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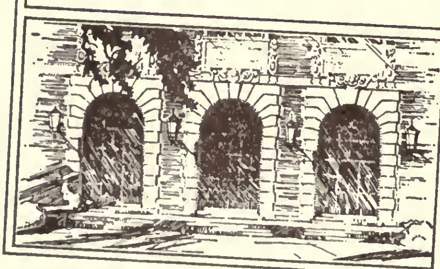

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FIELDIANA
Anthropology

Published by Field Museum of Natural History

Volume 63, No. 3 June 11, 1974

The Fauna from the Terminal Pleistocene of Palegawra Cave,

A Zarzian Occupation Site in Northeastern Iraq

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I. INTRODUCTION

Palegawra cave was one of many prehistoric archeological sites excavated in northeastern Iraq by members of the Iraq-Jarmo Project of the Oriental Institute, University of Chicago, during 1948, 1950-1951, and 1954-1955, under the direction of Dr. Robert J. Braidwood, University of Chicago. The research of the prehistoric cultures of the Pleistocene epoch was primarily under the direction of Dr. Bruce Howe of the Peabody Museum, Harvard University. During his periods of research in Iraq, Dr. Howe was also Baghdad Professor of the American Schools of Oriental Research. In this latter capacity, he first tested Palegawra in the spring of 1951, and excavated it almost completely in the spring of 1955. One of us (Reed) was a member of the Iraq-Jarmo Project in 1954-1955; while not participating directly in the excavation at Palegawra Cave, he visited the site during the period of excavation, and has been in charge of the preparation and study of the faunal remains since. The senior author (Turnbull) has been responsible for the major laboratory study, particularly of the mammalian bones, once these had been freed from their matrix.

Library of Congress Catalog Number: 74-75777.
US ISSN 0071-4739
Publication 1183

The two authors, however, share joint and equal responsibility for this published report.

The Iraq-Jarmo Project was supported primarily by the Oriental Institute of the University of Chicago. Further funds came from a variety of sources, but the environmental study in which Reed was involved was supported in major part by a grant from the National Science Foundation to the Department of Anthropology, University of Chicago. Further financial aid came from the American Philosophical Society and the Wenner-Gren Foundation for Anthropological Research. We are grateful to these sources for support of the field research, and also acknowledge here with thanks the co-operation received at all times from the Department of Antiquities of the Government of Iraq.

Once the faunal collection had been received in Chicago, space for storage and study was generously donated by the administrative officials of Field Museum of Natural History, under the directorship of E. Leland Webber. The skeletal remains have since been catalogued by the Museum as part of the collections in Vertebrate Paleontology, Department of Geology. We owe a debt of gratitude to the late Dr. D. Dwight Davis, Curator of Anatomy at Field Museum of Natural History until his untimely death in 1965, both for giving up valued space in his workroom and for permission to use the Museum's important comparative collections of mammalian skeletons. We are also thankful to Dr. Joseph Curtis Moore, until recently Curator of Mammalogy at the Museum, for allowing us free access to the collections in his charge. Dr. Karel Liem, successor to Dr. Davis, has also kindly co-operated in numerous ways. Dr. Tibor Perenyi, staff artist at the Museum, made the drawings of an onager's teeth and the dog's mandible. Finally, we thank Dr. Douglas Lay, Department of Anatomy, University of North Carolina, for his critical reading of this manuscript and for a number of helpful suggestions.

There are many more who have helped us: The Kurdish workmen in the field, numerous colleagues from our own country and those from abroad, librarians, typists, and our spouses. The list would be almost endless, and it is with regret that we realize we cannot mention them all.

II. PLACE, TIME, AND ENVIRONMENT

Palegawra is a small cave (Braidwood and Howe, 1960, pl. 10B) in the Baranand Dagh, one of a series of Cretaceous anticlinal

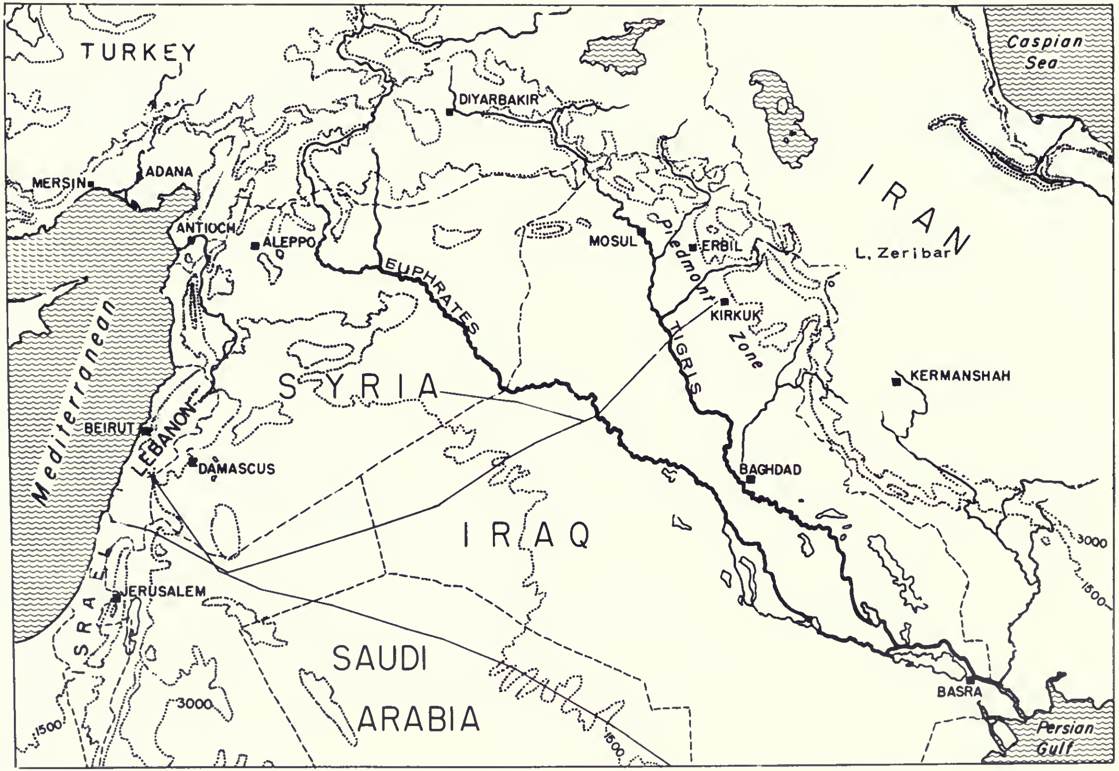

PLATE I. Map of Iraq and adjacent countries. The areas of the Jarmo-Palegawra excavations were in northeastern Iraq, east of Kirkuk. Reprinted from Braidwood and Howe, 1960.

limestone ridges, part of the southwestern foothills of the Zagros Mountains, in northeastern Iraq (pls. I, II). The cave mouth, some 3 m. across by 3 m. high, opens into an interior 5 m. deep by 6 m. across. The deposits of artifacts and associated faunal remains were nowhere more than 2.0 m. deep, and generally not more than 1.2 m. in depth. All parts of the cave are reached by daylight. The cave faces south, overlooking the elongate, round-bottomed Bazian Valley, which trends northwest to southeast. The valley is approximately 25 km. long and 8 km. wide, with a small stream draining toward the Tigris River by way of the Basira Chai and the Tauq Chai (pl. II); at the present time, however, only the waters of an occasional flood actually reach the Tigris.

Absolute elevation of the cave is 990 m. (= 3,250 ft.), which is some 70 m. above the valley floor. A small side valley, rather steep, goes down past the cave from the ridgetop above and provides the easiest path of access.

More information of the general area, of the history of the archaeological exploration of Palegawra Cave and other prehistoric sites in the area, and of the human cultural succession of the late Quaternary in northern Iraq can be found in Braidwood and Howe (1960). Also in that volume, Wright considered the climatic sequence of the late Quaternary for the whole area of the eastern Mediterranean, and Reed and Braidwood attempted a reconstruction of the environment for the foothill region of northeastern Iraq during the same period.

The human artifacts in the cave are of a microlithic type of assemblage termed Zarzian (Garrod, 1930; Braidwood and Howe, 1960, pp. 57-59, 180). The Zarzian has hitherto lacked absolute dating, but recently bone from Palegawra, chosen by ourselves, was submitted by Dr. Robert J. Braidwood to Dr. Reiner Protsch of the University of California at Los Angeles. Dr. Protsch extracted the collagen from the bone and used this protein for radiocarbon dating, as follows:

Laboratory Number	Level at Palegawra	C-14 Determination (Half-life = 5570)
UCLA 1714D	80 - 100 cm.	13,350±460 B. P.
UCLA 1703A	120 cm.	14,400±760 B. P.

While only two dates are available, they are from undisturbed layers in the middle parts of the deposits, and are in the expected chronologic order. However, with the relatively large standard deviation of each, these "dates" could well be closer together — or possibly farther apart — in time than the near-millenium of difference between 14,400 and 13,350. More precisely, we can say

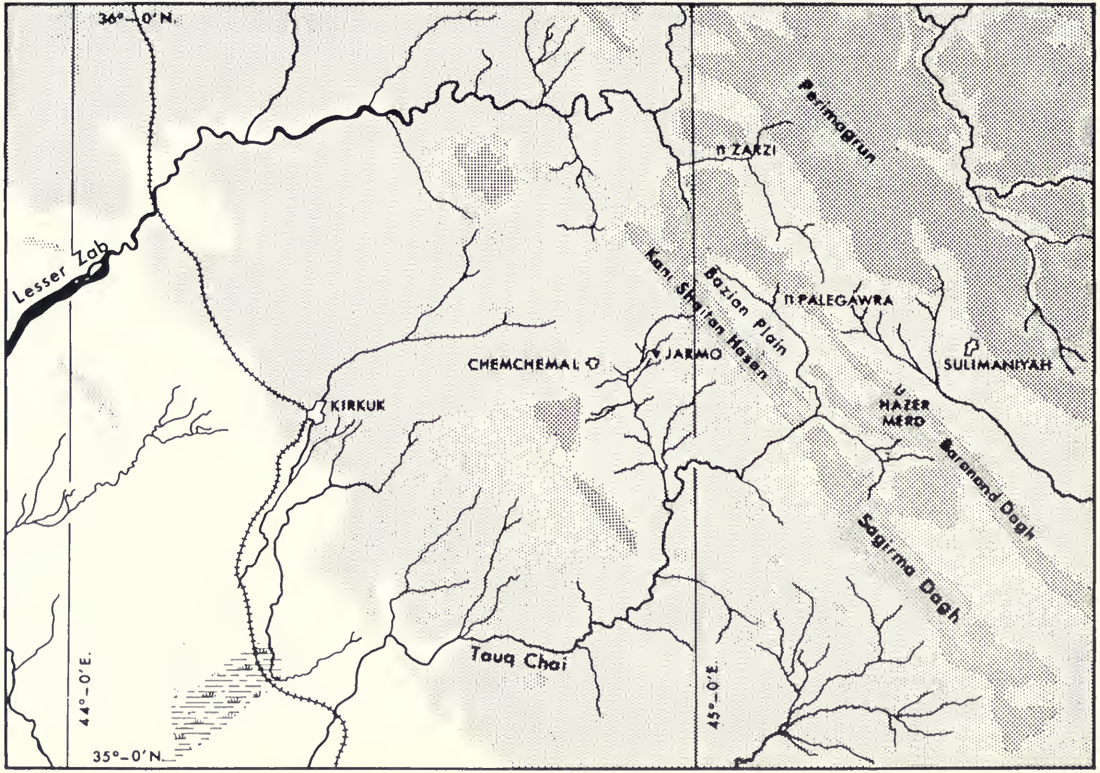

PLATE II. Map of the area east of Kirkuk, in northeastern Iraq, showing the location of Palegawra cave in the Baranand Dagh. Reprinted from Braidwood and Howe, 1960.

that the middle 40 cm. of the cave deposits have a 68 per cent (.68) chance of being between 15,160 and 12,890 B. P. and a 95.5 per cent (.955) chance of being between 15,920 and 12,430 B. P. For convenience, we adopt the round figure of 14,000 B. P. for these middle levels in the cave, realizing (as should the reader) this represents only a sort of statistical optimum.

