* has been recorded from the Aurignacian (Schroeder, l.c.; Zeuner, 1946, p. 235). It is generally considered a woodland animal.

In the Mount Carmel succession, Merck's rhinoceros is confined to levels

TABLE 13

Range of variation of measurements of upper teeth of
Dicerorhinus merckii (Jäger)

	Ksâr'Akil	Germany (Schroeder, 1903, 1930)
P ² , ant. post.	ca. 30	28-36
ant. transv.	33	31-43
post. transv.	35	46
P ³ , ant. post.	ca. 35-ca. 37	36-46
ant. transv.	49-52	45-70
post. transv.	ca. 48-49	—
M ¹ , ant. post.	ca. 42-ca. 46	47-60
ant. transv.	57-62	63-72
post. transv.	53-58	62-67
M ² , ant. post.	ca. 50-ca. 56	52-63
ant. transv.	62-66	63-73
post. transv.	55-61	63-65
M ³ , ant. post.	48-51	—
ant. transv.	57-63	56-70
length outer surface	63-69	61

E, D and C of the Tabûn, and also Skhûl, in association with Upper Acheulean and Lower Levalloiso-Mousterian industries (Bate, 1937 b); no rhinoceros remains are known from Tabûn B or later levels. Fleisch (1955) notes the presence of *D. merckii* at Ras el-Kelb in association with an industry virtually identical with that of level C of the Tabûn (Garrod, 1958). In our Ksâr'Akil sequence, as we have seen above, *D. merckii* occurs exclusively in levels XXVI A to and including XXIX A, which contains a late form of Levalloiso-Mousterian industry.

Thus, in terms of the associated Palaeolithic industries, the appearance of Merck's rhinoceros must have been later at Ksâr'Akil than at the Wady el-Mughara caves. Miss D. A. E. Garrod (in litt., Jan. 30, 1955) kindly informs me that the tooth of *Dicerorhinus merckii* from the Emireh cave, found in the disturbed layer but undoubtedly from the Palaeolithic horizon, is transitional from Upper Levalloiso-Mousterian to Aurignacian, in other words, Emiran. Therefore, the appearance of Merck's rhinoceros at the Emireh cave is one stage more recent than that at Ksâr'Akil. Moreover, Miss Garrod notes that Neuville had noted its presence in a horizon at Jebel Qafseh which is almost certainly contemporary with the Upper Levalloiso-Mousterian of the Tabûn. The absence of the rhino in the Upper Levalloiso-Mousterian of the Wady el-Mughara caves was perhaps accidental.

Order ARTIODACTYLA

Sus scrofa L. subsp.

The pig from the Upper Acheulean and Lower Levalloiso-Mousterian of Palestine was described as *Sus gadarensis* (Bate, 1937 b, p. 203). It differs from *Sus scrofa* L. in the structure of its premolars: P¹⁻³ are more simple on their lingual borders, P⁴ is rather narrow lingually, the lower C is less markedly *scrofa*-like, the P₄ stout, low-crowned, trilobate but simple in build, less tuberculate than in *Sus scrofa*.

Pig remains are present throughout the Ksâr'Akil deposits, and none of the premolars is of the simple type of those of *Sus gadarensis*. It is evident that all the Ksâr'Akil remains belong to *Sus scrofa*, the species that occurs at Mount Carmel from the Aurignacian on upward.

In the Ksâr'Akil collection *Sus* is absent only in the following samples: 5.30-5.60, E5, F5; 5.60-5.80, E5; 13.50-13.90, F3; 14.20-14.50, F3; 14.90-15.10, F5; XIV, F3, F4; XXIV, E4, F4; and XXXVI, E5, which is undoubtedly accidental; just as at Mount Carmel *Sus* is never plentiful.

The variability in size of the last molars of *Sus scrofa* found in various Lebanon caves by Zumoffen has been commented upon by Fritsch (1893, p. 29/30). In contradistinction to Fraas (1878, p. 376/77), who refers the pig remains from the cave of Nahr el-Kelb to *Sus priscus*, Fritsch has no doubt in referring them to *Sus scrofa*. It is noted further that the remains do not belong to domestic pigs since the teeth are large and few in number; *Sus* is less common than many other game animals.

20 specimens of left upper last molars and 30 specimens of right upper last molars of *Sus scrofa* from Ksâr'Akil vary in length from 37.5 mm to 47.2 mm, and in width from 21.2 mm to 23.9 mm; of the lower last molars 16 left and 18 right specimens vary in length from 40.8 mm to 50.3 mm, and in width from 16.7 mm to 20.6 mm. The material is not indicative of any trend toward greater or toward less complication in the last molars of the Ksâr'Akil pig during the time span represented by the series of deposits; the talons and talonids vary irrespective of relative age. Some of the extremes in length and width are shown on pl. II figs. 4-7.

Dama mesopotamica (Brooke)

The Iranian fallow deer is by far the most abundantly represented species at Ksâr'Akil, as it is also at Mount Carmel (Bate, 1937 b, p. 210). The remains of *Dama* found in the Wady el-Mughara caves (over ten thousand specimens), together with those of *Gazella* (also rather numerous), have been used by Miss Bate, on Professor F. E. Zeuner's advice, for making a tenta-

tive outline of the varying climatic conditions during the period of human habitation of these caves, the *Gazella-Dama* graph (Bate, 1937 b, p. 141). As a woodland form, *Dama* would suggest a more moist climate and a wooded vegetation, in contrast to *Gazella*, characteristic of dry country and suggesting a drier climate and a grassland or steppe vegetation. The varying relative percentages of these animals through the sequence of cave levels have been hailed by Zeuner (1945, p. 197) as "unmistakable palaeontological evidence for fluctuations of the climate".

The total number of specimens of *Dama* identified from the Ksâr'Akil collection is almost ten thousand (9531). The total number of identified *Gazella* specimens only amounts to about one-thirtieth of this, viz., 320. Even at those levels in which *Gazella* is best represented (20 specimens each in 11.00-11.50 m, E5, and F5) the number of *Dama* specimens is ten to fifteen times that of *Gazella*. These proportions vary from level to level. At level III, D5-7, at 9.75-10.00 m, F5, and at 13.85-14.15 m, F5, we find 82-85 specimens of *Dama* against 1 of *Gazella*, whilst at level VIII, E4, F4, at 11.50-12.00 m, F5, and at 12.00-12.40 m, F5, we find 98-100 *Dama* specimens against 6-7 of *Gazella*. Within the same level, e.g., XXVII A, we have 20 *Dama* specimens in E4, but 134 *Dama* specimens in F4, both against 1 *Gazella* specimen. These examples, taken fully at random from the tables made by me, suffice to illustrate that it is impracticable to compose a *Gazella-Dama* graph for Ksâr'Akil such as has been made by Miss Bate for Mount Carmel. At no point in the long sequence of Ksâr'Akil deposits does *Gazella* ever exceed *Dama* in quantity of identified specimens. It is true that there are variations in the numbers of *Gazella* specimens relative to those of *Dama*, but the numbers of *Gazella* specimens invariably are so very small compared to those of *Dama* specimens as to render these variations meaningless.

Therefore, it is clear that the fauna of Ksâr'Akil produces no evidence for fluctuations of the climate such as that derived from the study of *Gazella* and *Dama* of Mount Carmel by Professor Zeuner and Miss Bate.

Although the remaining cervids and bovids of the collections from the Wady el-Mughara caves have not been used as indicators of climatic changes to the same extent as were *Gazella* and *Dama*, I have also counted all the specimens from all the levels of *Cervus*, *Capreolus*, *Bos*, and *Capra*, and have used these figures in the discussions of the various forms as well as in the concluding chapter of the present work. Even if these figures do not reflect climatic changes, nor tell us anything about the relative frequency of occurrence of the various forms in nature at any given time, they do tell us something about the composition of the Palaeolithic menu of the Ksâr'Akil hunters, because all these animals have been used for human food.

During the period of human habitation of the rock shelter of Ksâr'Akil *Dama* has always been the staple dish, the percentages of *Dama* invariably being higher than those of any other cervid or bovid. Table 25 shows that, in percentages of the total numbers of cervid and bovid specimens taken together, *Dama* varies from 37 per cent. (3.00-7.40 m) to 73 per cent. (levels XXVI A to XXIX B). The nearest approach to these percentages is 36 per cent. contributed by *Capreolus* (3.00-7.40 m), while *Gazella* never contributed more than 4 per cent. (levels X to XVIII).

In her report on the animal remains from Mugharet ez-Zuttiyeh Bate (1927b, p. 43, fig. 9) figures a portion of an antler of *Dama mesopotamica* obtained from Ksâr'Akil, and presented to the British Museum by the American University of Beirut. There is a small, downwardly directed, broken brow tine; the bez tine is bifurcated, the inner surface of the antler is very flattened, and the extreme compression of the antler commences almost immediately above the burr, while 6 cm above the burr the thickness is only 32 mm. In the present Ksâr'Akil collection there are several proximal antler fragments (levels VII, F4, G3; VIII, G4; IX, F4, 7.25 m), which, though less complete than that figured by Miss Bate, show the flattening above the burr that is so characteristic of the present species in contradistinction to *Dama dama* (L.), which has the beam between brow and trez tines roughly circular in cross section.

The variation in length P²-M³ recorded by Bate (1937b, p. 212) is 84-99 mm, length P₂-M₃ is given as 94.5 mm. The specimens from Ksâr'Akil, the measurements of which will be found in tables 14 and 15, vary in the same way; those of the lower jaw range from 80 mm in an old individual from 8.40-9.20 m, F5, to 104 mm in a specimen from level VI.

TABLE 14
Measurements of upper teeth of *Dama mesopotamica* (Brooke)

	Length P ² -M ³	Length M ¹⁻³
Ksâr'Akil, 3.10-3.20, E5, F5	94	56
4.20-4.40, F5	84	52
10.00-10.40, F5	92	55
11.00-11.50, E5	96	57
12.65-13.05, E5	90	53
level VIII, D5-7	89	53
IX, E4, F4, 7.55	96	59
XII, F4, 9.70	92	54
XVII, F3, 10.90	82	—
XVII, E4, 11.05	90	53
XVII, E4, 11.05	91	56

TABLE 15
Measurements of lower teeth of *Dama mesopotamica* (Brooke)

	Length P ₂ -M ₃	Length M _{1,3}
Ksâr'Akil, 8.40-9.20, F ₅	96	59
8.40-9.20, F ₅	80	53
level V, E ₄ -6	101	65
V, G ₃ -6	100	63
VI, F ₃ -4	104	65
VIII, F ₃ , 6.75	103	65
IX, F ₃ -4, 7.25	92	57
IX, E ₄ , 7.75	93	57
XI, E ₄ , 9.30	87	62
XII, F ₄ , 9.70	97	59
XVII, E ₄ , 11.05	92	58
XVII, F ₄ , 11.25	98	61
XX, F ₄ , 12.65	97	58
XXXII, F ₅	97	60

***Cervus elaphus* L. subsp.**

A large species of deer is of rare occurrence at Ksâr'Akil; it is found neither in the top nor in the bottom layers, and, while present, it is so very irregularly. Its most recent occurrence is at level V, and the oldest remains are from level XXVII B. The most important break in this record is that which occurs between level IX, E₄ (7.65 m) and level XIX, F₄ (11.70 m), a gap only filled by a single tooth from 9.75-10.00 m, F₅. It is rather plentiful in the lots from 12.40-12.90 m, F₅, 12.65-13.05 m, E₅, 14.40-14.80 m, F₅, 14.65-15.10 m, E₅, as well as from levels XXIII, F₄, and XXIV, E₄ (both 14.50 m). At other levels it is represented by one or two teeth only.