Zarzian artifacts and the associated faunal remains of the upper 80 cm. of the deposits at Palegawra are probably not extremely later in age than are the deeper deposits; we suggest that quite possibly the uppermost Zarzian at Palegawra is at least 12,000 years old. Since the Pleistocene is generally considered to have been giving way to the Recent by 11,000 years ago, we can say that the fauna we are discussing in this study is probably all from the terminal Pleistocene. However, that fauna as found in the cave is definitely not a random population sample for its time and place, as the bones represented are, for the most part, of animals collected by man; our sample has been through a "cultural filter," concerning which we shall have more to say later.

The paleo-environment of the late Quaternary of the Zagros Mts. and adjacent foothills has been studied intensively by H. E. Wright and colleagues working with him or on materials collected by his group. The basic paleo-ecologic data come from analyses of sediments at Lake Zeribar in west-central Iran, some 70 km. east-north-east of Palegawra, correlated with radiocarbon determinations and surveys of the modern pollen rain. These studies — on pollen by van Zeist and Wright (1963), and by Wright et al. (1967); on the chemistry of the sediments by Hutchinson and Cowgill (1963); on the Cladocera by Megard (1967); and on the paleo-botany by Wasylikowa (1967) — confirm and supplement the earlier conclusions based on geologic studies of the area (Wright, 1960, 1961a, b, 1964).

During the last glacial maximum, some 20,000 years ago, the Zagros Mts. were subjected to intensive local glaciation, correlated with extreme depression of the snow-line and absence of trees (Wright, 1961a). By 18,000 B. P., however, the glaciers were probably beginning to recede and presumably the altitudinally controlled lifezones of the Zagros Mts. were beginning to move upward. However, the evidence of the pollen from the cores at Lake Zeribar and elsewhere in western Iran indicates the continuation of a cold-dry period with a dominance of *Artemisia*-steppe vegetation and a general absence of trees, not only for the mountains but for their foothills as well. Beginning shortly before

12,000 B. P., the evidence of changes in both pollen and Cladocera (as summarized by Wright, 1968) indicates the beginning of a slow warming without any evidence of increase in precipitation; the conditions of the present warm-dry climate may not have been attained until 5,500 years ago.

Palegawra Cave is approximately 370 m. lower than Lake Zeribar, so at present would have an average annual (or seasonal) temperature 2.5 - 2.75°C higher than does the area of the lake (Wright, 1961a, fig. 3, p. 156); we assume a similar temperature differential for the past. We do not, unfortunately, feel that we are capable of transforming such a temperature differential into direct vegetational differences for 14,000 - 12,000 years ago, as based on the Zeribar pollen profiles, but must be content with more general conclusions.

Precipitation in the Zagros Mts. generally increases with altitude but also decreases with distance inland beyond the crest of the mountains. Numerous factors controlling the precipitation, past and present, in the Taurus-Zagros chain have been discussed by Wright (1961a) and need not be repeated here except to emphasize that Palegawra is on the south-facing side of the crest of the mountains where the moisture-bearing storms from the Mediterranean strike first and drop a major share of their contents.

The evidence of the pollen diagrams at Lake Zeribar definitely indicates the first consistent post-glacial appearance there of oak pollen by approximately 14,000 B.P. (van Zeist, 1967; Wright, 1968). Presence of pollen does not necessarily indicate presence of oaks nearby, for pollen of *Quercus* may be wind-wafted as much as 75 km. (Wright et al., 1967, p. 439), but the evidence is clear that, after several thousand years of treelessness, some oaks were beginning to grow near or on the southern and western foothills of the Zagros by 14,000 B.P., at approximately the time when we think the older layers of bone and human artifacts were being deposited at Palegawra. However, the general environment at this time, and presumably for much of the period of intermittent occupancy at Palegawra, was that of a relatively dry sagebrush *(Artemisia)* steppe, cold in winter but warm-to-hot in summer. By 12,000 B.P. pollen of pistachio is found in the record at Lake Zeribar; since pistachio pollen is not wind-borne in such quantities or for such distance as is that of oak, its presence — even as a minor component of the total pollen — indicates the occurrence of trees in the immediate vicinity.

Considering the lower elevation of Palegawra as compared with that of Zeribar, we believe that such initial appearance of oak and pistachio could have been occurring at Palegawra at the time of its occupancy by Zarzian people (14,000-12,000 B.P.). While in general the cold-dry *Artemisia*-steppe was probably still predominate in the area, to conform with the known data of the flora and temperature as determined at Zeribar, yet some oak and pistachio, certainly accompanied by willows and brush, would have been invading the streamside areas in the region of Palegawra; possibly, we think, some trees also occurred away from the streams to produce an open savannah. Indeed, the botanical remains as identified from charcoal recovered at Palegawra are all of trees which live in the area today: oak, tamarisk, poplar, and a conifer (juniper?) (Braidwood and Howe, 1960, p. 59). An environment which would allow such trees to grow could be colder than that of the present but not as severe as was that of Lake Zeribar, higher and further inland, where the plants of a steppe environment continued to predominate for 6,000 years thereafter.

The continuing presence of pollen of oak and of some pistachio at Lake Zeribar of ca. 12,000 years ago agrees, we think, with our interpretation of the Palegawra environment of the same and somewhat earlier period, considering the distance (70 km.) between the two sites, and the lower altitude and more westerly (and hence warmer) location of Palegawra. For any one time, as noted above, we postulate the region of Palegawra Cave would be somewhat warmer than that of Lake Zeribar and with passing time would precede that area in floral succession from steppe toward savannah to woodland.

The archaeological evidence from northern and northeastern Iraq has also been interpreted as suggesting environmental change at this time, circa 14,000 B.P., since man possibly had been absent from this foothill area for some 13,000 years prior to re-occupation by peoples with the Zarzian-type industry (various authors in: Braidwood and Howe, 1960). Perhaps, during the period of the latest Pleistocene, coincident with the most intensive phase of the Würm glaciation in Europe, the sagebrush-steppe of the Zagros Mts. and their foothills were not inviting to men. Possibly the culture of the people of the pre-Zarzian period was not capable of coping with the cold-temperate environment of the foothill region, although we must remember that in Europe both man and several larger mammals did inhabit cold-steppes, and we see no reason to believe that the onager (*Equus hemionus*), for instance, which lives today in the cold-steppes of central Asia, would not have been present in the Zagros foothills of the Late Pleistocene. Lack of game would not, thus, have been a factor responsible for man's absence from the area, and, indeed, apparently man did live and hunt onagers throughout this particular period in the higher, more inland, and presumably colder environment of west-central Iran, as indicated by the record at the rock-shelter of Warwasi near Kermanshah (Turnbull, MS.).

By the time of the Zarzian occupation, ca. 14,000 years ago, the floral and faunal evidence for Palegawra, as correlated in our thinking with the pollen and Cladoceran profiles from Lake Zeribar, indicate that the environment for the area of the cave was somewhat cooler than at present; the winters were probably cold but the summers could have had days warm to hot, as on the Anatolian plateau today. The presence at Palegawra of the pika, *Ochotona* cf. *rufescens*, also suggests a climate considerably colder than that of today, but we must remember that at approximately the same time these animals were living in Palestine, in the Dead Sea drainage near 0 m. elevation (Haas, 1951). Furthermore, in Iran and Pakistan at present, populations of this *Ochotona* live in areas where the climate is not cold (Lay, *pers. comm.*), as well as in parts of the high, dry Elburz Mts. (Lay, 1967, p. 151).

The presence in Palegawra of large numbers of the snail *Helix salomonica*, plus the presence of this species and fewer individuals of three other species of snails at Zarzi, had earlier suggested (Reed and Braidwood, 1960, p. 109) an annual weather cycle that might not be too dissimilar from that of the present in the same region today. However, observation of living *Helix salomonica* and other land snails in western Iran (Reed, 1962) shows that they emerge from underground hiding to feed actively — and can thus be collected by man — under conditions of cool (11-14° C) rain or drizzle. Inasmuch as these circumstances might easily be present several times each year whether a past climate was the same as that of today or considerably colder, we cannot utilize the presence of these snails for paleo-environmental conclusions until much more is known in detail of the ecologic requirements and tolerances of the several species involved.

We estimate the present rainfall at Palegawra to average 70-75 cm. annually (Wright, 1961a, fig. 1, table 1); that at the higher altitude of Lake Zeribar is thought to average ca. 80 cm. (Megard, 1967). We have no evidence that the Palegawra rainfall of some 14,000-12,000 years ago would have been any heavier than that of today, and possibly it was less. Under such circumstances we visualize that possibly by 14,000 years ago but probably by 12,000 B.P. a mixed deciduous savannah of *Quercus* and *Pistacia* would have been thinly scattered over the slopes of the ridges, but would not have been as dense a forest as occurred later and as is typical of the few remaining virgin forests of northern Iraq today at altitudes between 1,600 and 1,900 m. Prune, almond, hawthorne, apple, maple, ash, and some other trees may have been minor floral components, but if so we have no palynological evidence for them. The valley bottoms and more open plains may have been grassy with a few scattered oaks and some junipers at their sides; a variety of chenopods and small shrubs, to correspond to the pollen pattern found at Lake Zeribar, would also have been present, with oak, pistachio, willow, and much brush undoubtedly bordering the streams, which may well have had water throughout the year.

The climatic pattern, undoubtedly, was then, as it is now, of the classic Mediterranean type (Trewartha, 1961, pp. 223-247; Fisher, 1963, pp. 35-65). At present, precipitation comes largely in the months of November to April, inclusive, dropping from storms moving from west to east and each of several days duration. Winter snowfall is not uncommon at the altitude of Palegawra in northern Iraq today; probably it was more common when the Zarzian people lived there, but the depth and duration of that snow is not now ascertainable. In April and early May, if modern conditions are any guide, violent thunderstorms would occur, with lightning and sudden fierce winds, often followed by torrential rains of the cloudburst type. The late spring, summer, and early autumn now are, and presumably were then, rainless with high mid-day temperatures. The grass would die, the hills brown off beneath and between the trees, and water sources would have shrunk to a few springs and the permanent streams in the valley bottoms.

This picture, we stress, is a hypothetical one, of the environment as we visualize it on the basis of our understanding of the present evidence. It is an environment in which the animals whose remains were found in Palegawra cave could and did live.

III. THE FAUNA

A. PROCEDURE. The Palegawra fossil bones were found imbedded in semi-cemented limey cave-earth. The travertine that forms the cementing material precipitated from moisture in the cave during wet periods; today, the cave during the rains of winter and the early spring is uncomfortably damp and drips continually, and travertine continues to form. The cave-earth in which the bones were first buried is chiefly formed from limestone dust and gravel with perhaps a little soil that may have been blown or carried inside the shelter. In color the cave-earth is grey to buff or brown, and weathers reddish; the travertine is white to buff, and also weathers reddish. Many of the bones were completely imbedded in the travertine, which of course is much harder than the cave-earth, and which we dissolved in a mild solution of hydrochloric acid to expose the surfaces of the bones. Other specimens were prepared by scraping and chiseling the matrix away, and in the course of these various preparatory operations many rodents' teeth and jaws were found cemented to fragments of large bones.

The skeletal collections in the Division of Vertebrate Anatomy of Field Museum of Natural History have been invaluable in aiding us to identify these fragmentary bones. Many of these recent skeletons were collected by Reed in Iraq in 1955 and in Iran in 1960, and by the Field Museum's Street Expedition to Iran in 1962.

Aside from the more recent introduction of some late proto-historic and early historic materials into the upper 60 cm. of deposit, no ascertainable stratification was apparent in the cave when it was being excavated. Accordingly, Dr. Howe removed the deposits in levels of 20 cm. each, until the cave floor was reached at 1.2-2.0 m. depth.

Each lot of bone, as removed, was labeled for depth and position in the cave. Faunal lists were made by us for each level of 20 cm. as study proceeded on the materials. Among the many analyses of this fauna that we have made was an attempt to discern differences in percentages of faunal elements at various levels throughout the entire depth. No significant trends can be discovered and it is probably correct to consider the entire sequence as a bio-cultural unit.

Abbreviations: In plates, figures, and tables the following abbreviations are used:

FMNH 0000. Recent specimens catalogued in the collection of the Division of Mammals, Department of Zoology, Field Museum.

FMNH PM 0000. Fossil mammals catalogued in the collection of the Division of Paleontology, Department of Geology, Field Museum.

YPM 0000. Recent specimens in the osteological collection of the Peabody Museum of Natural History, Yale University.

B. Mammalian Fauna.

Order Insectivora
  Family Erinaceidae
    Erinaceus europaeus (European hedgehog)
    Hemiechinus auritus (long-eared hedgehog)
Order Chiroptera
  Family Rhinolophidae
    ?*Rhinolophus* (bat)
Order Lagomorpha
  Family Ochotonidae
    Ochotona cf. *rufescens* (pika)
  Family Leporidae
    Lepus cf. *capensis* (hare)
Order Rodentia
  Family Cricetidae
    Mesocricetus sp. (hamster)
    Cricetulus cf. *migratorius* (grey hamster)
    Arvicola cf. *terrestris* (water vole)
    Microtus socialis (social vole)
    Ellobius cf. *fuscocapillus* (mole vole)
    Meriones cf. *persicus* (Persian jird)
  Family Spalacidae
    Spalax leucodon (lesser mole rat)
Order Carnivora
  Family Canidae
    Canis lupus; C. familiaris (wolf; dog)
    Vulpes vulpes (fox)
  Family Mustelidae
    Martes cf. *foina* (marten)
    Mustela cf. *putorius* (European polecat)
    Meles meles (badger)
  Family Felidae
    Felis cf. *chaus* ("jungle," or booted cat)
    Felis lynx (lynx)
Order Perissodactyla
  Family Equidae

Equus hemionus (onager)
Order Artiodactyla
Family Suidae
Sus scrofa (wild pig)
Family Cervidae
Cervus elaphus (red deer)
Family Bovidae
Bos primigenius (wild cattle)
Capra hircus aegagrus (wild goat)
Ovis orientalis (wild sheep)
Gazella subgutturosa (gazelle)

Table 1. The column labeled "Number of Specimens" refers to the counts of individual bones or bone fragments at all levels. In computing "Minimum Numbers of Individuals" of each species that could be represented by these thousands of bone fragments, we proceeded as White (1954) had done before us: the one or two most abundant kinds of bone were selected as a measure[1] for each species—for example, second phalanges and left upper third molars of the onager. The right and left upper third molars were counted separately. The phalanges were arranged in sets of four, based at first on similarity of size and later counted and divided by four (or whatever number is typical for each species). The largest total of these counts was then taken as the minimum number of animals for each species that could have been present in Palegawra cave. In the case of the equid left upper third molars, there are: one unerupted tooth, three showing slight wear, five with moderate wear, and five that are very worn — a total of 14, representing 14 individual onagers. There are 103 second phalanges (including one very immature one) which, divided by four, gives a minimum of 26, plus one immature or a total of 27 individuals. As the latter figure is the larger, we know that 27 represents the *least* number of equids that could possibly have yielded the bones deposited in the cave over all the period of accumulation. This estimate does not include the number of animals that were killed and eaten outside the cave, the bones of which were left for scavengers; it does not include specimens eaten at the site whose bones perhaps

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[1] Kehoe, 1967, independently employed methods similar to ours at the Boarding School Site, Montana. Perkins (1964, and *pers. comm.)* has devised more complex but more meaningful statistical procedures for evaluating populations from counts of fragments of bone in archeological sites. Until his results are tested and published, we will continue to use the simpler concept of the MNI (minimum number of individuals).

TABLE 1. Total counts of species at Palegawra Cave

Genus and species	Number of identified bones	Minimum number of individuals	Percentage based on minimum number of individuals
Equus hemionus (onager)	1121	27	20.9
Meriones cf. *persicus* (Persian jird)	86	14	10.8
Cervus elaphus (red deer)	456	12	9.3
Spalax leucodon (lesser mole rat)	29	12	9.3
Ovis orientalis (wild sheep)	134	10	7.7
Capra hircus aegagrus (wild goat)	97	8	6.0
Gazella subgutturosa (gazelle)	95	7	5.4
Vulpes vulpes (red fox)	33	6	4.6
Lepus cf. *capensis* (hare)	11	4	3.0
Ochotona cf. *rufescens* (pika)	7	4	3.0
Mesocricetus sp. (hamster)	6	4	3.0
Sus scrofa (wild pig)	68	3	2.3
Hemiechinus auritus (long-eared hedgehog)	7	3	2.3
Bos primigenius (wild cattle)	19	2	1.5
Ellobius cf. *fuscocapillus* (mole vole)	3	2	1.5
Arvicola cf. *terrestris* (water vole)	2	2	1.5
Martes cf. *foina* (marten)	2	2	1.5
Canis lupus or *C. familiaris* (wolf, dog)	12	1	.7
Canis familiaris (dog)	1	1	

TABLE 1. Total counts of species at Palegawra Cave *(Continued)*

Genus and species	Number of identified bones	Minimum number of individuals	Percentage based on minimum number of individuals
Felis lynx (lynx)	4	1	.7
Felis cf. *chaus* ("jungle" or booted cat)	2	1	.7
Cricetulus cf. *migratorius* (grey hamster)	1	1	.7
Mustela cf. *putorius* (European polecat)	3	1	.7
Erinaceus europaeus (European hedgehog)	2	1	.7
Meles meles (badger)	2	1	.7
Microtus cf. *socialis* (social vole)	2	1	.7
Chiroptera (bat)	1	1	.7
(*Ovis/Capra* indet.) (sheep/goat indet.)	390		
TOTAL		131	100.0%

were then tidily thrown out of the shelter; it cannot express the number of animals killed whose stripped flesh is all that was "schlepped"[1] by one or more hunters from a considerable distance.

Therefore, we cannot attach too much importance to computations of animal populations for situations such as that which existed at Palegawra Cave. There were many variables operating,

[1] "Schlepping" is the useful term introduced by Perkins and Daly (1968) to describe the assumed butchering and retrieval techniques of prehistoric Near Eastern hunters after killing a large mammal. Presumably the animal was skinned, with the bones of the feet and sometimes the mandibles retained in the skin as handles. The meat would then be cut from the carcass and piled on the skin, which would be carried or dragged to camp or village. Most of the skeleton, therefore, was left in the field. The concept of "schlepping" has in its favor both logic and the evidence that many skeletal parts are not found at the home sites.

TABLE 2. Percentages based on game mammals
(See text, page 93 and Table 7, for explanation of how minimum numbers were computed)

Genus and species	Minimum number of individuals	% of total game mammals	Amount of* meat/ individual (in kg.)	Available meat represented (in kg.)
Equus hemionus	27	28.4	150	4050
Cervus elaphus	12	12.6	100	1200
Ovis orientalis	10	10.5	35	350
Spalax leucodon	12	12.6	0.1	1.2
Capra hircus aegagrus	8	8.4	35	280
Gazella subgutturosa	7	7.4	20	140
Vulpes vulpes	6	6.3	3	18
Lepus cf. *capensis*	4	4.2	1.5	6
Sus scrofa	3	3.2	35	105
Bos primigenius	2	2.1	350	700
Martes cf. *foina*	2	2.1	0.5	1.0
Meles meles	1	1.1	5	5
Mustela cf. *putorius*	1	1.1	0.4	0.4
Total	95	100.0%		

*Calculations of meat/individual are based on one-half the live weights given in Walker, 1964, adjusted in some instances to fit with Reed's experiences with the animals as collected in the Zagros Mountains of Iraq and Iran.

and the human cultural filter was too complex to permit more than approximations, as indeed is invariably the case. Computing minimum numbers of animals represented by a collection of bones is only an estimate of the *least*, not the *most*, individuals that were present during a long period of time. However, computing amounts of edible meat (table 2) available from these animals results in an understanding of which animals were most important to the prehistoric inhabitants — i.e., which gave the most meat to eat, provided the best sinew for bindings, had the warmest fur and the best bone for tools. Beyond this, it is also important to know as precisely as possible what species were living in the area at that time. Hence all bone should be identified as far as possible, not just the medium-large game animals.

Approximately 4,000 bone fragments were brought back to Field Museum from Palegawra Cave; of these 2,200 of large to medium size were partially or wholly identified. At least another 500 from small mammals were also identified, at least to order.

In addition to computing percentages of occurrence (relative numbers) by species and minimum possible number of individuals for each of the larger game species, we also computed these data for each collecting level (0-20 cm., 20-40 cm., etc.). While the apparent total number of individuals would have been larger, if reported on this basis, the relative percentages of each species were almost identical to those computed for the entire population throughout all the levels.

The complete faunal list is given above and in Table 1. The following discussion treats in detail the most important elements, but does not include every genus identified in the fauna.

Order Insectivora.

Family Erinaceidae

It is interesting to us that both the small long-eared hedgehog (*Hemiechinus*) and the larger European hedgehog (*Erinaceus*) occur in the cave fauna. Both genera live today in Iraq.

Order Chiroptera.

One partial humerus of a bat was found by Dr. E. Tchernov among assorted bird bones sent to him for identification (see below). This proximal end of a humerus compares closely with that of *Rhinolophus*. Unfortunately, no jaws or teeth of bats have been found.

Order Rodentia.

Two genera of rodents not reported by Hatt (1959) in his study of the mammals of Iraq are represented in this fauna (in each instance only lower jaws with teeth were identified): *Arvicola* cf. *terrestris* (water vole), two rami; and *Mesocricetus* sp. (hamster), seven rami. The dentitions of most of the specimens of hamsters are too worn to be diagnostic; one specimen (PM 11589) with rt. $M_{\overline{2-3}}$ is not distinguishable from either *M. auratus* or *M. brandti* (as based on the few specimens of these species available to us), but has teeth larger than those of either *auratus* or *brandti*.

Palegawra is at present within the range of *M. brandti* (Hamar and Schutowa, 1966), but specific assignment of these mandibles from the late Pleistocene must await collection of additional unworn specimens.

The presence of 29 bones of the lesser mole rat, *Spalax leucodon*, representing at least a dozen individuals is noteworthy. As pointed out below in section IV, "The Fauna and Human Hunting," these burrowing rodents must have been purposely hunted as food.

Order Lagomorpha.

Not mentioned by Hatt, 1959, but present at Palegawra, is *Ochotona* cf. *rufescens* (pika), represented by six mandibular rami.

Order Carnivora.

Family Mustelidae

One species hitherto unreported for Iraq, *Mustela* cf. *putorius* (European polecat), is represented by a left mandible, with teeth. Hatt (1959, p. 42) had mentioned *M. nivalis*, a weasel, as possibly being present according to a verbal report. While *M. nivalis* has a wide range in Eurasia and North Africa, and might be expected to occur in Iraq, *M. putorius* has an equally wide range and its presence in northern Iraq at any time during the last 14,000 years is reasonable. Size, proportions, and the details of the cusps of the teeth are more as in *M. putorius* than as in *M. nivalis*. The most characteristic difference is the broadness of the talonid of $M_{\overline{1}}$ in this specimen and in other specimens of *M. putorius* at our disposal. All *M. nivalis* that we have seen from Europe and Iran are relatively narrower across the talonid of $M_{\overline{1}}$.