Although there is hardly any antler fragment, there can be no doubt that the large deer remains belong to *Cervus elaphus*, a species that is now extinct in Syria and Palestine. Fritsch (1893, p. 14) records its remains from the Antelias caves, and it occurs in the Wady el-Mughara caves from the Lower Levalloiso-Mousterian up into the Upper Aurignacian (Bate, 1937b, p. 210). In the Natufian of the Kebarah cave it is still present (Bate, l.c.), but it is lacking in the Natufian of the Shukbah and Abu Usba caves. The red deer has also been recorded from earlier levels, viz., the Tayacian and Upper Acheulean of Umm Qatafa (Vaufrey, 1931, p. 256; 1951, p. 201).

I have compared the Ksâr'Akil specimens with four adult males of *Cervus elaphus* (Leiden Museum, cat. ost. a, b, reg. nos. 2138, 6958) and four adult females (Leiden Museum, cat. ost. e, reg. nos. 1313, 2038, and 11936), and the only difference found is one of size. The fossil red deer is not considerably larger than the living, a fact well known to students of the group (Boule, 1910, p. 203; Woodward, 1924, p. 718; Reynolds, 1933). A right

upper molar series M^{1-3} from 12.40-12.90 m, F5, is 83 mm long, against 65-71 mm in the male, and 60-65 mm in the female specimens examined. A right mandibular ramus from 14.65-15.10 m, E5, has a length P_2-M_3 (crowns) of 144 mm, as opposed to 118-126 mm in the recent male, and 107-115 mm in the recent female skulls seen.

Capreolus capreolus (L.) subsp.

As noted by Bate (1937b, p. 209) Professor A. E. Day found that remains of the roe were "uncommon" at Ksâr'Akil. However, this should have been "not uncommon", for in Day (1926, p. 95) we read: "There are also many remains of a smaller deer, the roe deer, which has until recent years been found in Syria and Palestine". The extensive collections studied by me show that *Capreolus* is rather common at Ksâr'Akil; the number of specimens counted (2894) is greater than that of the other species represented at the site except *Dama mesopotamica* (9531) and *Capra aegagrus* (3722). Thus, the roe is the third commonest species of the Ksâr'Akil fauna.

It is only toward the bottom of the sequence of levels, from a depth of about 13 m on down in E5, F3, and F5, and below level XX in E4 and F4, that *Capreolus* begins to show up less regularly. From level XXX to the bottom level XXXVI it is practically absent, only 14 specimens having been found as opposed to 319 specimens of *Dama*. In general, however, *Capreolus* figures rather prominently among the spoils of the chase of the Ksâr'Akil hunters, as shown by the numbers of specimens given above. As already observed by Fritsch (1893, p. 20) *Capreolus* is rather numerous in the Antelias caves.

In Palestine cave deposits the roe is much less commonly found than in those of the Lebanon. *Capreolus* occurs in small numbers at the Wady el-Mughara cave levels from Upper Acheulean to Natufian, the total number of specimens being forty (Bate, 1937b, p. 209). One specimen is known from the Natufian of the Shukbah cave (Bate, 1942b, p. 19), one from that of Erq el-Ahmar (Vaufrey, 1951, p. 211), while six specimens have been reported from the Natufian of the Abu Usba cave (Haas, 1952, p. 40). As suggested by Bate (l.c.) Palestine was probably the southern limit of the Pleistocene distribution area of *Capreolus*; it is now completely exterminated both in Palestine and in Syria.

Good skull fragments of the roe are rare in the Ksâr'Akil collection, but such specimens as have been found, e.g., at level VII, G2-4, agree with the recent material examined. Measurements of entire tooth rows, recent as well as fossil, are given in tables 16 and 17. The Ksâr'Akil specimens occasionally exceed the largest recent specimens in size.

TABLE 16
Measurements of upper teeth of *Capreolus capreolus* (L.)

	Length P ² -M ³	Length M ¹⁻³
Leiden Museum, cat. ost. a	57	32
cat. ost. c	59	33
cat. ost. d	57	32
cat. ost. e	54	31
reg. no. 1041	55	29
1190	57	32
1325	62	35
2355	62	34
11002	58	33
11164	59	33
12470	58	32
Ksâr'Akil, 5.94-6.45, F5	59	33
6.65-6.83, E5	58	35
7.40-8.40, F5	60	34
8.40-9.20, F5	62	35
8.40-9.20, F5	60	33
8.65-9.30, E5	63	35
8.65-9.30, E5	61	34
9.20-9.75, F5	57	32
9.30-9.85, E5	62	35
9.75-10.00, F5	59	33
level VIII, F3, 6.75	59	33
VIII, G3-4, 6.75	61	34
XX, F4, 12.65	63	35

TABLE 17
Measurements of lower teeth of *Capreolus capreolus* (L.)

	Length P ₂ -M ₃	Length M _{1,3}
Leiden Museum, cat. ost. a	60	37
cat. ost. c	64	38
cat. ost. e	59	36
reg. no. 1041	59	33
1190	61	37
1325	65	38
2355	68	40
11002	61	36
11164	63	37
12470	61	36
Ksâr'Akil, 4.90-5.10, E5	66	39
8.40-9.20, F5	65	37
10.00-10.40, F5	65	38
level VIII, E4, F4	67	39
IX, E4, F4, 7.55	62	37
X, F3, 8.10	66	39
XVII, F3, 10.90	66	37

Bos spec.

Both *Bison* and *Bubalus* have been recorded from Syrian cave deposits by Fritsch (1893, p. 29). In a preliminary paper on Ksâr'Akil, Ewing (1948) mentions even three types of large bovines as being present: a "Buffalo" in association with *Rhinoceros* (which latter, as we have seen, occurs only at levels XXVI A to XXIX A), and, at higher levels, *Bison* as well as *Bos* (Ewing, l.c., pp. 275-276).

Remains of large bovines are rather unequally distributed in the Ksâr'Akil sequence. There are few, if any, in the top levels (15 specimens in all from levels I-V). Passing down along the series of levels bovines begin to appear more regularly, first in small numbers, and then somewhat more plentifully, from level XII, E4, F4, and from the same depth (10 m) in E5 and F5 on down until level XXV has been reached. From level XXVI A down to XXIX A bovines are decidedly common, outnumbering all other species except *Dama mesopotamica*. There are over four times as many bovine specimens as *Capra* specimens in this portion of the Ksâr'Akil sequence, which is moreover characterized by the presence of *Rhinoceros*. In the bottom levels XXX to XXXVI, however, bovines are rare (12 specimens in all from levels XXX-XXXVI), and *Capra* outnumbers them seven to one, as it also does in levels higher than XXVI A. The temporary dominance of *Bos* over *Capra* at levels XXVI A to XXIX A, whereby *Bos* suddenly becomes the second best represented species of the assemblage (*Dama* always being in the lead) is the most remarkable feature observed in the distribution of the bovines through the Ksâr'Akil sequence. Both above and below the portion of the Ksâr'Akil sequence designated as levels XXVI A to XXIX B *Bos* is far from common, outnumbered by *Capra* six to one at least. Of the total of 793 bovine specimens obtained from all the levels of Ksâr'Akil, over two-thirds (539) have been taken from levels XXVI A to XXIX B. It is tempting to attribute this sudden change in the composition of the Ksâr'Akil assemblage to a temporary change in climate or environment, but all we do know is simply that during the time span represented by levels XXVI A to XXIX B a share of *Bos* was brought in greater than ever before or since, apparently for no other reason than that these animals were then in demand for food or other purposes.

We have now to consider whether or not there is good evidence for more than one species of large bovines at Ksâr'Akil. The Wady el-Mughara remains of large bovines have been recorded as "*Bos* sp." (Bate, 1937b, p. 216). In the Ksâr'Akil collection large bovines are represented mostly by isolated teeth and very fragmentary limb bones, neither of which suffice to distinguish between *Bos* and *Bison* (cf. Rüttimeyer, 1866, p. 98; Dubois

and Stehlin, 1932-1933, p. 130). There is, however, a good series of astragali in the Ksâr'Akil collection. Schertz (1936) has claimed to have found distinguishing characters in the extension of the non-articular fossae of the astragali of *Bos* and *Bison*, but according to Lüttschwager (1950) the development of these synovial fossae varies so much individually that no reliance can be placed on them for purposes of discrimination between *Bos* and *Bison*. The examination of the twenty-two Ksâr'Akil astragali has convinced me that Lüttschwager is right in stating that the astragalus affords no means of distinguishing between these two large bovines; the measurements of the specimens will be found in table 18. I have also given the measurements of the phalanges (table 19), both Bate (1942b, p. 20) and Haas (1952, p. 40) remarking upon the variability in size of these bones, a variability that is largely individual in nature. Among the series of second phalanges there is one specimen (level XXVI B, E5) decidedly smaller than the others, but even this specimen does not differ in shape from the remaining specimens, and may have belonged to a small female.

TABLE 18
Measurements of astragalus of *Bos* spec.

	Lateral length	Distal width
Ksâr'Akil, 10.70-11.00, E5	98	—
13.05-13.50, E5	85	56
level XXV, E4	86	54
XXV, F4	87	—
XXVI A, E5	92	—
XXVI A, E5	93	62
XXVI A, F5	92	62
XXVI A, F5	87	57
XXVI B, E5	94	62
XXVI B, F5	94	—
XXVI B, F5	93	59
XXVI B, F5	92	60
XXVI B, F5	88	63
XXVII A, E4	92	59
XXVII A, F5	91	58
XXVII A, F5	96	62
XXVII A, F5	—	63
XXVII B, E5	89	59
XXVII B, F4	—	67
XXVII B, F5	94	62
XXVIII A, F5	91	63
XXXI, F4	98	65

Considering the uncertainty that still prevails concerning the correct iden-

tification of the teeth and incomplete limb as well as of foot bones it seems advisable to use the name *Bos* in the broad sense for the large bovines at Ksâr'Akil, which may be recorded simply as *Bos spec.* 1).