The beech or stone marten, *Martes foina*, is presumably rare in Iraq, considering the few specimens reported there (Hatt, 1959, p. 41), but its long occupancy of the northern part of the country had already been attested by its presence in late Pleistocene, Middle Paleolithic (Mousterian) layers at Shanidar Cave (Reed and Braidwood, 1960, p. 165). Our recovery of a single jaw of this species indicates that this modern animal was also a resident of northern Iraq during the terminal part of the Pleistocene. The specimen, PM11266, a right ramus with $P_{\overline{4}}$, retains a fragment of $M_{\overline{1}}$, roots of $P_{\overline{2-3}}$, and alveolus of C, but has no $P_{\overline{1}}$, a condition observed in some other *Martes* in the collections of the Field Museum. There is a strong cingulum all around the $P_{\overline{4}}$. The protoconid is somewhat worn and the metaconid is also, but remains well separated from the protoconid. The metaconid, furthermore, is centrally located on the crown, not offset toward the buccal margin, as it is in most recent *Martes*. There is no incipient heel developed and therefore the tooth has a symmetrically oval outline. This condition is approached in a Recent specimen of *Martes foina* from Iraq in Field Museum. Unfortunately, the trigonid of the $M_{\overline{1}}$ is too broken to permit comparison with the data of Kurtén (1965) from Palestinian *Martes*. Although *M. foina* is associated with a forest environment in many workers' minds, collectors of the Field Museum Street Expeditions to Iran and Afghanistan found it living in rocky areas that were completely devoid of trees and had very sparse shrubs.

Family Canidae

Though we generally think of the food animals as being of medium to large size, it would seem reasonable to assume that occasional, even accidental, catches of small animals would have been welcome in the diet of these meat-eating people. In particular, the number of foxes (*Vulpes vulpes*) from Palegawra might have economic significance. Thirty-three bones, representing a minimum of six individuals, comprise 4.5 per cent of the total Palegawra bone (based on minimum number of individuals). Comparison with Stampfli's figures for some other collections from northern Iraq is as follows:

Site	*No. of bones*	*No. individuals*	*Per cent of total individ.*
Jarmo	6	not given	2.2
Karim Shahir	9	2	10.5
Tell Matarrah	2	1	7.7
PALEGAWRA	33	6	4.5

At Karim Shahir and Tell Matarrah, fox was a larger component than at Palegawra; at Jarmo it was considerably smaller. Considering its possible use as a food element, Reed recalls having heard that fox is occasionally eaten today in Kurdistan. Reed himself has tried roasted fox, but finds it has an unpleasant "skunky" taste. However, others may relish this flavor of fox, as did Bedouins with whom Reed worked in Upper Egypt. Also possible as an explanation for the number of these animals at Palegawra is that they may have inhabited the cave in winter and occasionally died during occupancy. Flannery, *in* Hole et al. (1969, p. 314), reported red fox was the commonest small mammal eaten by the prehistoric villagers at Deh Luran, Khuzistan, southwestern Iran.

As based on the size of the lower cheek-teeth, the foxes at Palegawra 14,000-12,000 B.P. were larger than those living in the same part of Iraq today (Turnbull, In press).

In the light of Lawrence's (1967, 1968) work on early domestic dogs, our study of the only large canid jaw found at Palegawra was particularly interesting. Miss Lawrence has kindly examined the jaw and has indicated agreement with our identification of it as dog, *Canis familiaris*. Independent identification of this specimen as a jaw of a dog was made by Juliet Clutton-Brock at the British Museum (Natural History).

Comparative materials at Field Museum included jaws of five Recent wolves from the Zagros area of Iraq and Iran, one of a Recent Kurdish dog, 14 prehistoric dogs from Jarmo, Iraq, and two of Recent Australian dingos. We conclude that the specimen from Palegawra shows several characters of domestication and therefore we designate it *Canis familiaris* rather than *C. lupus*. Measurements in millimeters appear below.

The specimen (pls. III, IV), FMNH PM 11265, is a left horizontal ramus with $P_{\overline{3\text{-}4}}$, $M_{\overline{1\text{-}2}}$, and alveoli of C-$P_{\overline{2}}$; it was dug from the E. front quarter of the cave at a depth of 50-60 cm. The estimated age of ca. 12,000 or more years of this dog from Palegawra might be thought to be extremely old, but is not so when considered against the known periods of other early dogs. Dogs from Jaguar Cave, Idaho, in North America, thought to have been derived originally from Eurasian wolves, have been dated at 10,370 B.P. or older (Lawrence, 1967, 1968). A dog has also been reported from probably Late Pleistocene deposits in Illinois (Galbreath, 1938, 1947), and dogs of similar age ("Late Pleistocene") have also been reported from Japan (Shikama and Okafuji, 1958). In western Eurasia, dogs from ca. 9,000 B.P. are known from England (Degerbøl, 1961) and southeastern Turkey (Lawrence, 1967). Such a wide distribution of dogs during and/or immediately following the latest Pleistocene indicates an antiquity for the beginning domestication of *Canis familiaris* earlier than generally thought; under these circumstances, a date of ca. 12,000 or older for a dog in southwestern Asia is not surprising.

The major points which have led us to identify the jaw as dog instead of wolf are:

1. The overall size of the jaw is small compared with modern wolves of the Zagros area (pp. 104-105).

2. The root of the canine is particularly shallow. In all wolves we have seen, the alveolus for the canine descends into the jaw to end

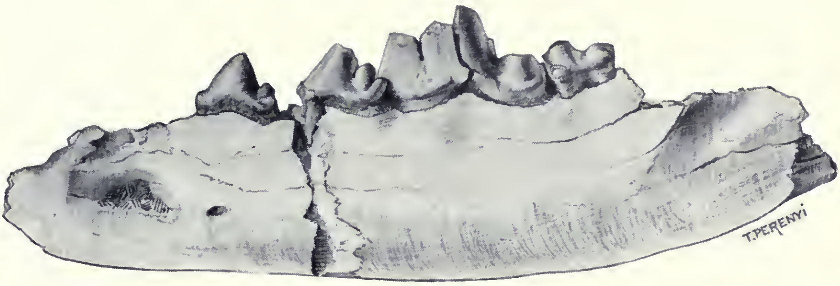

PLATE III. *Canis* cf. *familiaris*, FMNH PM 11265. Left mandibular ramus. Palegawra cave. Lateral view showing $P_{\overline{3-4}}$, $M_{\overline{1-2}}$. Drawn by Tibor Perenyi. Nat. size.

PLATE IV. *Canis* cf. *familiaris*, FMNH PM 11265. Dorsal view showing $P_{\overline{3-4}}$, $M_{\overline{1-2}}$ and alveoli of C, $P_{\overline{1-2}}$. Drawn by Tibor Perenyi. Nat. size.

approximately under the anterior root of $P_{\overline{2}}$. The alveolus for the Palegawra canid also reaches the anterior root of $P_{\overline{2}}$, but because the diastema of C-$P_{\overline{1}}$ is so short, the canine root and its alveolus are also short. Each alveolus was measured with a flexible wire inserted into the cavities and held against the posterior surface and along the length of the dorsal surface. Recent Zagros wolf no. FMNH 88468 — 3.0 cm.; wolf no. FMNH 88469 — 2.5 cm.; Palegawra canid FMNH PM 11265 — 1.5 cm., the maximum being estimated by continuing the surface of the broken alveolus to the assumed true level of the jaw bone. The canine roots of the same recent wolves were also measured: 88468 — 2.9 cm.; 88469 — 2.0 cm. From these data we conclude that the canid from Palegawra possessed a short canine root compared with that in wolves.

3. The diastema between $C_{\overline{1}}$ and $P_{\overline{1}}$ is shorter than in any specimen of wolf we have seen. Reed has noted that a neolithic dog from Suberde, Anatolia, collected by Dexter Perkins, Jr., showed a similar condition but had a much larger carnassial. Although the bone around the top of the canine alveolus of the Palegawra dog is broken, *very little* is missing and projection of the true surface proves the closeness of C and $P_{\overline{1}}$. The coefficients of variation, V, shown in the chart below, are extremely high for this character in our sample of Zagros wolves and Jarmo dogs, indicating that the linear distance between $C_{\overline{1}}$ and $P_{\overline{1}}$ is highly variable, perhaps due to mixed sex, age of the available specimens, or other reasons. However, as the graphics in the log-difference ratio diagram[1] show, in Figure 10, none of the other groups is as short in this dimension C-$P_{\overline{1}}$ as is the Palegawra canid. The suggestion is that this character was very responsive to effects of early domestication, a possibility also noted by Lawrence (1967).

4. The alveoli for $P_{\overline{1-4}}$ are very close together and the entire premolar series is relatively short. As the Vs for this character in the other samples are low, indicating the character is not highly variable in wolves and Jarmo dogs, we can cite this difference with confidence as being significant.

Other characters that may be important are:

5. The $P_{\overline{4}}$ overlaps $M_{\overline{1}}$ rather more than in most wolves, to the extent of the entire posterior cuspule. There is individual variation among wolves in this character, but usually the overlap is less.

6. Wolf, rather than jackal, ancestry of this specimen seems indicated by: the overall size; the single posterior cuspule on $P_{\overline{4}}$;

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[1] For complete explanation of log-difference ratio diagrams, see Simpson, 1941, p. 23; and Simpson et al., 1960, p. 359.

the incipient hypoconulid on $M_{\overline{1}}$; and on the $M_{\overline{2}}$ the protoconid is larger than the metaconid.

The measurements on pp. 104-105 indicate that the Palegawra canid is generally most similar in size to the Recent Kurdish dog (♂) or to the smaller (♀) of the two available Australian dingos. All the wolves are larger. The Palegawra canid most resembles the dingo in: the alveolar distances C-$P_{\overline{1}}$ and C-$M_{\overline{2}}$; the lengths of $P_{\overline{3}}$, $P_{\overline{4}}$, $M_{\overline{1}}$, $M_{\overline{2}}$ and crown length $P_{\overline{3}}$-$M_{\overline{2}}$; and width of $P_{\overline{3}}$. It resembles the specimen of Kurdish dog most closely in the widths of $P_{\overline{4}}$ and $M_{\overline{2}}$. In alveolar length $P_{\overline{1-4}}$ it is closest to the dogs from Jarmo. Thus, of the 12 characters measured by us, the Palegawra dog most resembles in size the Australian dingo in nine, the Kurdish in two, and the Jarmo dogs in one.

In our measurements, the ranges of the Recent wolves are greater than the ranges of the Jarmo dogs except in widths of $P_{\overline{3}}$, $P_{\overline{4}}$, and $M_{\overline{2}}$, in which the largest specimen of Jarmo dog is larger than the largest Recent wolf. Discussion of the Jarmo dogs will be found in another paper by Lawrence and Reed (In press).

On the ratio diagram of log differences, Figure 10, using nine means, the Palegawra canid is closest to the dingo in five characters, closest to Jarmo dog in one (alveolar length $P_{\overline{1-4}}$), closest to Kurdish dog in one (width $P_{\overline{4}}$), and about equally close to the Kurdish dog and the dingo in two (length and width $M_{\overline{1}}$). If the Jarmo dogs and modern Kurdish dog both represent many millenia of generally settled domesticity, and the Australian dingo a far less domestic situation — i.e., less closely tied to man, a more nomadic life — we can suggest reasons for the similarity between our early Palegawra dog and the dingo. The free-ranging life of the Australian dingo associating with the nomadic aboriginals is more closely parallel to the similarly loose association we imagine for dogs with the Zarzian hunters than is the more restricted village life led by the dogs of Jarmo and the modern Kurdish dogs.