TABLE 19
Measurements of phalanges of *Bos spec.*

	Length	Proximal width	Distal width
First phalanges			
Ksâr'Akil, level XXVI A, F5	76	44	39
XXVI A, F5	74	43	38
XXVI A, F5	76	38	34
XXVII A, F4	75	46	42
XXVII A, F4	77	—	—
Second phalanges			
Ksâr'Akil, 11.60-12.25, E5	59	46	37
12.90-13.30, F5	55	44	43
13.05-13.50, E5	53	44	40
level III, D5-7	55	46	43
XXVI A, F4	53	45	41
XXVI A, F5	50	40	36
XXVI B, E5	54	44	35
XXVI B, E5	46	35	29
XXVII A, F4	53	44	40
Hoof phalanges			
Ksâr'Akil, 11.50-12.00, F5	91	55	
14.10-14.30, E5	—	56	
15.20-15.40, E5	87	—	
level XVII, F3, 10.90	86	57	
XVII, F3, 10.90	93	63	
XVII, E4, 11.05	96	61	
XXI, F4, 12.95	91	60	
XXVI A, F4	89	57	
XXVI A, F5	—	59	

1) There is rather meagre evidence that *Bubalus* may have been present among the large bovines at Ksâr'Akil. Three small fragments of horn cores, two from level XVII, F3, 10.90 m, and one from level XXVII A, F5, appear to resemble the water buffalo for at least two of them show a sharp keel extending right down to the base, separating two flat surfaces that form an angle of about 90°, just as in the core of *Bubalus* which in cross section at base may show a sharply defined right angle between the upper and anterior surfaces. Such keels are found neither in *Bos* nor in *Bison* horn cores, nor have I been able to match the fossil fragments with the cores of any sheep or goat. *Bubalus* is present not only in the Pleistocene of Asia (Hooijer, 1958b) but also in that of Europe (Berckhemer, 1927; Schertz, 1937), and the water buffalo was apparently indigenous to Iraq (Hatt, 1959, p. 68). Therefore, it may well have been present in the Upper Pleistocene of the Lebanon, but I feel that until more conclusive evidence is forthcoming it would be premature to add *Bubalus* to the list of the Ksâr'Akil fauna.

(?) **Alcelaphus** spec.

A single left M_3 from level VIII, E4, longer and relatively narrower than those of *Capra aegagrus*, is here tentatively referred to *Alcelaphus*. The specimen (pl. II fig. 2) has a length of 33 mm by a width of only 11 mm. There are no previous records of Hartebeests from the Lebanon, but Bate (1937b, p. 215) has referred a small number of isolated teeth from Mugharet el-Wad and the Kebarah cave, as well as from the Shukbah cave (Bate, 1942b, p. 19) to this form, firstly because it had been claimed that *Alcelaphus* was known on the borders of Palestine until quite recently, and secondly because the fossil teeth are very similar to those of recent specimens of the genus with which she had compared them. The right M_3 figured by Bate (1937b, fig. 7 g) has a length of 30.5 mm and a width of 10.5 mm, as measured from the figure.

There is moreover the apical portion of a horn core, obtained from level XI, F3-4 (9.55 m) that agrees very well with the corresponding part of the horn core of recent Hartebeests examined. Although the present specimens are indicative of the presence of large antelopes at Ksâr'Akil, more complete material is needed before a specific determination can be attempted. It is of interest to note that remains of Hartebeests have been found in ancient Egyptian tombs (Flower, 1932, p. 437). Miss Bate's finds cited above seem to show that these animals ranged well into Palestine at still earlier periods. There is insufficient evidence yet to determine whether *Alcelaphus* formerly lived in the Lebanon, too, but the present record shows that such a discovery is within the realm of possibilities.

Gazella cf. **dorcas** (L.)

Remains of gazelles have been obtained from most of the Ksâr'Akil levels, but never in great quantities. *Gazella* is entirely absent from levels XIV, XV, XXI, XXIII-XXV, XXIX B, XXX, XXXII, and XXXIV-XXXVI, and in squares E5 and F5 it likewise occurs sparingly, especially toward the bottom: between 13.25 m and 15.40 m it is represented only by one (female) horn core, originating from 13.85-14.15 m, F5. In most lots in which it is present there are very few (less than 10) specimens only, the exceptions being those from 9.20-9.75 m, F5, 11.00-11.50 m, E5, and 11.00-11.50 m, F5, in which these numbers of specimens rise to 19 or 20 each. It is evident that, on the whole, *Gazella* has been a rare animal at Ksâr'Akil. The paucity of numbers of gazelle remains at Ksâr'Akil stands in remarkable contrast to the abundance of gazelle remains at the Wady el-Mughara caves; Bate (1937b, p. 216) found gazelle remains to be more numerous than those

of any other animal at the Wady el-Mughara caves except *Dama mesopotamica*. On the advice of Professor F. E. Zeuner she has used the varying numbers of specimens of *Gazella* and *Dama* through the sequence of levels as indicators of changing conditions during the period of human habitation (Bate, l.c., p. 141 fig. 1), a fact that lends additional interest to the gazelles of Ksâr'Akil.

The jaw fragments point to a small-toothed species, not much larger than *Gazella dorcas* (L.) or than *Gazella gazella* (Pallas), both living in Syria and in Palestine today. The horn cores, which are found quite regularly with the teeth and bones, do not vary conspicuously in shape or size. The amount of variation is not greater than could reasonably be expected to occur within one and the same species (see, e.g., Miller, 1912a; Morrison-Scott, 1939, p. 186). Therefore, no more than a single species of *Gazella* seems to have been present throughout the sequence of levels at Ksâr'Akil, a species that carried horns in both sexes, as in most gazelles.

The resemblance of the fossil horn cores to those of recent specimens of *Gazella dorcas* and *Gazella gazella* is very close. The cores are not twisted; the degrees of lateral compression and of backward curvature correspond quite well, and even the longitudinal furrows of the fossils are found in the recent specimens. There are male as well as female horn cores; the last-mentioned are small, conical, and almost straight, as are those in the recent species mentioned. Measurements and indices of the recent and fossil horn cores will be found in table 20.

The fossil horn cores will be noted to be larger than those of the recent species living in the same general area, but in this they only conform to the general rule.

Dental measurements, both of upper and of lower teeth, are presented in tables 21 and 22. The same excess in size of the fossil over the recent specimens is shown. Nevertheless, it does not seem opportune at this moment to describe the Ksâr'Akil species of *Gazella* as new in view of the fact that skull remains have not been obtained yet. Apart from a difference in size there is nothing to distinguish the fossil remains of *Gazella* from those of *Gazella dorcas*, to which the fossils may be provisionally referred. It is probable that the fossil material merely represents a large temporal race of the species today inhabiting the same area from which the cave material has been obtained.

The *Gazella* remains obtained at Mugharet el-Emireh (Bate, 1927a, p. 11), at Mugharet ez-Zuttiyeh (Bate, 1927b, pp. 32 and 44), and at Umm Qatafa (Vaufrey, 1931, p. 258) have been provisionally referred to *G. arabica* Lichtenstein (a race of *G. gazella*); these specimens are from Acheulean

TABLE 20

Measurements of horn cores of *Gazella* species

Males Leiden Museum	cross section at base		horn core index	length along front
	ant. post.	transv.		
<i>Gazella dorcas</i> , cat. ost. a	27	20	74	—
cat. ost. b	28	24	86	200
<i>G. g. bennettii</i> , cat. ost. b	29	20	69	150
reg. no. 4908	27	21	78	—
reg. no. 4909	29	22	76	175
Ksâr'Akil, 6.83-7.40, E5	33	25	76	—
9.75-10.00, F5	36	27	75	—
(pl. I fig. 2) 11.00-11.50, E5	32	24	75	140
11.00-11.50, E5	32	23	72	—
11.00-11.50, F5	29	24	83	—
11.00-11.50, F5	31	22	71	—
11.50-12.00, F3	33	22	67	—
11.50-12.00, F5	30	21	70	—
11.50-12.00, F5	34	24	71	—
level IV, D5, 7	34	22	64	—
V, F3-6	34	27	80	110+
V, G3-6	31	24	77	—
VII, F3	33	23	70	140
VII, F3	—	26	—	—
VIII, F3, 6.24	37	29	78	—
VIII, E4	32	23	72	—
XI, F4, 8.95	36	25	69	—
XI, F3, 9.30	33	25	76	—
XI, E4, 9.65	36	27	75	—
XVII, F3, 10.90	31	20	65	—
XVII, F3, 10.90	30	20	67	120+
XVII, F3, 10.90	32	23	72	130+
XVII, F3, 10.90	33	23	70	—
XXVII A, E4	—	23	—	—
Females				
Leiden Museum				
<i>Gazella dorcas</i> , cat. ost. d	12	12	100	80
reg. no. 1194	15	12	80	95
<i>G. g. bennettii</i> , cat. ost. a	12	11	92	50
Ksâr'Akil, 11.50-12.00, F5	14	12	86	—
12.25-12.65, E5	13	12	92	ca. 50
12.65-13.05, E5	16	15	94	—
13.85-14.15, F5	12	12	100	60

to Aurignacian levels. The gazelles of the Wady el-Mughara caves (Bate, 1937b, p. 216) are still undescribed, with the exception of those from the uppermost levels, Natufian (Bate, 1940), which have all been described as

TABLE 21
Measurements of upper teeth of *Gazella* species

Leiden Museum	Length P ² -M ³	Length M ¹⁻³
<i>Gazella dorcas</i> , cat. ost. d	52	33
cat. ost. b	54	33
cat. ost. d	51	31
reg. no. 1194	55	33
<i>G. g. bennettii</i> , cat. ost. a	57	35
cat. ost. b	53	34
reg. no. 4908	56	35
reg. no. 4909	—	37
Ksâr' Akil, 7.40-8.40, F5	—	39
10.00-10.40, F5	—	39
11.00-11.50, E5	—	39
11.00-11.50, F5	—	36
11.60-12.25, E5	—	40
level II, B1-2	—	38
V, G3-6	—	38
VI, F3-4	—	37
VIII, E4, F4	—	37
VIII, E4, F4	—	36
XI, F3-4, 9.30	—	40
XVII, E4, 11.05	—	36
XVIII, E4, 11.55	66	41
XVIII, E4, 11.55	—	36
XIX, F4, 11.70	—	38

new: *Gazella decora* Bate, *G. esdraelonia* Bate, and *G. arista* Bate. It is noted (Bate, 1940, p. 419) that the species of *Gazella* from the earlier cave levels (Upper Acheulean to Upper Levalloiso-Mousterian), numbering about half a dozen, are likewise extinct, but a description of these forms has never been published.

The gazelles from various levels of Umm Qatafa, Erq el-Ahmar, el-Khiam (Vaufrey, 1951, pp. 201, 210, 215) and Abu Usba (Haas, 1952, p. 41) have not been specifically identified. The horn cores described by Vaufrey (l.c., pl. XX figs. 2 and 4) do not appear to differ from those of Ksâr' Akil, with the exception of one el-Khiam specimen that is almost round at base (34 by 33 mm) and, therefore, may be a *Kobus* (known from the Natufian of Mugharet el-Wad: Bate, 1940, p. 432).

Capra aegagrus Erxleben

Two species of goat or ibex have long been known from cave deposits in Syria, viz., the Beden, *Capra nubiana* F. Cuvier, and a larger extinct form named *Capra primigenia* by Fraas (1878, p. 379).