The mandible discussed above is undoubtedly that of a dog, but the possibility remained that it could have been intrusive from a higher, and thus more recent, level. The physical characters of the bone, as tested by eye and hand, were the same as those of the other fossils at the site. However, considering the suggested antiquity of the specimen, comparative chemical tests were thought advisable. Dr. Theya Molleson of the British Museum (Natural History) offered to arrange for the tests; the government laboratory to which she submitted the samples of bone drilled

Comparison of Palegawra Canid with Certain Others

	Palegawra PM 11265	Iraq-Zagros Recent wolves	Post-Pleistocene dogs, Jarmo, Iraq	Recent Kurdish dog	Recent Australian dingos	
Post. edge alv. C—	1	5	7	1	2	N
post. edge alv. $P_{\overline{1}}$		10.5 - 14.8	7.9 - 12.3		7.1-9.6	OR
	6.6	12.8 ± 0.7	10.2 ± 0.6	12.5	8.35	M
		1.6	1.6			s
		12.4	16.2			V
Post. edge alv. C—	1	5	1	1	2	N
post. edge alv. $M_{\overline{2}}$		86.6 - 97.9			78.5-81.2	OR
	74.1	92.7 ± 1.7	82.4	84.3	79.85	M
		3.9				s
		4.2				V
Alv. length $P_{\overline{1-4}}$, incl.	1	5	7	1	2	N
		44.8 - 50.6	39.7 - 44.3		45.1-45.6	OR
	39.5	48.4 ± 1.0	42.1 ± 0.6	42.9	45.4	M
		2.2	1.5			s
		4.6	3.5			V
Crown length $P_{\overline{3}}$	1	5	7	1	2	N
		12.1 - 15.9	11.1 - 11.9		9.9-10.5	OR
	10.4	13.8 ± 0.7	11.5 ± 0.1	11.2	10.2	M
		1.5	0.3			s
		10.6	2.7			V
Crown breadth $P_{\overline{3}}$	1	5	7	1	2	N
		6.1 - 6.8	5.8 - 7.0		5.2-5.4	OR
	5.6	6.4 ± 0.1	6.2 ± 0.2	5.1	5.3	M
		0.3	0.5			s
		5.1	8.4			V
Crown length $P_{\overline{4}}$	1	5	14	1	2	N
		13.4 - 16.1	11.8 - 14.4		12.6-13.2	OR
	12.8	15.1 ± 0.5	13.2 ± 0.1	12.2	12.9	M
		1.1	0.4			s
		6.9	2.9			V
Crown breadth $P_{\overline{4}}$	1	5	14	1	2	N
		6.8 - 8.1	6.2 - 8.6		6.8-6.9	OR
	6.1	7.5 ± 0.2	7.1 ± 0.2	5.8	6.85	M
		0.5	0.7			s
		6.3	10.3			V

COMPARISON OF PALEGAWRA CANID WITH CERTAIN OTHERS — *Continued*

	Palegawra PM 11265	Iraq-Zagros Recent wolves	Post-Pleistocene dogs, Jarmo, Iraq	Recent Kurdish dog	Recent Australian dingos	
Crown length $M_{\overline{1}}$	1	5	10	1	2	N
		24.3 - 28.6	22.6 - 25.6		21.8-22.2	OR
	21.9	26.6 ± 0.8	24.3 ± 0.3	22.1	22.0	M
		1.7	1.0			s
		6.4	4.1			V
Crown breadth $M_{\overline{1}}$ at protoconid	1	5	13	1	2	N
		9.7 - 11.0	8.2 - 10.4		8.5-9.5	OR
	8.7	10.6 ± 0.3	9.7 ± 0.2	8.3	9.0	M
		0.6	0.7			s
		5.2	6.9			V
Crown length $M_{\overline{2}}$	1	5	8	1	2	N
		11.0 - 11.9	10.1 - 11.1		9.4-10.2	OR
	9.5	11.5 ± 0.2	10.6 ± 0.1	9.9	9.8	M
		0.4	0.4			s
		3.1	3.5			V
Max. crown breadth $M_{\overline{2}}$	1	5	7	1	2	N
		7.8 - 8.8	7.1 - 8.9		7.4-7.6	OR
	6.8	8.2 ± 0.2	8.2 ± 0.2	7.0	7.5	M
		0.4	0.6			s
		4.4	7.5			V
Crown length $P_{\overline{3}}$ - $M_{\overline{2}}$	1	5	—	1	1	N
		58.3 - 69.3				OR
	55.8	65.4		56.1	55.8	M

N = number of specimens in sample
OR = observed range
M = mean ± standard error
s = standard deviation
V = coefficient of variation

Measurements in millimeters

from the dog's jaw and from four other fossils taken from different layers at Palegawra was able to analyse the nitrogen, fluorine, and phosphate content of the five samples. These results are:

Sample no.	*Depth of fossil bone at Palegawra (in cm.)*		*Fluorine %*	*Phosphate %*	$\frac{F \times 100}{P_2O_5}$	*Nitrogen %*
AS 244	Mandible of *Canis*	50-60	0.05	18.6	0.27	0.11
AS 245	Bone 1	0-20	0.08	21.8	0.36	0.53
AS 246	Bone 2	40-50	0.09	24.4	0.37	0.23
AS 247	Bone 3	40-50	0.09	23.4	0.38	0.47
AS 248	Bone 4	120	0.08	27.3	0.29	0.18

As fluorine accumulates (non-reversibly) in teeth and bone after burial, organic nitrogen is simultaneously leached out (Oakley and Hoskins, 1950; Oakley, 1963). Dr. Molleson informs us that differences in nitrogen content of less than 1 per cent are meaningless as between themselves, but the overall consistency in our samples is meaningful. Because porous bone is often contaminated with silt, the phosphate content of the sample is also determined and the fluorine value of each specimen is then expressed as the ratio of the percentage of fluorine to percentage of phosphate. This achieves less misleading figures for the fluorine content of variably contaminated bones which may then be compared one with another. The Palegawra bones are all low in fluorine content. This is not surprising in cave-deposited bone, which, as at Palegawra, are not subjected to typical ground-water but are wetted almost entirely by drip-water from the cave-roof after a rain. The slightly lower fluorine content in the dog, wrote Molleson (1974, pers. comm.) is inconclusive in view of the low nitrogen. The fluorine/phosphate percentage ratio varies only by 0.11. The chemical results thus leave no doubt that the mandible of the dog is not appreciably different in age than are the other bones.

The post-cranial bones of *Canis* consist of one ulna, one calcaneum, two astragali, five metapodials, and two phalanges. It is not possible for us to determine whether or not these bones belonged to wolf or domestic dog. One of the astragali is charred.

One coprolite, containing innumerable fragments of bone, was found at the level of the dog's jaw (see above). This coprolite apparently was the only one found in the cave. The absence of numerous such remains and the lack of bones of *Hyaena* would make unlikely the possibility that this scat is from a hyena. Equally possible sources are dog or wolf. The coprolite appears to be rather too large for a jackal.

Order Perissodactyla

Family Equidae

Equus hemionus (the onager, hemione, or half-ass) forms the largest bulk of the bones in the cave, clearly indicating that the occupants of Palegawra were hunters and eaters of onager meat. Several jaws with partial dentitions are preserved in this collection, but loose teeth are far more numerous, and isolated equid teeth are often difficult to identify as to their exact position in the jaw. Modern specimens used for comparison with the cave fossils consisted of six skulls and jaws of the Mongolian onager, *Equus hemionus hemionus*; one skull, jaw, and partial skeleton of a Syrian onager, *E. hemionus hemippus*; one complete skeleton and one partial skeleton of *E. hemionus onager* from Iran; and one complete skeleton plus another skull of domestic *E. asinus* from Iraq. In addition, skulls of numerous modern true horses — *E. caballus* — were available for comparison.

The Palegawran equids are referred to *E. hemionus* for several reasons. In the lower cheek teeth (omitting $P_{\overline{2}}$ and $M_{\overline{3}}$), the medial groove between the metaconid-metastylid in $P_{\overline{3}}$-$M_{\overline{2}}$ is not U-shaped as in caballine horses (*E. caballus* and *E. przewalskii*) but approaches the sharp angularity (V-shape) of the zebras and African asses (pls. V, VII), as noted by Boule, (1899), Hopwood (1936), and McGrew (1944). Groves and Mazák (1967, p. 325) indicated that a V-shaped metaconid-metastylid valley is characteristic of horse and a U-shaped valley characteristic of asses. Actually the reverse is true as indicated here.[1] A summary of individual examinations of all $P_{\overline{3}}$, $P_{\overline{4}}$, $M_{\overline{1}}$ and $M_{\overline{2}}$ of equids from Palegawra shows that while some degree of variation exists, the general characterization holds true.

Number of teeth: 174 (all $P_{\overline{3}}$ through $M_{\overline{2}}$ of lower cheek series)

No. with strong V-shaped metaconid-metastylid valleys: 147

No. with shallow V-shaped valleys: 4

No. with tendency toward rounding of valley bottom: 3

No. with definitely more U-shape than V-shape: 2

No. with double-folded valley: 2

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[1] In September, 1968, one of us (Turnbull) spent several days at the British Museum (Nat. Hist.) in London examining the collection of onagers on which Groves and Mazák had worked. Our conclusions based upon our Chicago materials were entirely confirmed, and we therefore believe that Groves and Mazák inadvertently reversed their terminology in their published report.

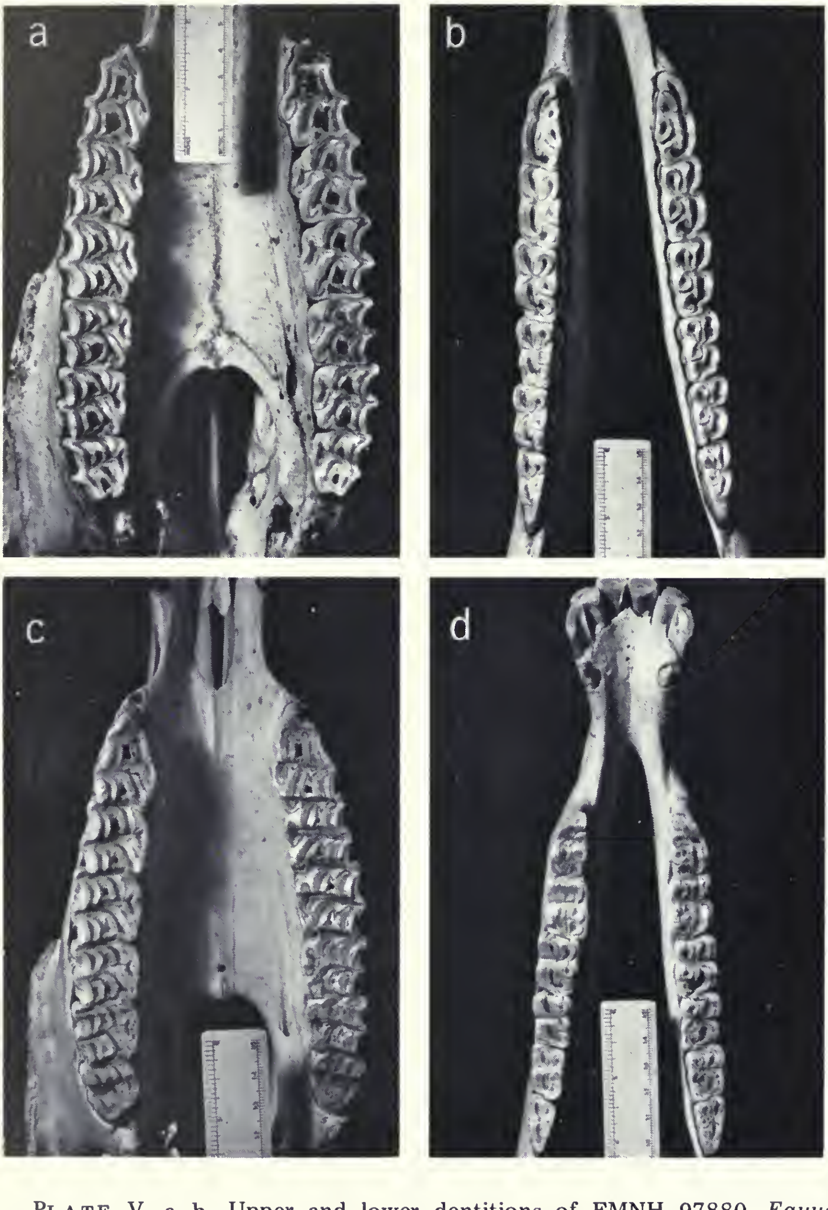


PLATE V. a, b. Upper and lower dentitions of FMNH 97880, *Equus hemionus onager*. Recent, Iran. c, d. Upper and lower dentitions of YPM 1637, *Equus hemionus hemippus*. Recent, Syria. Measures show inches and millimeters.

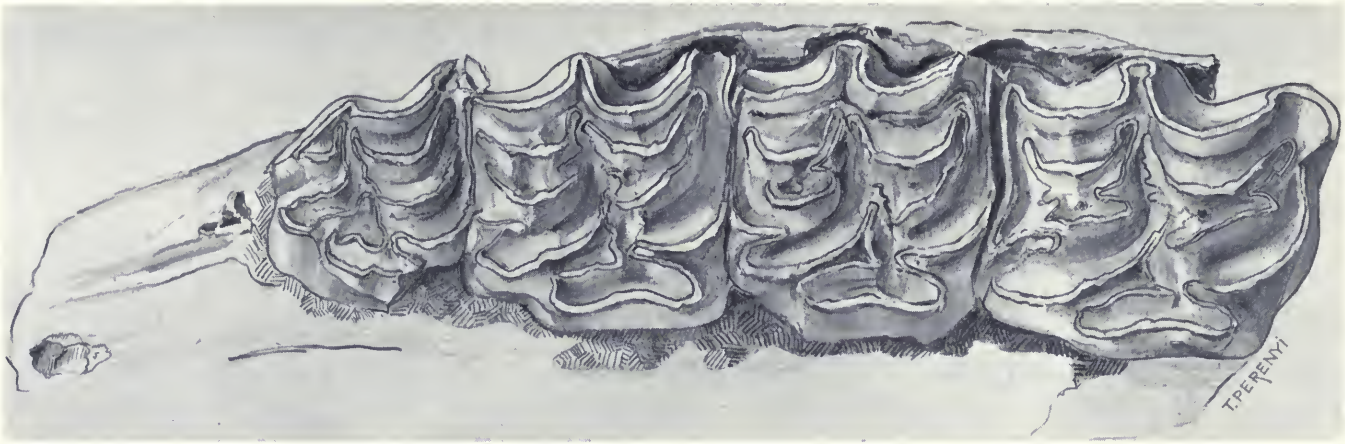
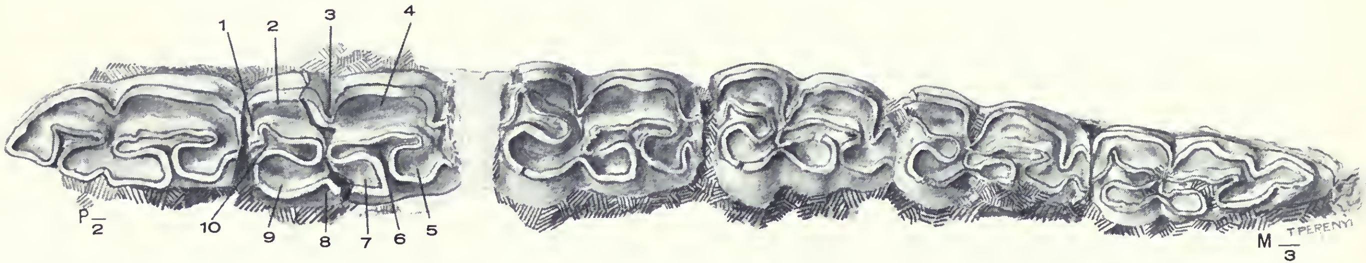


PLATE VI. *Equus hemionus*, Palegawra, PM 10329, Rt. $P^{\underline{4}}$-$M^{\underline{3}}$. x 1.4. Drawn by Tibor Perenyi.



1 paralophid
2 protoconid
3 prd.– hyd. valley
4 hypoconid
5 entoconid
6 entoflexid
7 metastylid
8 mtd.–msd. valley
9 metaconid
10 metaflexid

PLATE VII. *E. hemionus,* Palegawra, PM 12006, $P_{\overline{2-3}}$ at left; PM 12007, $P_{\overline{4}}$-$M_{\overline{3}}$ at right; probably one individual but lacks bone contact. Nat. size. Drawn by Tibor Perenyi.

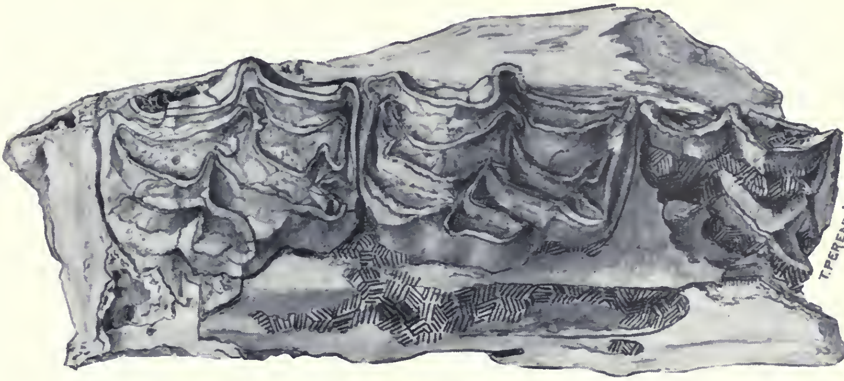


PLATE VIII. *E. hemionus*, Palegawra, PM 12721. L. $dP^{\underline{3-4}}$ and unerupted $M^{\underline{1}}$. x 1.2. Drawn by Tibor Perenyi.

No. too broken or unworn to determine shape: 6

No. of deciduous premolars, all of which have V-shape valleys: 10

As to the depth of the protoconid-hypoconid valley, we are more in agreement with the statement of Groves and Mazák that it does not penetrate as deeply in asses as in horses, or, we add, as in zebras. The following figures refer to the 190 lower teeth (all cheek teeth including the $P_{\overline{2}}$ and $M_{\overline{3}}$) in the Palegawra collection:

Shallow protoconid-hypoconid valleys: 8

Medium protoconid-hypoconid valleys; these do not completely reach the top of the valley between metaconid and metastylid: 152

Deep valleys that nearly reach the metaconid-metastylid valley: 21

Broken: 9

The borders of the metaconid and metastylid are flattened as in caballines, not round as in the zebra. In all of these features we have just described, the Palegawran equid compares very well with specimens of the Persian and Mongolian hemiones in Field Museum as well as with those in the British Museum. In addition, the entaflexid of the Palegawran equid is long, as it is also in the Asian onager and in horses, not short as in zebra. No hypostylid is present on $dP_{\overline{3}}$, which is also a valid character McGrew (1944) found to be present in zebra but absent in horses and African asses. The parastylid is variable.

Scatter diagrams and computations of coefficients of variability (V) were prepared to allow comparisons with other equids and to determine if more than one species was likely to be represented.

PLATE IX. *E. hemionus*, Palegawra. a, PM 10026, Rt. P^{4}-M^{3} to show method of measuring last molar. b, PM 12764, Rt. M_{3}. c, PM 10030, first phalanx, anterior view. d, PM 12614, second phalanx, antero-proximal view. e, PM 12608, distal end of metapodial, anterior view. Broken arrow line shows how anterior-posterior distance was measured on metapodials.

The manner of measurement for each bone is shown on its illustration (pl. IX).

Figures 1-5 present the data of a series of measurements on the teeth and on foot bones. In Figure 1, 24 right and left M^{3}'s are plotted and compared with similar teeth of Recent onagers and a domestic ass.

Figure 2 shows the variation for 21 M_{3}s. As in Figure 1, we include measurements of homologous teeth in *E. hemionus*

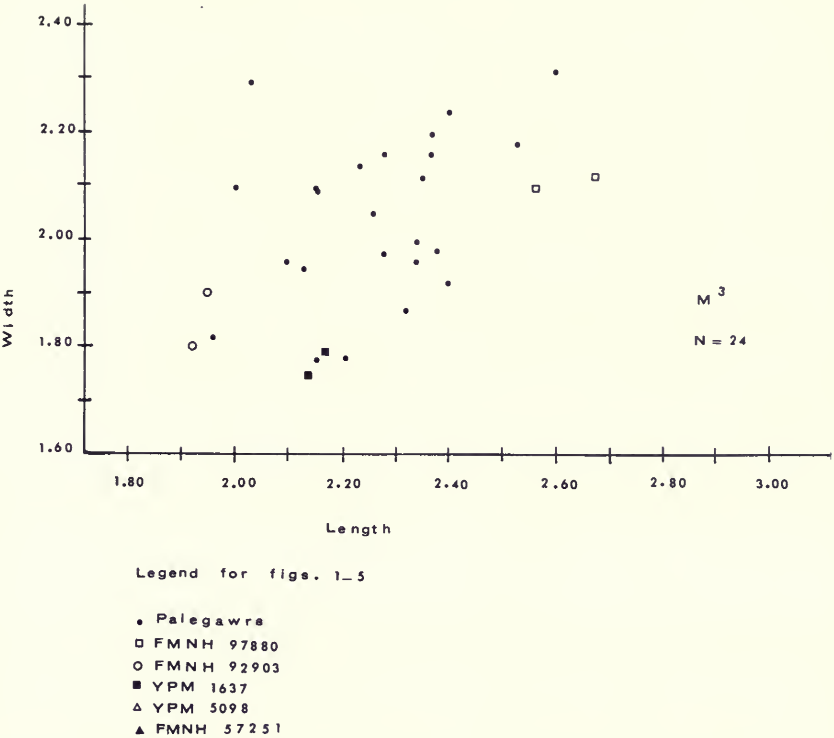


FIG. 1. *Equus hemionus*, Palegawra: scatter diagram of 24 right and left M^3. For comparison the following specimens have been added (legend shown on Figure 1): YPM 1637, *E. hemionus hemippus*, Recent, Syria; right and left M^3. FMNH 92903, *E. asinus* (domestic), Recent, Iraq; right and left M^3 FMNH 97880, *E. hemionus onager*, Recent, Iran; right and left M^3. In Figures 3-5 YPM 5098, *E. hemionus onager*, Recent, Persia; FMNH 57251, *E. asinus*, Recent, Iraq. Width of M^3 is maximum right-left, perpendicular to length. Length measured on enamel band from anterior external ectoloph to posterior external ectoloph. All measurements in centimeters.

hemionus (Mongolia), *E. hemionus hemippus* (Syria), *E. hemionus onager* (Iran), and domestic *E. asinus* (Iraq). We recognize that one specimen of each of the compared species is of no significance if it fits into the pattern, but it might be significant if it fell far outside the pattern's limits.

Figure 3 illustrates variation in 26 first (most proximal) phalanges undifferentiated as to front and rear. The phalanges of *E. hemionus hemippus* (Syria) obviously are smaller, fore and hind, than are the undifferentiated ones from Palegawra. In the case of the Recent onagers from Iran, the anterior phalanges compare well with the group of undifferentiated Palegawran phalanges, but the posterior ones are relatively shorter. The first

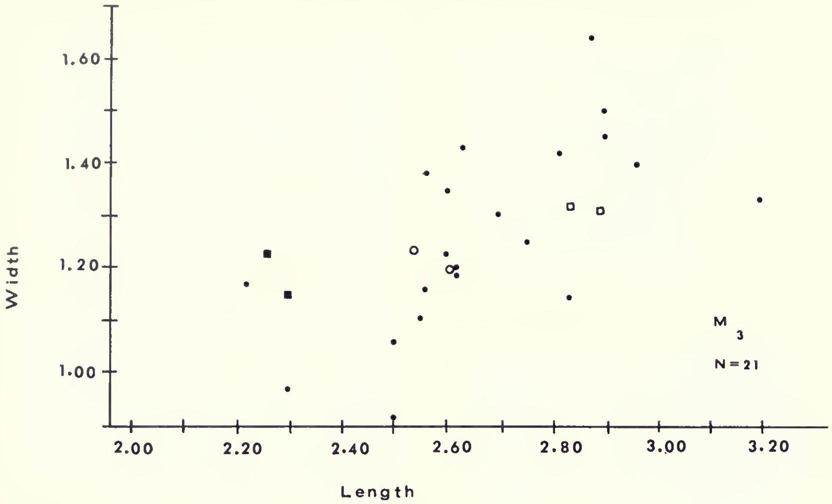


FIG. 2. *Equus hemionus*, Palegawra; scatter diagram of 21 right and left $M_{\overline{3}}$. Legend as for Figure 1. Length measured parallel to the lingual edge. Width measured perpendicular to length. Additional Recent specimens shown for comparison. All measurements in centimeters.