TABLE 22

Measurements of lower teeth of *Gazella* species

Leiden Museum	Length P ₂ -M ₃	Length M ₁₋₃	M ₃ (length × width)
<i>Gazella dorcas</i> , cat. ost. a	54	37	17 × 6
cat. ost. b	57	39	18 × 6
cat. ost. d	54	37	16 × 7
reg. no. 1194	59	38	16 × 6
<i>G. g. bennettii</i> , cat. ost. a	59	40	17 × 6
cat. ost. b	56	37	17 × 7
Ksâr'Akil, 3.40-3.50, E ₅ , F ₅	—	—	19 × 7
5.40-5.60, F ₅	58	39	—
6.37-6.64, E ₅	—	—	19 × 7
9.20-9.75, F ₅	—	40	17 × 6
9.20-9.75, F ₅	—	39	18 × 7
9.20-9.75, F ₅	—	—	18 × 7
9.30-9.85, E ₅	—	—	17 × 7
11.00-11.50, F ₅	—	42	17 × 7
11.00-11.50, F ₅	—	—	19 × 7
11.00-11.50, F ₅	—	—	18 × 7
11.60-12.25, E ₅	—	41	19 × 7
12.00-12.40, F ₃	—	—	20 × 8
level I, D ₂	56	ca. 38	—
II, B ₁₋₂	—	—	18 × 7
V, F ₃₋₆	—	—	16 × 6
VII, F ₂₋₄	—	—	19 × 7
VII, G ₂₋₄	—	39	19 × 7
VIII, E ₄ , F ₄	—	—	19 × 7
IX, F ₃ , 7.60	59	ca. 38	— × 7
IX, E ₄ , 7.65	—	—	18 × 7
IX, G ₄ , 8.00	—	—	— × 8
XI, F ₄ , 8.95	—	41	18 × 7
XI, E ₄ , F ₄ , 9.10	60	39	17 × 7
XI, F ₃₋₄ , 9.55	—	—	17 × 7
XI, F ₃₋₄ , 9.55	—	—	18 × 7
XIII, F ₃₋₄ , 9.90	—	41	18 × 7
XVI, F ₃ , 10.70	55	36	17 × 7
XVII, F ₃ , 10.90	—	40	18 × 7
XVII, F ₃ , 10.90	—	—	17 × 6
XVIII, E ₄ , 11.55	—	—	19 × 8
XIX, F ₄ , 11.70	—	41	16 × 6
XXII, F ₄ , 13.70	—	40	18 × 7
XXVIII, E ₄	—	—	18 × 7

Capra nubiana is regarded as a subspecies of *Capra ibex* L. by Ellerman and Morrison-Scott (1951, p. 407), but it is considered a subspecies of *Capra hircus* L. by Schwarz (1935, p. 435). There is something to be said

for both of these views. The horns of the males do have knots on the front edge, as in *C. ibex*, but there are distinct white marks on the wrists, as in *C. hircus* and not in *C. ibex*. There is further a distinct tendency to develop an antero-internal horn keel, as is typical of *C. hircus*, but this is also shown in many specimens of *C. ibex ibex* (Ellerman and Morrison-Scott, 1951, p. 404). The horns of one male specimen of *Capra nubiana* from Upper Egypt in the Leiden Museum (*Capra sinaitica*, cat. syst. a) are more flattened in their external surface than on their internal surface, as in *C. ibex*, but the reversed, *C. hircus* condition obtains in the small-horned females (cat. syst. c and d). The horns of a male from Palestine¹⁾ (Leiden Museum, reg. no. 822) are, again, more flattened externally than internally. It would seem preferable, for the present, to accord full specific status to the Beden.

The large extinct form mentioned above as *Capra primigenia* Fraas, as pointed out by Kretzoi (1942, p. 345), has to be called *Capra libanotica* Kretzoi, as Fraas's name is preoccupied by *Capra primigenia* Gervais, 1864, proposed for a different form of goat from the Laroque cave, and hence some substitute name was called for.

Both *Capra nubiana* and *Capra libanotica* are represented in the collections from Syrian caves explored by Zumoffen (Fritsch, 1893, p. 22), the latter species being rather abundant. Fritsch gives measurements and figures of the teeth (l.c., p. 23, pl. VIII figs. 5-13). A figure of the frontal with the bases of the horn cores of *Capra libanotica* has been given by Bate (1927b, p. 45 fig. 10); this specimen originates from the Upper Acheulean or Levalloiso-Mousterian of Mugharet ez-Zuttiyeh. The cores are elliptical in outline at the base without a sharp edge anteriorly, and are flattened on their external surface (as in *C. ibex*), with a greatest anteroposterior diameter of 67 mm, and a greatest width of 47 mm. In a fine recent specimen of *Capra nubiana* these measurements are 58 mm and 43 mm respectively (Bate, l.c., p. 46). In the male of *Capra nubiana* from Upper Egypt in the Leiden Museum (*Capra sinaitica*, cat. syst. a) the horn cores are 44 mm anteroposteriorly, and 32 mm transversely at the base; the horn cores of another male, from Palestine (Leiden Museum, reg. no. 822), measure 48 mm anteroposteriorly, and 33 mm transversely at the base. These specimens have weak antero-internal edges, and are flattened on their external surfaces. The apical ends of the horn cores are much compressed transversely, with rounded anterior (upper) and posterior (lower) edges.

¹⁾ There are not even subspecific differences between *Capra nubiana* of Sinai and that of Upper Egypt (Flower, 1932, p. 436).

Capra remains occur almost throughout the sequence of the Wady el-Mughara cave levels (Upper Acheulean to Natufian) but are not plentiful in any (Bate, 1937b, p. 214). These remains have not been identified specifically, and neither were those of the Upper Levalloiso-Mousterian of the Shukbah cave (Bate, 1942b, p. 18). *Capra* spec. has also been recorded from Mugharet el-Emireh (Bate, 1927a, p. 11), and from Mugharet ez-Zuttiyeh (Bate, 1927b, p. 32); in both cases the resemblance of the fossil specimens to recent *Capra nubiana* is noted.

There is, however, a fragmentary horn core of the *hircus* type, with a sharp anterior edge, from Mugharet el-Wad. This find unfortunately is undatable (Bate, 1937b, p. 215), but *Capra hircus* horn cores have since been recorded from the Natufian of el-Khiam by Vaufrey (1951, p. 215, pl. XX fig. 3).

Capra remains from various levels (Tayacian to Natufian) of Umm Qatafa and Erq el-Ahmar have all been referred to *Capra ibex* (Vaufrey, 1931, p. 259; 1951, pp. 202, 212).

In the Natufian of the Abu Usba cave several species of goat appear to be present: "Some teeth completely corresponded in shape and size to Fritsch's *Capra primigenia*, while others were exactly like those of a recent male of *Capra nubiana* Cuv. Other teeth were decidedly smaller than both these groups" (Haas, 1952, p. 41).

Thus, from the earliest cave levels (Tayacian of Umm Qatafa) on up into the Natufian we have evidence of the existence of at least one species of *Capra* similar to recent *Capra nubiana* F. Cuvier, occasionally accompanied by a larger species first described from Syrian caves, but afterwards also found, more sparingly, in Palestine cave deposits, viz., at Mugharet ez-Zuttiyeh (Upper Acheulean or Lower Levalloiso-Mousterian) and at Abu Usba (Natufian). The latter species, which should be named *Capra libanotica* Kretzoi, is an extinct form of ibex. In the Natufian there is evidence of a third *Capra* species similar to *Capra hircus* L., with a sharp antero-internal edge on its horn core, which is flattened on its internal surface. Several of these horn cores from el-Khiam are regarded by Vaufrey (1951, p. 215) as the first evidence of the domestication of the goat by the Natufian people of Palestine; Bate (1937b, p. 175) had already announced the presence of a domestic dog in the Natufian of Mugharet el-Wad. Both of these are considered unverified claims by Reed (1959).

Remains of *Capra* are much more common in Syrian caves than in those of Palestine; as in fact has already been noted by Professor A. E. Day the most plentifully represented forms at Ksâr'Akil are *Capra* and *Dama mesopotamica* (Bate, 1937b, p. 209). *Capra* remains do abound in the Ksâr'Akil

collection now under study. Their specific position would, however, have been indeterminate were it not for the presence of several horn cores the characters of which leave no doubt as to the species to which they belong. None of the horn cores is as large as that of *Capra libanotica* figured by Miss Bate. Nor do they belong to *Capra nubiana*, for in all of them the internal surface is flattened, the external rounded, instead of the reverse as in *C. nubiana*. There is an antero-internal edge, more pronounced in some specimens than in others, indicating that the horns of the animal have been keeled, not so markedly as those in the domestic goat but exactly like those of *Capra aegagrus* Erxleben, a wild goat long considered to be the sole ancestor of the domestic goat¹). This species is known at present from the mountains of Asia Minor, Iran, and the Caucasus, and has not been recorded from Syria or Palestine. However, it is to *Capra aegagrus* that the Ksâr' Akil horn cores must be referred, for they show the distinctive internal flattening and moderate anterior edge of that species.

An exceptionally fine specimen is a portion of the frontal with the greater part of both horn cores from level XVII, E₄ (11.05 m). The superior borders of the orbits are damaged, and the skull is broken off just in front of the supraorbital foramina, which are 50 mm apart. A frontal bulge between these foramina and the bases of the horn cores is distinctly shown; the surface of the bone is damaged in places, exposing the sinuses, which extend into the horn cores. The cores are oval in cross section at base with a flattened internal border; the external surface of the cores is convex throughout. There is a rounded edge at the front inner side, while behind the surface of the core is rounded from side to side below, forming, however, a weak edge higher up that is more pronounced in the left than in the right core. As can be seen from the figure (pl. II fig. 1) the cores diverge upward, when seen in front, at an angle of approximately 30°, and are almost perfectly straight as far as preserved. The backward curvature is likewise very slight. The cores are not parallel with the anteroposterior line of the skull with their longer axes; when seen from above the longer diameters of their cross sections at base converge to the front, forming an angle again of 30° approximately. The least distance between the right and the left bases of the horn cores is 37 mm, a distance that has increased to 80 mm at a height of 8 cm above the bases, where the cores are broken off. The anteroposterior and transverse diameters of the cores are 38 mm and 27 mm respectively at the base, and 33 mm and 22 mm respectively at 8 cm above the

1) Nachtsheim (1949, p. 25) lists three ancestral forms of the domestic goat, the bezoar goat (*Capra aegagrus*), the screw-horned goat (*Capra falconeri*), and an extinct form from Eastern Central Europe (*Capra prisca*).

base. Though nothing of the parietals and the back of the skull is present there is not the slightest doubt as to its specific identity with the living wild goat *Capra aegagrus*; in all observable characters it agrees perfectly with recent specimens of that species.

The discovery of unmistakable remains of *Capra aegagrus* in the Ksâr'Akil collection brings, of course, the earlier identifications of the fossil goat from Syrian and Palestine caves as *Capra nubiana* in doubt. The dentitions of these two species of *Capra* appear to be indistinguishable, and as no horn cores of the "*Capra sinaitica*" of Fritsch (1893), or of the *Capra* sp. of the Wady el-Mughara caves (Bate, 1937b, p. 214) have been found it is here suggested that these remains may also have belonged to *Capra aegagrus*.

In the collection of the same lot that yielded the skull fragment above described (level XVII, E4, 11.05 m) there are the apical ends of two horn cores, much compressed transversely with sharp edges, and with one of the surfaces flat, the other convex, exactly of the shape of the tips of the cores in recent specimens of *Capra aegagrus* (in *Capra nubiana* the core tips have less sharpened edges, and both surfaces are convex). There is also a portion of a right frontal with the base of the horn core the lateral part of which is missing; the anteroposterior diameter is 35 mm. A similar fragment, but of the left side, is from level XVII, F3, 10.90 m; the basal diameters of the horn core are 38 mm and 27 mm respectively. A better specimen again is from level XVII, F3, 10.90 m; this comprises parts of both frontals, with the left core broken off at the base but the right preserved for a length of 4 cm. The least distance between the cores is ca. 35 mm; the right core measures 36 mm anteroposteriorly and 26 mm transversely at base. The external surface is convex, the internal flattened, and there is a rounded but distinct edge anteriorly. The angle between the longer axis of the core and the median sagittal suture between the frontals is ca. 15° ; hence, the anterior convergence of the basal longer diameters of the cores is the same as that in the more complete specimen described above. There is further a portion of a left horn core, 7 cm long, slightly curved, and much compressed transversely; at the wider end the diameters are . 30 by 15 mm, at the other, 24 by 12 mm. The internal surface is perfectly flat.

The basal portion of a left horn core from level XXII, E4, 13.70 m, is slightly smaller than the others: it measures 36 mm anteroposteriorly, and 24 mm transversely at base. The flat internal surface passes anteriorly into the convex external surface by an edge, while the posterior surface of the core is rounded from side to side.

From level XXVI A, F4, we have a basal fragment of a horn core with the adjoining portion of the frontal, showing it to be of the right side. The

distal end of a horn core, found in the same lot, is 7 cm long, flattened on one of the surfaces and convex on the other, with sharp anterior (upper) and posterior (lower) edges. The basal diameters of this fragment are 24 by 14 mm. In all its characters it conforms to the preceding specimens.

A portion of the left frontal with the base of the horn core from level XXVII A, F4, appears to be slightly crushed. The basal diameters of the core are 35 by 25 mm.

A rather large individual is represented by the base of a right horn core with part of the frontal still attached to it. Unfortunately it is incomplete anteriorly, but it shows well the flat internal and convex external surfaces characteristic of the species. The transverse diameter of the core at base is 29 mm. This specimen was found between 11.60 and 12.25 m, E5.

The last specimen definitely referable to *Capra aegagrus* is a horn core fragment from 12.90-13.30 m, F5. The fragment is edged above and below, transversely compressed with one flat and one convex surface, and diminishes in diameters distally from 25 by 16 mm to 18 by 10 mm over a length of 8 cm.

The clear-cut characters of the specimens above described prove their belonging to *Capra aegagrus*. From all the levels from which they came, and from many others, there are *Capra* remains the specific identity of which is uncertain. Since there are no specimens of horn cores of *Capra* in the present collection belonging to species other than *Capra aegagrus* it seems justified to refer all *Capra* remains provisionally to that species. As already detailed at the beginning of the present chapter, the species of *Capra* thus far identified from Syrian and Palestine caves are *Capra libanotica*, *Capra nubiana* (syn. *sinaitica*), *Capra ibex*, and *Capra hircus*, the last-mentioned apparently confined to the Natufian. The el-Khiam horn cores (Natufian) described and figured by Vaufray (1951, p. 215, pl. XX fig. 3) as *Capra hircus* are smaller than those from Ksâr'Akil, measuring 32 by 21 or 22 mm at base as opposed to 35-38 mm anteroposteriorly, and 24-29 mm transversely in the Ksâr'Akil specimens. Moreover, they appear to taper more rapidly toward their tips than do the Ksâr'Akil specimens. Both *Capra libanotica* and (recent) *Capra nubiana* have the *ibex* form of horn core, flattened externally rather than internally, without an anterior edge, and also without edges apically, as described from Syrian caves by Fritsch (1893, p. 26) and from Mugharet ez-Zuttiyeh by Bate (1927b, p. 46). These characters obtain in none of the specimens of horn cores from Ksâr'Akil, the only species of which they give evidence being *Capra aegagrus*.

Capra aegagrus, then, is a very common animal at Ksâr'Akil; it occurs in greater numbers than any other species at the site, living or extinct, with

Dama mesopotamica as the sole exception. It is present at all levels except XIII, XIV, and XXIX A, which is undoubtedly accidental as very few specimens even of *Dama* (from 2 to 13) have been obtained from just these levels. The relative frequency of occurrence is much the same throughout the Ksâr'Akil sequence. It is only in levels XXVI A to XXIX B that the number of *Capra* specimens is less than one-tenth that of *Dama* specimens; in general *Dama* is one and one-half to three times as abundant as is *Capra*.

It will be remembered that at levels XXVI A to XXIX B both *Rhinoceros* and *Bos* appear in great numbers. At these levels *Bos* is four times more abundantly represented by specimens than is *Capra*, while in general *Capra* outnumbers *Bos* six to one at least. These facts do not seem to be wholly unrelated, and in all probability are indicative of a change in food choice, the preference for food being temporarily given to *Bos* and *Rhinoceros* rather than to *Capra*.

Most of the fossil teeth of *Capra aegagrus* are larger than those of a recent male in the Leiden Museum (cat. ost. b), which agree in size with those of a male from Iran recorded by Goodwin (1940, p. 16). The measurements are presented in tables 23 and 24. The variation in length of the

TABLE 23
Measurements of upper teeth of *Capra aegagrus* Erxleben

	Length P ² -M ³	Length M ¹⁻³
Leiden Museum, cat. ost. b	75	51
Ksâr'Akil, 3.00-3.10, E5, F 5	85	57
3.80-3.90, E5, F 5	—	53
9.75-10.00, F5	—	50
10.70-11.00, F5	—	52
11.00-11.50, E5	83	55
12.40-12.90, F5	—	49
14.30-14.65, E5	—	49
14.30-14.65, E5	—	58
level I, A-C	—	55
II, E4	—	58
VIII, F2-4 (6.24)	78	51
XVII, F3, 10.90	—	52
XX, F4, 12.65	—	53

tooth series depends on the individual age of the specimens; there is much difference in the length M¹⁻³ between a young adult and an aged individual, as appears from the two specimens of 14.30-14.65 m, E5.

As stated by Haas (1952, p. 45): "The numerous remains of *Capra* also

TABLE 24

Measurements of lower teeth of *Capra aegagrus* Erxleben

	Length P ₂ -M ₃	Length M _{1,3}
Leiden Museum, cat. ost. b	75	51
Ksâr'Akil, 3.00-3.10, E ₅ , F ₅	—	58
10.70-11.00, F ₅	—	53
level V, F ₃₋₆	—	56
VI, F ₃₋₄	—	55
VIII, E ₄ , F ₄	76	51
IX, E ₄ , F ₄ , 8.10	—	57
XVII, E ₄ , 11.05	82	60

present some difficulty. The only surviving wild goat of the country" (Palestine: *Capra nubiana*) "is restricted to the most arid mountains around the Dead Sea and to the southern desert, but other species, now extinct, may have existed in the Mediterranean woodland, which in some parts of the Eastern Mediterranean is still the habitat of the wild goat *Capra aegagrus*. The occurrence of goats, therefore, does not necessarily indicate arid conditions". In Asia Minor *Capra aegagrus* extends from the mountain-summits to (in some districts) the sea level (Danford and Alston, 1877, p. 276).

CAVE OF ANTELIAS (MUGHARET EL-BILENI) AND ABRI BERGY

As stated by Ewing (in Braidwood, Wright and Ewing, 1951, p. 122) the detailed chronological picture at Ksâr'Akil has also been supplemented by material from several minor excavations practiced at neighbouring sites. With the collection from Ksâr'Akil sent to me there are a few boxes labelled "Cave of Antelias (Mugharet el-Bileni)", and a few marked "Abri Bergy". The fauna of these two sites has the usual aspect: mostly *Dama*, *Capra*, and *Capreolus*, while *Sus* is rare. In addition, there is a single specimen of *Gazella* in the Mugharet el-Bileni collection, and a single specimen of *Ursus* in that of Abri Bergy.

GENERAL ACCOUNTS OF THE SUCCESSIVE MAMMALIAN ASSEMBLAGES

It is intended here to present, in a very general way, a picture of the various assemblages succeeding each other at Ksâr'Akil. The lithic correla-

tions have not yet been worked out, but the fauna may be conveniently grouped as follows:

levels I-V

levels VI-IX
3.00-7.40 m, E5, F5

levels X-XVIII
7.40-11.50 m, E5, F5

levels XIX-XXV
11.50-15.40 m, E5, F3, F5

levels XXVI A — XXIX B

levels XXX — XXXVI

TABLE 25

Relative frequency of occurrence of cervids and bovids

	Total numbers						total
	<i>Dama</i>	<i>Gazella</i>	<i>Capreolus</i>	<i>Capra</i>	<i>Cervus</i>	<i>Bos</i>	
level I-V	984	25	280	550	2	15	1856
level VI-IX	1402	64	991	805	5	1	3268
3.00-7.40 m	442	27	425	302	1	—	1197
level X-XVIII	681	50	323	314	—	25	1393
7.40-11.50 m	1256	86	647	507	1	67	2564
level XIX-XXV	586	16	48	299	47	53	1049
11.50-15.40 m	1872	36	124	723	114	81	2950
XXVI A-XXIX B	1989	13	42	129	7	539	2719
XXX-XXXVI	319	3	14	93	—	12	441
							17437

	Percentages						total
	<i>Dama</i>	<i>Gazella</i>	<i>Capreolus</i>	<i>Capra</i>	<i>Cervus</i>	<i>Bos</i>	
level I-V	53	1	15	30	0	1	100
level VI-IX	43	2	30	25	0	0	100
3.00-7.40 m	37	2	36	25	0	0	100
level X-XVIII	49	4	23	22	0	2	100
7.40-11.50 m	49	3	25	20	0	3	100
level XIX-XXV	56	2	4	29	4	5	100
11.50-15.40 m	63	1	4	25	4	3	100
XXVI A-XXIX B	73	0	2	5	0	20	100
XXX-XXXVI	72	0	4	21	0	3	100

The three sections from squares E₅, F₃, and F₅ the depth of which is indicated in meters appear to correspond with levels VI-IX, X-XVIII, and XIX-XXV of the remaining squares, respectively, and will be considered together with these respective lots, to the effect that six sections remain to be described. As already stated under the head of *Dama mesopotamica* counts have been made of all the specimens of cervids and bovids, and the proportional quantities of these forms are presented in table 25, both the actual numbers of specimens counted, and the percentages of the whole of cervid and bovid specimens in every assemblage contributed by each of the species.

Levels XXX — XXXVI

In the bottom section of the Ksâr'Akil sequence there are fewer specimens than in any other section. *Dama mesopotamica* is by far the best represented species, the specimens being three times more abundant than those of *Capra aegagrus*, and twenty times more abundant than those of *Capreolus* and *Bos*. There are a few specimens of *Gazella*, of *Sus*, and of some of the larger carnivores: *Canis lupus*, *Ursus arctos*, and *Crocuta crocuta*. Among the smaller mammals, *Microtus*, *Spalax*, and *Apodemus* are represented by a small number of specimens each.

Levels XXVI A — XXIX B

This section is mainly characterized by *Rhinoceros* and *Bos*, which are more abundant than in any other section, *Rhinoceros* making its first and only appearance at the Ksâr'Akil site. Noticeable is the small number of specimens of *Capra*, which is less than one-tenth that of *Dama*. *Bos* is over four times more abundant than is *Capra*, whilst in other sections *Capra* is at least six times more abundant than is *Bos*.