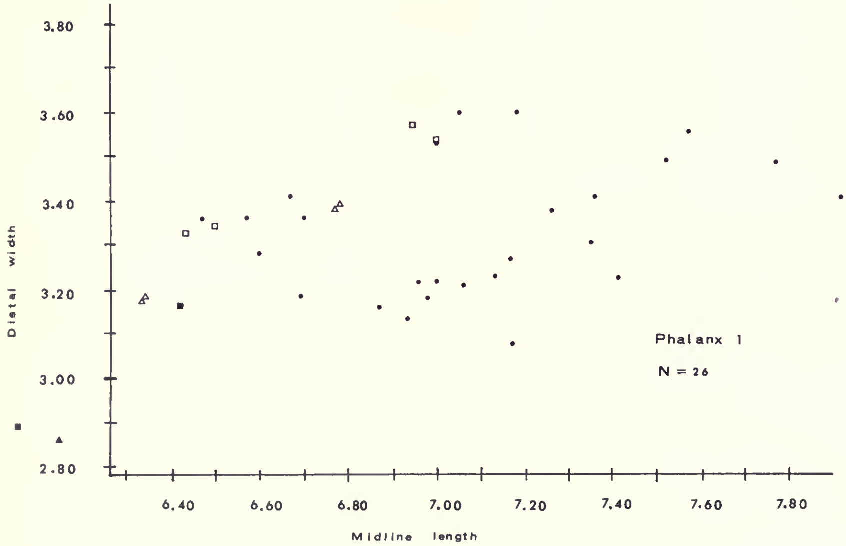


FIG. 3. *Equus hemionus*, Palegawra; scatter diagram of 26 first phalanges. Comparison of Recent measurements are FMNH 57251, *E. asinus*, right fore (hind too small to plot here); YPM 1637, *E. hemionus hemippus*, right fore, left hind; YPM 5098, *E. hemionus onager*, right and left fore, hind. Legend as for Figure 1. Length measured at midline on anterior surface. Distal width measured at condyle (Pl. IXc). All measurements in centimeters.

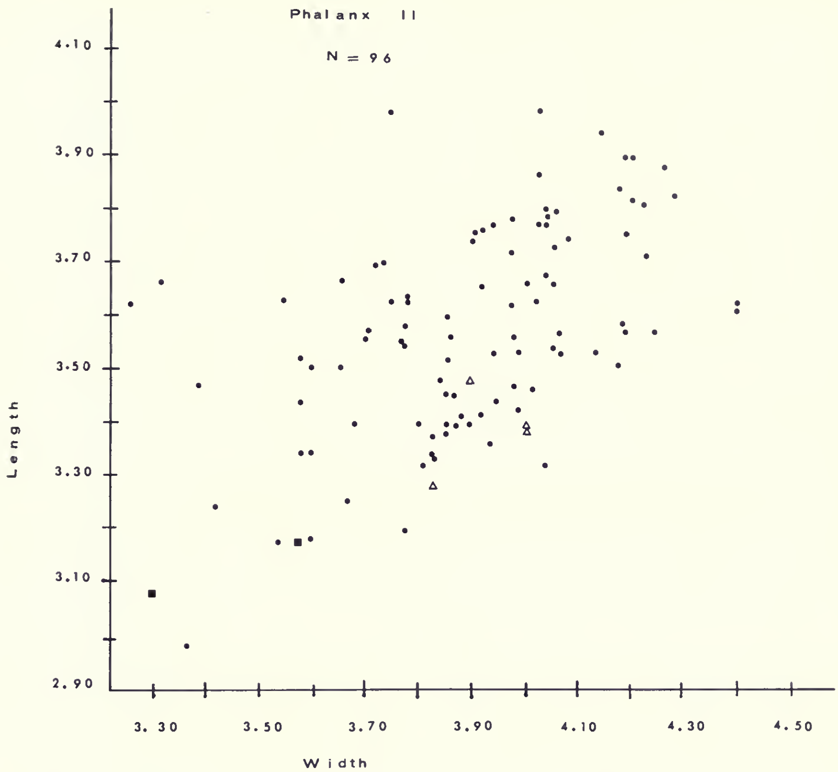


FIG. 4. *Equus hemionus*, Palegawra; scatter diagrams of 96 second phalanges (NOTE: two specimens from Palegawra mentioned in the text were too large to be shown in this figure.) Recent specimens plotted for comparison are: YPM 1637, *E. hemionus hemippus*, right fore, left hind; YPM 5098, *E. hemionus onager*, right and left fore and hind. Width measurement is at proximal end. Length measurement at midline on anterior (dorsal) surface (Pl. IXd). Legend as for Figure 1. All measurements in centimeters.

phalanges of domestic *E. asinus* were too small to appear within the limits of the chart. Perhaps these results indicate that Persian onagers of 12,000 years B.P. and earlier were somewhat larger than Recent forms.

In Figure 4, 98 second phalanges of fossil *E. hemionus* were measured. We chose the distal width of first phalanges, but the proximal width of second phalanges because many of the foot bones are broken and the greatest number of specimens were available with these particular portions intact. In Figure 4, domestic *E. asinus* again was too small to show. The second phalanges of *E. hemionus hemippus* are short, but lie within the lower range of the group of Palegawran specimens. *E. hemionus* *onager* lies well within the range. Two of the bones from Palegawra are much larger than the others and do not show in the figure; both were collected well down in the section, making it unlikely that they are recent domestic horses. The degree of difference in size between these two bones and the smallest of the other 96 specimens is less than the difference in size in the second phalanges of the largest and smallest specimens of domestic *E. caballus* present in Field Museum. We would be inclined to consider that two species of equids are represented at Palegawra if there was a more equal division of the sizes into two groups. Perhaps these two largest phalanges represent extreme size variability between sexes in the population; possibly — although we doubt this — they were deposited in the cave and belonged to an equine population other than the local one. Again we recognize the limitations of our methods on unnatural accumulations of bones.

Figure 5 shows measurements of the distal ends of 37 metapodial (cannon) bones, with domestic *E. asinus* smaller in both dimensions, *E. hemionus hemippus* much narrower in width, and *E. hemionus onager* about equal to the mean of the specimens from Palegawra.

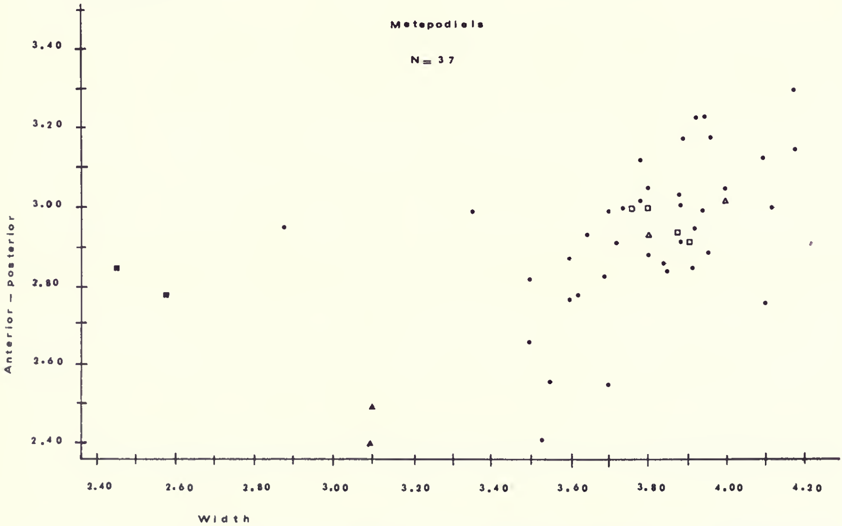


FIG. 5. *Equus hemionus*, Palegawra; scatter diagram of 37 distal ends of metapodials. Compared Recent specimens are: YPM 1637, *E. hemionus hemippus*, right fore and left hind; YPM 5098, *E. hemionus onager*, right fore and hind; FMNH 57251, *E. asinus*, right fore and hind. Legend as for Figure 1. The distal antero-posterior dimension was measured at midline. Width measured distally (Pl. IXe). All measurements in centimeters.

As our sample of equid remains is large, we were able to check our observed conclusion regarding the presence of one species of equid statistically. We are indebted to Dr. Ernest L. Lundelius, Jr., University of Texas, for his generosity in giving us the use of a series of equivalent measurements he made on a modern collection of Mongolian *E. hemionus hemionus* in the American Museum of Natural History, New York.

Right M^3s were measured from the enamel band at the antero-external tip of the ectoloph to the tip of the enamel band at the postero-external corner of the ectoloph. Only teeth showing enough wear to prove complete eruption were used. The formula for standard error was first applied, after which the coefficient of variability was computed (Simpson et al., 1960, pp. 87, 91). For the right M^3s, N = 11, V = 7.97, corrected for small sample size (Haldane, 1955).

For the left M^3s, similar data are: N = 13, V = 8.13, corrected.

The rather high coefficients of variability indicate a group of mixed sex and varying ages of animals from young adults to very old (Simpson et al., 1960, p. 91). Next, for comparison, we made similar calculations using Lundelius' measurements (made in the same manner) of 15 right M^3s of the Mongolian onagers. In this sample, N = 15, V = 6.4, corrected. The lower coefficient of variability of this sample is probably due to the indisputable contemporaneity of the sample in time, and the similar ages of the specimens, as shown by the fact that all teeth were fully erupted but none extremely worn.

Finally, we calculated the coefficient of variability for the widths of 37 distal ends of metapodia in the collection from Palegawra. These represented fore and hind as well as right and left bones. N = 37, and V = 7.4.

All of these results further indicate to us that the Palegawra equids show a degree of variability compatable with what should be expected in a single population. The coefficients of variability were computed for the broken metapodial ends specifically, because we wondered if the scatter diagram might indicate that more than one species was present. In the case of the first phalanx, only 26 specimens were available as opposed to 37 distal ends of metapodials, which circumstance is another explanation of the choice we made. Finally, in the case of the second phalanges, with only two of the very large specimens[1] but 96 others that seemed to form a compact group, we felt extreme individual variation or possibly intrusion of foreign elements (see above) better explained

[1] The measurements for these (in mm.) are: length 4.37 x prox. width 5.51; length 4.39 x prox. width 5.44.

the facts than would an assumption of the presence of two species on so little evidence.

Although Azzarolli (1966) considered the equid populations *onager*, *hemionus*, and *hemippus* to be full species on the basis of skull characters, we cannot distinguish our late Pleistocene form from the modern Iranian *onager* or the Mongolian *hemionus* on the basis of cheek teeth. The Syrian *hemippus* is also very similar except for the smaller size. We continue, therefore, to regard these populations as subspecies of *Equus hemionus*.

While we agree with Groves and Mazák (1967) in considering African and Asiatic asses to be closely related, we do not care to remove these from the genus *Equus*. Instead, we would conservatively retain the genus *Equus* to include true horses, zebras, and the African and Asiatic asses, the latter two groups under the subgenus *Asinus*. The Asiatic hemiones, including our Palegawran forms, are thus designated *Equus (Asinus) hemionus*. The subspecific names *hemippus*, *onager*, *kulan*, *khur*, *luteus*, *kiang*, and *hemionus* are used for modern forms in which size, pelage, etc., reflect living conditions and isolation. We do not propose to assign a subspecific designation to our late Pleistocene fossils, as the diagnostic characters of pelts and skulls are lacking.

We emphasize our belief that only one taxon —*Equus (Asinus) hemionus* — of equids is represented by the remains of equids at Palegawra Cave, because of the often-held assumption that true wild horses, *Equus caballus*, were present in southwestern Asia during the late Quaternary. The presence of such horses in late prehistoric context has indeed been reported for areas as widely separated as Palestine (Josien, 1955), Baluchistan (Guha and Chatterjee, 1946), and Egypt (Gaillard, 1934),[1] but we hold to the belief until convinced otherwise that true horses did not occur in the late Quaternary of the more southern parts of southwestern Asia until introduced from the north as domestic animals early in the second millenium B.C.