Somehow *Rhinoceros* and *Bos* must have replaced a good deal of *Capra* on the Palaeolithic menu during the time span represented by levels XXVI A to XXIX B.

Dama mesopotamica, the best represented species, is almost four times more abundant than is *Bos*. *Gazella*, *Capreolus*, and *Sus* are rare, while *Cervus elaphus* appears on the scene for the first time.

A second species of *Apodemus* is added to the one already present in the bottom section; *Microtus* and *Spalax* continue to be present, and the sole *Crocidura* specimen obtained at Ksâr'Akil is also from this section. *Hystrix* shows up for the first time, and *Vulpes* is added to the stock of carnivores already present in the bottom section.

Levels XIX — XXV

11.50-15.40 m

In this section we notice *Gazella* and *Capreolus* becoming slightly more numerous. *Dama*, as always, is in the lead. The numbers of specimens of *Bos*, however, have declined sharply to less than one-tenth of those of *Dama*, and *Capra* has retaken the position of the second best represented species of the assemblage, its numbers of specimens being about one-half of those of *Dama*.

Cervus elaphus is better represented than in any other section; in numbers of specimens it almost equals *Capreolus*, four per cent. of the total number of cervid and bovid specimens.

None of the small rodents (*Microtus*, *Spalax*, and *Apodemus*) are represented, only *Hystrix* remains.

The carnivores of the earlier sections (*Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, and *Crocota crocuta*) continue to be present, but this stock is augmented by four species: *Meles meles*, *Felis silvestris*, *Felis chaus*, and *Felis pardus*.

One of the few specimens of *Equus* is from the present section; *Rhinoceros* has vanished. *Sus* is present but, as always, in small numbers only.

Levels X — XVIII

7.40-11.50 m

Capreolus and *Gazella* continue to increase in numbers, the former to such an extent that it exceeds *Capra* in quantity, and becomes the second best represented species, after *Dama*, the remains of which make up one-half of the total number of cervid and bovid specimens. *Bos* is on the decline, contributing only 2-3 per cent. of the total. An extremely rare large antelope (? *Alcelaphus*) appears on the scene.

All the rodents of the earlier sections are absent, but we find some remains of the tree squirrel, *Sciurus*.

Among the carnivores we notice the first remains of *Martes*, while *Crocota* appears to have disappeared forever, and *Meles* is temporarily absent. The more steady elements among the carnivores, *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Felis silvestris*, and also *Felis pardus*, carry on.

Levels VI — IX

3.00-7.40 m

Bos is almost entirely absent, and *Cervus* is likewise extremely rare. *Capra* and *Capreolus* dominate the scene, their numbers taken together ex-

ceeding those of *Dama*. The number of *Capreolus* specimens almost equals that of *Dama* in 3.00-7.40 m, while *Capra* is slightly less well represented than is *Capreolus*, making up just one-fourth of the total number of cervid and bovid specimens. *Gazella* remains in the fourth position, with two per cent.

As the only representative of the rodents one specimen of *Sciurus* has been obtained.

The carnivores are the same as those of the next older section but for *Meles*, which appears once again, and *Felis chaus*, which has gone.

Equus is noticed once more, and so is the large antelope, (?) *Alcelaphus*. *Sus* remains a constant, however rare, element.

Levels I — V

In the top section of the Ksâr'Akil sequence both *Capreolus* and *Gazella* are decidedly on the decline, while *Bos* is somewhat more numerous than it has been in the preceding section, contributing one per cent. of the total of cervid and bovid specimens. *Capra* has retaken the second position, after *Dama*, with thirty per cent. of the total of cervid and bovid specimens, *Capreolus* being third with fifteen per cent. *Cervus* is as rare as it has been in the two preceding sections.

Remains of rodents have not been found in the top section.

Several of the carnivores are absent, such as *Canis lupus*, *Martes cf. martes*, *Meles meles*, and *Felis pardus*, as well as *Crocuta crocuta*, and *Felis chaus*, which were already missing in the preceding section. The only addition to the carnivore stock is *Canis aureus*, the sole specimen of which is from level I. *Vulpes vulpes*, *Ursus arctos*, and *Felis silvestris* show up as they did through most of the Ksâr'Akil sequence.

Such is the general picture of the various assemblages that succeed each other at Ksâr'Akil. While the larger mammals undoubtedly were hunted and transported to the rock shelter by Man, the insectivore and the small rodents may have been deposited among the refuse left by Man in the form of owl pellets, which, perhaps, explains their rarity, no "microfauna" (except one or two *Sciurus* jaws) having been collected in levels higher than XXVI A.

As already explained under the head of *Dama mesopotamica* no *Gazella-Dama* graph will be found in the present work, the quantity of *Gazella* being so small as compared with that of *Dama* that at no point in the whole sequence of Ksâr'Akil deposits *Gazella* ever outnumbers *Dama*.

While at the Wady el-Mughara caves it was found that *Capra* is rare, and *Gazella* occurs in greater numbers than any other species at the sites

except *Dama mesopotamica*, exactly the opposite situation obtains at Ksâr' Akil: *Capra*, with 3722 specimens identified, is the second best represented element to the Ksâr' Akil assemblage, after *Dama* with 9531 specimens. *Gazella* remains at Ksâr' Akil number only 320. It has already been stated under *Capra aegagrus* that this genus would be of no use as an indicator of climatic conditions.

Capreolus was found to be the third commonest species of the Ksâr' Akil assemblage, with 2894 specimens identified. This figure stands in remarkable contrast to that of 40 specimens obtained at Mount Carmel, the number of *Dama* specimens obtained at the Mount Carmel sites being over ten thousand, a figure of the same order as that of the *Dama* specimens found at Ksâr' Akil (9531).

The portion of the Mount Carmel sequence roughly equivalent to that of Ksâr' Akil is Tabûn B to M. Wad B. The Mount Carmel sequence is by no means uninterrupted as was originally thought to be the case: there are erosional as well as cultural gaps (Howell, 1959, p. 8). As shown in the *Gazella-Dama* graph (Bate, 1937b, p. 141) in this portion of the Mount Carmel succession of deposits the relative frequency of *Gazella* and *Dama* appears to fluctuate, *Gazella* prevailing at M. Wad F, E, and C, whereas *Dama* prevails at Tabûn B (? M. Wad G) and M. Wad D. *Capra* and *Capreolus* remain rare throughout.

We have seen above how entirely different is the aspect of the Ksâr' Akil sequence, with *Dama* prevailing throughout, while *Gazella* is always rare, and *Capra* and *Capreolus* are common. If the variations in proportional quantities of *Gazella* and *Dama* (indicating dry, and moist habitats, respectively) would be the result of fluctuations in climate we should have found similar changes in relative frequency of *Gazella* and *Dama* at Ksâr' Akil. The fact that we did not, of course, throws severe doubt on the value of this kind of paleontological evidence for climatic fluctuations. One is led to seriously doubt if there is any point in correlating the maxima of *Dama* with some or other peaks of glacial advance in Europe as done by Zeuner (1945, p. 199) and Vaufreys (1939, p. 402). I believe it is only correct to say that what we see reflected in the refuse parts is accessibility of game, and food choice of the men who occupied the rock shelter, rather than climatic changes the evidence for which is geological.

Cervus and *Bos* are generally rare at Mount Carmel as they are at Ksâr' Akil. Apart from the difference in relative frequency of *Gazella*, *Capra*, *Dama*, and *Capreolus* there is no significant difference between the assemblage of Ksâr' Akil and that of the Upper Levalloiso-Mousterian and Aurignacian of Mount Carmel. These two assemblages have twenty mam-

malian forms in common. Of the Ksâr'Akil species, *Crocidura* spec., *Microtus* cf. *machintoni*, *Apodemus* cf. *mystacinus*, *Canis aureus*, and the rhinoceros (*Dicerorhinus merckii*) do not occur in the equivalent but only in older cultural deposits of Mount Carmel (Upper Acheulean and Lower Levalloiso-Mousterian), while *Felis chaus* does not occur at Mount Carmel at all.

On the other hand, the following species identified by Miss Bate from the Upper Levalloiso-Mousterian and Aurignacian of Mount Carmel do not occur at Ksâr'Akil: *Erinaceus carmelitus*, *Vormela* cf. *peregusna*, *Lepus* spec., *Equus hemionus*, *Equus* cf. *hydruntinus*, and *Procavia* cf. *syriaca*. Gerbillinae have not been obtained from Ksâr'Akil either; these are typically inhabitants of dry and desert country, and are rare even at Mount Carmel.

At Ksâr'Akil moist habitats seem to have been the prevalent hunting grounds. We have noticed an outbreak of *Rhinoceros* and *Bos*, of animals that require considerable areas of wood or jungle with damp ground, at levels XXVI A to XXIX B. This may be interpreted as the result of environmental changes having taken place, but it may as well be attributed to deliberate choice on the part of the Palaeolithic hunters. The steady association of *Gazella* and *Dama* both at Mount Carmel and at Ksâr'Akil indicates that the spoils of the chase have always been brought in from areas with different biotopes existing side by side. Much as climate and environment may have varied in the course of the Late Pleistocene in the Levant, both fallow deer and gazelle remained accessible to the hunters throughout. What we have been sampling in the present study is not the climate and environment, but the history of the Palaeolithic menu at the rock shelter of Ksâr'Akil.

LITERATURE CITED

- AHARONI, B., 1932. Die Muriden von Palästina und Syrien. Zeitschr. f. Säugetierk., vol. 7, pp. 166-240, pl. XIX, 1 fig.
- AHARONI, J., 1930. Die Säugetiere Palästinas. Ibid., vol. 5, pp. 327-343.
- ALLEN, G. M., 1915. Mammals obtained by the Phillips Palestine Expedition. Bull. Mus. Comp. Zool., vol. 59, pp. 1-14.
- ALLEN, J. A., 1920. Note on Gueldenstaedt's names of certain species of Felidae. Journ. Mamm., vol. 1, pp. 90-91.
- ARAMBOURG, C., 1958. Les gros mammifères des couches tayaciennes, in: La Grotte de Fontéchevade, part 3. Arch. Inst. Pal. Humaine, Mém. 29, pp. 185-229, pls. XI-XIV, figs. 56-65.
- BATE, D. M. A., 1927a. On the animal remains obtained from the Mugharet-el-Emireh in 1925, in F. TURVILLE-PETRE, Researches in Prehistoric Galilee 1925-1926. Brit. School of Arch. in Jerusalem, London, pp. 9-13, 4 figs.
- , 1927b. On the animal remains obtained from the Mugharet-el-Zuttiyeh in 1925 and 1926. Ibid., pp. 27-52, pl. XVII, 10 figs.
- , 1928. Excavation of a Mousterian rock-shelter at Devil's Tower, Gibraltar. The animal remains. Journ. Roy. Anthropol. Inst., vol. 58, pp. 92-110, figs. 24-25.

- BATE, D. M. A., 1937a. New Pleistocene Mammals from Palestine. *Ann. Mag. Nat. Hist.*, ser. 10, vol. 20, pp. 397-400.
- , 1937b. Palaeontology: The fossil fauna of the Wady el-Mughara caves, in *The Stone Age of Mount Carmel, Excavations at the Wady El-Mughara*. Oxford (Clarendon Press), vol. 1, part 2, pp. 137-233, 8 figs.
- , 1940. The fossil antelopes of Palestine in Natufian (Mesolithic) times, with descriptions of new species. *Geol. Mag.*, vol. 77, pp. 418-443, 9 figs.
- , 1942a. Pleistocene Murinae from Palestine. *Ann. Mag. Nat. Hist.*, ser. 11, vol. 9, pp. 465-486, 5 figs.
- , 1942b. The fossil mammals of Shukbah, in D. A. E. GARROD, *Excavations at the Cave of Shukbah, Palestine, 1928*. *Proc. Prehist. Soc.*, new series, vol. 8, pp. 15-20.
- , 1945. Note on small mammals from the Lebanon mountains, Syria. *Ann. Mag. Nat. Hist.*, ser. 11, vol. 12, pp. 141-158, 2 figs.
- BERCKHEMER, F., 1927. *Buffelus murrensis* n. sp. Ein diluvialer Büffelschädel von Steinheim a. d. Murr. *Jahresh. Ver. vat. Naturk. Württ.*, vol. 83, pp. 146-158, pl. IV, 5 figs.
- BERNSEN, J. J. A., 1927. The geology of the Teglian clay and its fossil remains of Rhinoceros. 's-Hertogenbosch (C. N. Teulings), 108 pp., 12 pls.
- BODENHEIMER, F. S., 1935. *Animal life in Palestine. An introduction to the problems of animal ecology and zoogeography*. Jerusalem, 506 pp., 70 pls., 77 figs.
- , 1937. *Prodromus faunae Palaestinae. Essai sur les éléments zoogéographiques et historiques du Sud-ouest du sous-règne Paléarctique*. *Mém. Inst. Egypte*, vol. 33, pp. I-III, 1-286.
- , 1949. Problems of vole populations in the Middle East. Report on the population dynamics of the Levant vole (*Microtus guentheri* D. et A.). Jerusalem (The Research Council of Israel), 77 pp., 8 figs.
- BÖTTGER, O., 1879. Reptilien und Amphibien aus Syrien. *Ber. Senckenb. Naturf. Ges.*, pp. 57-84.
- BOULE, M., 1910. *Les Grottes de Grimaldi (Baoussé-Roussé)*, vol. 1, fasc. 3, *Géologie et Paléontologie (Suite)*, pp. 157-236, pls. XIV-XXIX, figs. 19-33.
- , 1919. *Ibid.*, vol. 1, fasc. 4, *Géologie et Paléontologie (Fin)*, pp. 237-357, pls. XXX-XLI, figs. 34-48.
- BOULENGER, G. A., 1889. *Catalogue of the Chelonians, Rhynchocephalians, and Crocodiles in the British Museum (Natural History)*. New edition. London, X + 311 pp., pls. I-VI, 73 figs.
- BRAIDWOOD, R. J., H. E. WRIGHT, and J. F. EWING, 1951. *Ksâr'Akil: its archeological sequence and geological setting*. *Journ. Near Eastern Studies*, vol. 10, pp. 113-122, 3 figs.
- COLYER, F., 1936. *Variations and diseases of the teeth of animals*. London, VIII + 750 pp., 1007 figs.
- COUTURIER, M. A. J., 1954. *L'Ours brun. Ursus arctos L.* Grenoble, 904 pp., 82 pls., 49 figs.
- DANFORD, C. G., and E. R. ALSTON, 1877-1880. On the mammals of Asia Minor. *Proc. Zool. Soc. London*, 1877, pp. 270-281, 1 pl.; *ibid.*, 1880, pp. 50-64, 1 pl., 7 figs.
- DAWKINS, W. B., and W. A. SANFORD, 1866-1872. *The British Pleistocene Mammalia. Part I, British Pleistocene Felidae*. London (Palaeontographical Society), L + 194 pp., 25 pls.
- DAY, A. E., 1926. *The rock shelter of Ksâr'Akil. Al-Kulliyyah*, issued by the American University of Beirut, vol. 12, pp. 91-97, 3 figs.
- DEGERBØL, M., 1933. *Danmarks Pattedyr i Fortiden i Sammenligning med recente Former. I. Vidensk. Medd. Dansk. naturh. Foren.*, vol. 96, pp. 357-641, pls. XII-XXIV, 21 figs.

- DUBOIS, A., and H. G. STEHLIN, 1932-1933. La Grotte de Cotencher, station moustérienne. *Mém. Soc. Pal. Suisse*, vol. 52-53, pp. 1-292, 15 pls., 37 figs.
- ELLERMAN, J. R., and T. C. S. MORRISON-SCOTT, 1951. Checklist of Palaearctic and Indian Mammals, 1758 to 1946. London (British Museum), 810 pp., map.
- EWING, J. F., 1947. Preliminary note on the excavations at the Palaeolithic site of Ksâr'Akil, Republic of Lebanon. *Antiquity*, no. 84, pp. 186-196, pls. III-IV, 2 figs.
- , 1948. Ksâr'Akil in 1948. *Biblica*, vol. 29, pp. 272-278, pls. I-III.
- , 1949. The treasures of Ksâr'Akil. *Thought*, Fordham Univ. Quarterly, vol. 24, no. 92, pp. 255-288.
- , 1960. Human types and prehistoric cultures at Ksâr'Akil, Lebanon. Selected Papers Fifth Int. Congr. Anthropol. Ethnol. Sci. Philadelphia, 1956, Philadelphia (Univ. of Penn. Press), pp. 535-539.
- FALCONER, H., 1868. *Palaeontological Memoirs and Notes* (edited by C. MURCHISON), London (R. Hardwicke), 2 vols.
- FLEISCH, H., 1955. Le Rhinocéros de Merck dans la grotte levalloiso-moustérienne de Ras el-Kelb. *L'Anthropologie*, vol. 59, pp. 168-170.
- FLOWER, S. S., 1932. Notes on the recent mammals of Egypt, with a list of the species recorded from that kingdom. *Proc. Zool. Soc. London*, 1932, pp. 369-450.
- , 1933. Notes on the recent reptiles and amphibians of Egypt, with a list of the species recorded from that kingdom. *Ibid.*, 1933, pp. 735-851, 1 fig., map.
- FRAAS, O., 1878. *Geologisches aus dem Libanon*. Jahreshefte Naturk. Württemberg, vol. 34, pp. 257-391, pls. III-VIII.
- FRITSCH, K. VON, 1893. Die Funde des Herrn Pater Gottfried ZUMOFFEN in den Höhlen am Fusse des Libanon. *Abh. naturf. Ges. Halle*, vol. 19, fasc. 2, pp. 1-41, pls. V-VIII, 1 fig.
- GARROD, D. A. E., 1953. The relations between South-west Asia and Europe in the later Palaeolithic age. *Cahiers d'Histoire Mondiale*, vol. 1, pp. 13-38, 1 fig.
- , 1958. The ancient shore-lines of the Lebanon, and the dating of Mt. Carmel. *Hundert Jahre Neanderthaler*, Utrecht (Kemink & Zn.), pp. 182-184, pl. XLVI.
- , 1961. Excavation of a Palaeolithic rock shelter at Adlun, Lebanon, — 1958. *Bull. Mus. Beyrouth* (in the press).
- GOODWIN, G. G., 1940. Mammals collected by the Legendre 1938 Iran Expedition. *Amer. Mus. Novit.*, no. 1082, pp. 1-17.
- HAAS, G., 1951. Remarques sur la microfaune de mammifères de la Grotte d'Oumm-Qatafa, in *Le Paléolithique et le Mésolithique du Désert de Judée*, by R. NEUVILLE et alii. *Arch. Inst. Pal. Humaine*, *Mém.* 24, pp. 218-233, figs. 75-78.
- , 1952. The fauna of layer B of the Abu Usba cave, in M. STEKELIS and G. HAAS, *The Abu Usba cave (Mount Carmel)*. *Israel Exploration Journ.*, vol. 2, pp. 35-47, pls. 1-4.
- HALLER, J., 1946. Notes de préhistoire phénicienne. L'abri de Abou-Halka (Tripoli). *Bull. Mus. Beyrouth*, vol. 6, pp. 1-19, pls. I-IV, 4 figs.
- HALTENORTH, T., 1936. Die verwandtschaftliche Stellung der Grosskatzen zueinander. I. Beschreibung der Schädelknochen. *Zeitschr. f. Säugetierk.*, vol. 11, pp. 32-105, 307 figs. on pls. 21-46.
- HATT, R. T., 1959. The mammals of Iraq. *Misc. Publ. Mus. Zool. Univ. Michigan*, no. 106, pp. 1-113, 6 pls.
- HELBING, H., 1935. Zur Feststellung der maximalen Grösse von *Felis silvestris* Briss. *Eclogae Geol. Helv.*, vol. 28, pp. 577-580, 3 figs.
- HELLER, F., 1939. Die Bärenzähne aus den Ablagerungen der ehemaligen Neckarschlinge bei Eberbach im Odenwald. *Sitzungsber. Heidelb. Akad. Wiss., Math-nat. Kl.*, 1938, part 7, 57 pp., 1 pl., 5 tables.
- HOOIJER, D. A., 1946a. Prehistoric and fossil rhinoceroses from the Malay Archipelago and India. *Zool. Med. Museum Leiden*, vol. 26, pp. 1-138, pls. I-X, 1 fig.

- HOOIJER, D. A., 1946b. Some remarks on recent, prehistoric, and fossil porcupines from the Malay Archipelago. *Ibid.*, vol. 26, pp. 251-267, 20 figs.
- , 1947. Pleistocene remains of *Panthera tigris* (Linnaeus) subspecies from Wansien, Szechwan, China, compared with fossil and recent tigers from other localities. *Amer. Mus. Novit.*, no. 1346, 17 pp., 3 figs.
- , 1952. The cave hyaena, *Crocota crocuta spelaea* (Goldfuss), new to the Pleistocene fauna of the Netherlands. *Geol. & Mijnb.*, new series, vol. 14, pp. 385-388, 4 figs.
- , 1958a. An Early Pleistocene mammalian fauna from Bethlehem. *Bull. Brit. Mus. (Nat. Hist.)*, Geol., vol. 3, no. 8, pp. 265-292, pls. 32-35.
- , 1958b. Fossil Bovidae from the Malay Archipelago and the Punjab. *Zool. Verh. Museum Leiden*, no. 38, 112 pp., 9 pls.
- , 1960a. Fossil mammals from Jisr Banat Yaqub, south of Lake Huleh, Israel. *Bull. Research Council of Israel*, vol. 8G, pp. 177-199, 4 pls.
- , 1960b. A *Stegodon* from Israel. *Ibid.*, vol. 9G, pp. 104-108, 1 pl.
- HOPWOOD, A. T., 1936. The former distribution of caballine and zebrine horses in Europe and Asia. *Proc. Zool. Soc. London*, 1936, pp. 897-912, pls. I-II, 2 figs.
- HOWELL, F. C., 1959. Upper Pleistocene stratigraphy and Early Man in the Levant. *Proc. Amer. Phil. Soc. Philadelphia*, vol. 103, pp. 1-65, 34 figs.
- KORMOS, T., 1914. Drei neue Raubtiere aus den präglazial-Schichten des Somlyóhegy bei Püspökfürdő. *Mitt. Jahrb. k. ung. geol. Reichsanst.*, vol. 22, pp. 223-247, pl. VIII.
- KRETZOR, M., 1942. Präokkupierte und durch ältere zu ersetzende Säugetiernamen. *Földtani Közlöny*, vol. 72, pp. 345-349.
- LÜTTSCHWAGER, H., 1950. Kritische Bemerkungen zur Unterscheidung der Gattung *Bison* und *Bos* an dem Astragalus-Knochen. *Anat. Anz.*, vol. 97, pp. 385-387, 3 figs.
- MCGREW, P. O., 1944. An Early Pleistocene (Blancan) Fauna from Nebraska. *Field Mus. Nat. Hist., Geol. Ser.*, vol. 9, no. 2, pp. 33-66, figs. 14-22.
- MEINERTZHAGEN, R., 1954. Birds of Arabia. *Edinburgh (Oliver & Boyd)*, XIII + 624 pp., XIX + 9 pls., 53 figs., 35 maps.
- MERTENS, R., and L. MÜLLER, 1940. Die Amphibien und Reptilien Europas (Zweite Liste, nach dem Stand vom 1. Januar 1940). *Abh. Senckenb. naturf. Ges.*, no. 451, pp. 1-56.
- MILLER, G. S., 1903. Description of two new mole rats. *Proc. Biol. Soc. Washington*, vol. 16, pp. 161-164.
- , 1912a. Variation in the skull and horns of the *Isabella gazelle*. *Proc. U. S. Nat. Mus.*, vol. 42, pp. 171-172, pl. 15.
- , 1912b. Catalogue of the mammals of Western Europe (Europe exclusive of Russia) in the collection of the British Museum. *London (British Museum)*, XV + 1019 pp., 213 figs.
- MORRISON-SCOTT, T. C. S., 1939. Some Arabian mammals collected by Mr. H. St. J. B. PHILBY, C.I.E. *Novit. Zool.*, vol. 41, pp. 181-211, pl. VI, figs. 125-127.
- MOTTL, M., 1940. Die Fauna der Mussolini-Höhle. *Geol. Hungarica*, ser. Pal., fasc. 14, pp. 1-116, pls. I-II, 56 figs.
- NACHTSHEIM, H., 1949. Vom Wildtier zum Haustier. *Berlin/Hamburg (Paul Parey)*, 2nd ed., 123 pp., 72 figs.
- NEHRING, A., 1902a. *Mustela foina syriaca* n. subsp. und *Mustela palaesyriaca* n. sp. *Sitzungsber. Ges. naturf. Freunde Berlin*, no. 7/8, pp. 145-147.
- , 1902b. Nachträgliche Bemerkungen über die Sumpfluchse von Palästina. *Ibid.*, pp. 147-148.
- NEUHÄUSER, G., 1936. Die Muriden von Kleinasien. *Zeitschr. f. Säugetierk.*, vol. 11, pp. 161-236, pl. LVII (map).
- PEI, W. C., 1934. On the Carnivora from locality 1 of Choukoutien. *Pal. Sinica*, ser. C, vol. 8, fasc. 1, 166 pp., 24 pls., 47 figs.

- PEI, W. C., 1940. The Upper Cave fauna of Choukoutien. *Ibid.*, new series, C, no. 10 (whole series no. 125), 84 pp., 8 pls., 38 figs.
- POCOCK, R. I., 1909. On the skulls of Leopards. *Proc. Zool. Soc. London*, 1909, pp. 204-209, figs. 22-23.
- , 1930. The panthers and ounces of Asia. *Journ. Bombay Nat. Hist. Soc.*, vol. 34, pp. 64-82 and 307-336, pls. I-XIII.
- , 1932a. The Leopards of Africa. *Proc. Zool. Soc. London*, 1932, pp. 543-591, pls. I-IV, 9 figs.
- , 1932b. The black and brown bears of Europe and Asia. *Journ. Bombay Nat. Hist. Soc.*, vol. 35, pp. 771-823, 11 figs.; vol. 36, pp. 101-138, 2 pls., 12 figs.
- , 1939. The Fauna of British India including Ceylon and Burma, vol. 1, Primates and Carnivora (in part), families Felidae and Viverridae. London (Taylor & Francis), XXXIII + 463 pp., 31 pls., 106 figs.
- REED, C. A., 1959. Animal domestication in the prehistoric Near East. *Science*, vol. 130, no. 3389 (December 11), pp. 1629-1639, 3 figs.
- REYNOLDS, S. H., 1933. A Monograph on the British Pleistocene Mammalia, vol. 3, part 4, The Red Deer, Reindeer, and Roe. *Palaeontographical Soc.*, London, 46 pp., 3 pls.
- RODE, P., and R. DIDIER, 1944. Différences entre la tête osseuse de la marte et celle de la foine. *Mammalia*, vol. 8, pp. 127-132, 4 figs.
- RÜGER, L., 1928. Beiträge zur Kenntnis der altdiluvialen Fauna von Mauer an der Elsenz und Eberbach am Neckar. *Carnivora et Rodentia. Geol. Pal. Abh.*, new series, vol. 16, pp. 197-232, 3 pls., 8 figs.
- RÜTIMEYER, L., 1866-1867. Versuch einer natürlichen Geschichte des Rindes in seinen Beziehungen zu den Wiederkäuern im Allgemeinen. *Neue Denkschr. Schweiz. naturf. Ges.*, vol. 22, pp. 1-102, pls. I-II, 1866; vol. 23, pp. 1-175, pls. I-IV, 1867.
- SCHAEFER, H., 1932. Die Artbestimmung der deutschen Anuren nach dem Skelet. *Zeitschr. f. Anat. u. Entw. Gesch.*, vol. 97, pp. 767-779, 23 figs.
- SCHAUB, S., 1938. Tertiäre und quartäre Murinae. *Abh. Schweiz. Pal. Ges.*, vol. 61, pp. 1-38, 1 pl., 18 figs.
- SCHERTZ, E., 1936. Zur Unterscheidung von *Bison priscus* Boj. und *Bos primigenius* Boj. an Metapodien und Astragalus, nebst Bemerkungen über einige diluviale Fundstellen. *Senckenbergiana*, vol. 18, pp. 37-71, 17 figs.
- , 1937. Ein neuer Wasserbüffel aus dem Diluvium mitteldeutschlands (*Buffelus wanckeli* nov. spec.). *Pal. Zeitschr.*, vol. 19, pp. 57-72, pls. 3-4.
- SCHROEDER, H., 1903. Die Wirbelthier-Fauna des Mosbacher Sandes. I. Gattung *Rhinoceros*. *Abh. k. preuss. Geol. Landesanst.*, new series, vol. 18, pp. 1-143, (atlas) pls. I-XIV.
- , 1930. Über *Rhinoceros mercki* und seine nord- und mitteldeutschen Fundstellen. *Ibid.*, new series, vol. 124, 111 pp., 26 pls., 1 fig.
- SCHWARZ, E., 1935. On Ibex and Wild Goat. *Ann. Mag. Nat. Hist.*, ser. 10, vol. 16, pp. 433-437.
- SIEBENROCK, F., 1909. Synopsis der rezenten Schildkröten, mit Berücksichtigung der in historischer Zeit ausgestorbenen Arten. *Zool. Jahrb., Suppl.* no. 10, pp. 427-618.
- SMITH, M. A., 1931. The Fauna of British India including Ceylon and Burma, Reptilia and Amphibia, vol. 1, Loricata, Testudines. London (Taylor & Francis), XXVIII + 185 pp., 2 pls., 42 figs., map.
- TEILHARD DE CHARDIN, P., 1938. The fossils from locality 12 of Choukoutien. *Pal. Sinica*, new series, C, no. 5 (whole series no. 114), 47 pp., 1 pl., 36 figs.
- , and W. C. PEI, 1941. The fossil mammals of locality 13 of Choukoutien. *Ibid.*, new series, C, no. 11 (whole series no. 126), 106 pp., 6 pls., 78 figs.
- THOMAS, O., 1920. A new shrew and two new foxes from Asia Minor and Palestine. *Ann. Mag. Nat. Hist.* ser. 9, vol. 5, pp. 119-122.
- TRISTRAM, H. B., 1884. The Survey of Western Palestine. The fauna and flora of

- Palestine. London (Committee of the Palestine Exploration Fund), XXII + 455 pp., pls. I-XX.
- VAUFREY, R., 1931. L'Acheuléen supérieur de la Grotte d'Oumm-Qatafa (Palestine). IV. Paléontologie. *L'Anthropologie*, vol. 41, pp. 253-263, figs. 22-24.
- , 1939. Paléolithique et Mésolithique palestiniens. *Rev. Sci. Paris*, nos. 6-7, pp. 390-406, 15 figs.
- , 1951. Mammifères, in *Le Paléolithique et le Mésolithique du Désert de Judée*, by R. NEUVILLE et alii. *Arch. Inst. Pal. Humaine, Mém.* 24, pp. 198-217, pls. XVII-XX.
- WEBER, T., 1875. Thierknochen aus einer Höhle des Libanon. *Zeitschr. f. Ethnologie*, vol. 7, p. (25).
- WOODWARD, A. S., 1924. Some remarks on the Pleistocene Mammalia. *Essex Naturalist*, vol. 21, pp. 1-12, pls. 1-2.
- ZEUNER, F. E., 1945. The Pleistocene Period. Its climate, chronology and faunal successions. London (Ray Society), XII + 322 pp., 76 figs.
- , 1946. *Dating the Past. An introduction to Geochronology*. London (Methuen), XVIII + 444 pp., 24 pls., 103 figs.

EXPLANATION OF THE PLATES

PLATE I

Fig. 1. *Equus caballus* L. subsp., fragment of left mandibular ramus with P₂₋₃, Ksâr'Akil, 11.50-12.00 m, F5, crown view.

Fig. 2, *Gazella* cf. *dorcas* L., right horn core of male, Ksâr'Akil, 11.00-11.50 m, E5, lateral view.

Figs. 3-6, *Dicerorhinus merckii* (Jäger), crown views of upper molars from Ksâr'Akil; fig. 3, M¹⁻³ sin., associated, level XXVIII B, F4; fig. 4, DM² dext., level XXVII B, F5; fig. 5, P³ sin., level XXVII B, F4; fig. 6, M³ sin., level XXVIII A, F5.

All figures $\frac{3}{4}$ natural size.

PLATE II

Fig. 1, *Capra aegagrus* Erxleben, portion of frontal with horn cores, Ksâr'Akil, level XVII, E4 (11.05 m), front view.

Fig. 2, (?) *Alcelaphus* spec., M₃ sin., Ksâr'Akil, level VIII, E4, crown view.

Fig. 3, *Ursus arctos* L. subsp., left maxillary with C, P⁴, and M¹⁻² in situ, Ksâr'Akil, level XXVII B, E4, palatal view.

Figs. 4-7, *Sus scrofa* L. subsp., crown views of last molars from Ksâr'Akil; fig. 4, M₃ dext., level XXIII, F4; fig. 5, M₃ sin., level XXVII A, E4; fig. 6, M³ dext., 7.15-7.40 m, F5; fig. 7, M³ dext., level XXVIII B, F5.

Fig. 1, $\frac{2}{3}$ natural size; figs. 2-7, $\frac{3}{4}$ natural size.