Many of the lower jaws and their contained cheek teeth, as well as many of the separated cheek teeth of the onagers, are sheared off horizontally below the gum line, but above the base of the roots. Some of these teeth are freshly broken by the semi-quarrying procedures of the excavators, but most of the broken surfaces are old and obviously produced prior to deposition. There is no

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[1] Reed and Turnbull (1969) have shown, indeed, that this Egyptian Pleistocene "horse" was actually a wild ass, *Equus asinus*.

evidence from scratches or striations that such teeth or jaws were used as scrapers, a use known for jaws in earlier Pleistocene cultures (Kitching, 1963, pl. 31); in the Palegawra specimens the crowns of the teeth are not abraded or worn down in any artificial way nor does the bone show signs of hand-held polish. Neither the loose teeth nor any bony edges of the broken jaws bear any signs of use, and they are not pierced or scratched. That the teeth were actually used to grind or scrape is, of course, possible, but no evidence for such can be determined from study of these jaws. As pointed out below, nearly all of the bones are broken in a fashion "unnatural" to the paleontological eye as a result of the butchering and/or post-butchering practices of the cave dwellers. To what use, if any, the sheared horse jaws were put remains unknown to us at this time. Possibly the thinner ventral jaw fragments — the parts removed— were the desired elements, but no bone artifacts definitely referable to equid lower jaws were found in the cave; indeed, the removed ventral portions of these horizontal mandibular rami are missing entirely. As mandibles possess little marrow and no useful sinew, we are at a loss to understand why these are broken in this fashion.[1] Whatever the reason for the mutilation of the onagers' mandibles, the mutilated (and occasionally intact) lower jaw was carried into the cave more frequently than were most other parts of the skeleton, except feet, as is proved by actual counts of representative lower cheek-teeth, right and left, as contrasted with the numbers of individual post-cranial bones, again excepting foot bones. (See also table 4.)

Some maxillaries are present, also sheared off and with the cheek teeth often broken horizontally near their roots, but these upper jaws are not as numerous as are the lower. Other parts of onagers' skulls seem to be quite rare; admittedly, if fragmented, some parts are difficult to recognize, but the supraoccipital portions should remain intact and are always identifiable.

Order Artiodactyla

Family Suidae

Sus scrofa, wild pig, occurs throughout the cave strata as a small component of the total bone. Probably more than the three

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[1] In February, 1973, Turnbull, then in East Africa, learned from Dr. Mary Leakey that modern African hunters break open lower jaws for the nutriment contained in the spongy bone inside. We have not yet had opportunity to investigate marrow content in lower jars of equids or other game animals, but if a significant amount of edible material is available in this way, our problem of the broken hemione mandibles is at least partially answered.

individuals we list as the minimum possible number are present. The bones appear to fall into a large group, a medium-size group, and a small, immature group. Measurements on upper and lower whole or nearly whole teeth are given below: all measurements are in millimeters; lengths were measured at the midlines, and widths are maximum for each tooth.

Upper teeth

PM 10182. Rt. maxilla with $M^{\underline{1-2}}$, both broken laterally:

L. $M^{\underline{1}}$	17.4
L. $M^{\underline{2}}$	23.2

PM 11795. Rt. maxilla with $dP^{\underline{3-4}}$, $M^{\underline{1}}$:

$dP^{\underline{3}}$	L. 14.2	W. 9.2
$dP^{\underline{4}}$	L. 15.5	W. 12.2
$M^{\underline{1}}$	L. 17.8	W. 15.4

PM 11913. Rt. maxilla with $dP^{\underline{2-3}}$:

$dP^{\underline{2}}$	L. 11.7	W. 5.8
$dP^{\underline{3}}$	L. 13.7	W. 9.2

Lower teeth

PM 10610. Left $M_{\overline{1}}$, moderately worn:

L. 19.7 W. 13.4

PM 12503. Left $M_{\overline{3}}$, unerupted, talonid broken posteriorly:

L. as preserved	29.6
W. at trigonid	19.7

The relatively small number of bones of pigs at Palegawra, in contrast to the numerous remains of onagers, red deer, sheep, and goats, indicates to us that pigs were rare in the area during the period of the latest Pleistocene. The other possibility, that they were a common component of the fauna but little hunted, does not seem logical considering that the Zarzians were competent hunters of big game.

Family Bovidae

The remains of large bovids are rare; while, in general, in the past such bones have been attributed to *Bos*, there is the possibility of confusion with *Bison*, for whose presence in Iraq there is cultural evidence (Hatt, 1959, p. 67). In addition, a few bones from Jarmo have been tentatively identified as *Bison* (Stampfli, In press). The fragmentary bones of the larger bovids at Palegawra are all big relative to those of living cattle. In the case of one fragment of lower jaw, Jesse Robertson, Florida State Museum (pers. comm.) stated that the shape of the coronoid process and relative size of the mental foramen indicate that this specimen at least more closely resembles *Bos* than *Bison*. In fact, the overall size of this bone is much larger than that from living *Bos* or *Bison*, and is as large as that of the North American *Bison latifrons*, a size attained also by some specimens of *Bos primigenius*. Due to the small sample and the lack of any truly diagnostic pieces of bone, we cannot assign the larger bovids from Palegawra with certainty to either *Bos* or *Bison*. The general absence of definitely diagnostic remains of *Bison* from any late Quaternary collections in southwestern Asia inclines us to the tentative conclusion that our few bones of "cattle" do indeed represent a sample from a population of *Bos primigenius*.

Wild *Ovis orientalis* and *Capra hircus aegagrus* from the area of northern Iraq can be distinguished from each other osteologically if an adequate sample of bone is present. Despite careful observations and critical study there remained a significantly large group of bone fragments lacking any diagnostic features other than gross size and these we have had to include as a sheep/goat category.

The detailed descriptions and illustrations of differences between wild sheep and goats given in Boessneck et al., 1964, proved valuable to us, and provided many additions to our own observations made on the large collection of modern wild sheep and goats in Field Museum. Boessneck et al. based their criteria on many forms from various areas. Some of the criteria they listed proved valid for us, others did not. Limitations are often the result of badly broken bone. Many of the most obvious differences — i.e., proportions of length/width in metapodials — could not be used at all because no complete metapodials were preserved.

The lack of any horncores of *Ovis*, and the presence of only one horncore of *Capra* together with a few skull fragments, probably indicate that the skulls were left behind when the partial carcasses were brought back to the cave. Perhaps the brains were consumed on the spot as a welcome picnic lunch for the hungry hunters. Possibly some of the indeterminate bone fragments belong to skulls of *Ovis* or *Capra*, but if any abundance of horn cores or other parts of skulls had in fact been brought to the shelter these hard parts would undoubtedly have been preserved. As with the lack of equid skulls, this near-absence of horncores of sheep and goats seems to prove the skulls never were brought to the cave. However, at least 46 fragments of lower jaws are present. The butchering technique therefore must have involved shattering the cranium and separating the lower jaws from the rest of the skull.

It is interesting to note that bones of the forequarters of the sheep and goats are two to five times more numerous than are bones of the hindquarters:

Scapulae	15	Pelves	3
Humeri	27	Femora	12
Radii-ulnae	38	Tibiae	20

The situation among the bones of onagers is much more equal:

Scapulae	15	Pelves	12
Humeri	11	Femora	25
Radii-ulnae	23	Tibiae-fibulae	20

Our study of the ages of the sheep and goats indicates that these animals were not domesticated (see table 5). Many more slight-to-moderately worn (74 per cent) cheek teeth than unerupted (16 per cent) or extremely worn (10.0 per cent) cheek teeth tell us the hunters were killing adults and were not slaughtering an excess of young animals or feeble old ones particularly.

Remains of *Gazella subgutturosa* form 8.5 per cent of the total identified bone of game animals, estimated to represent at least seven individuals. The fact that about as many remains of gazelle as goat are present may be taken as another indication that all caprines present at Palegawra were wild. It would be expected that domestic animals, if present, would make up a larger proportion of the preserved bone than hunted ones.

Wild gazelle of southwestern Asia may be distinguished from sheep/goat by the smaller, more slender, and more delicate shape of teeth, jaws, and post-cranial bones. The phalanges are considerably smaller and cannot be mistaken as belonging to immature sheep/goat. Two very commonly preserved elements — preserved because of the compact nature of these bones — are the astragalus and calcaneum, which are similar in all small bovids and are also easily confused with the same bones of the small cervid, *Capreolus* (roe deer). Although not actually represented at Palegawra, *Capreolus* is one animal we expected to find and were aware might well be present in this fauna.

Family Cervidae

We refer all of the remains of deer to *Cervus elaphus*. All of these bones are larger than are those of *Dama mesopotamica* and no size difference exists to indicate separation into either sexual or specific groups. Figures 6-9 are scatter diagrams of measurements of $M_{\overline{3}}$s, distal metapodials, and first and second phalanges of the population as present at Palegawra. The sample of $M_{\overline{3}}$s is small (7)

PLATE X. *Cervus elaphus*, Palegawra. a, L.$M_{\overline{3}}$, PM 10164. b, PM 10675, L.$P_{\overline{3-4}}$, $M_{\overline{1-3}}$. c. PM 10755, distal end of Rt. metacarpal, anterior view. d, as for c, medial view. e, PM 11088, proximal end of first phalanx. f, PM 11100, proximal end of second phalanx. All show method of measuring bones.

and three of these are unworn teeth, but the samples of foot bones are larger. Relatively little antler is present. One suggestion might be that cervid antlers and bovid horn were utilized for tools; if true, the tool-making and tool-use were accomplished away from the cave. We suggest as an alternative that this lack of antlers and horncores in the cave is indicative of a butchering practice of the Zarzian people, already mentioned for their treatment of onagers, of removing the lower jaw (and occasionally the upper ones also) and leaving the remainder of the head in the field.

There is another factor to be considered; red deer, especially in mineral-impoverished country, will eat shed antlers almost as soon

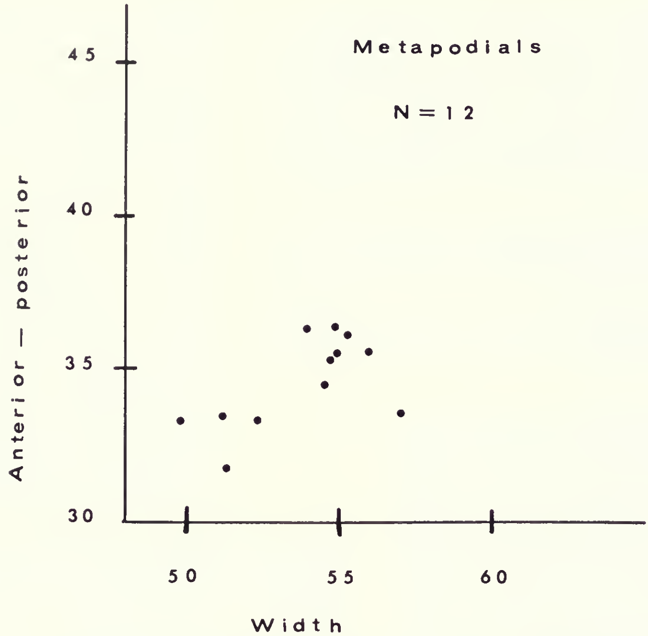

FIG. 6. *Cervus elaphus*, Palegawra; scatter diagram of 12 distal ends of metapodials. The antero-posterior dimension is the maximum one. Width measured across the condyle (Pl. Xc-d). All measurements in millimeters.

as they are dropped. Darling (1956, p. 160) has reported that by midsummer in his Scottish field, barely a trace of antler can be found, so complete is the ingestion of this bone, rich in calcium phosphate. It is certainly possible that a similar activity characterized the red deer of our Zagros mountain foothills (although we do not imply mineral impoverishment), explaining the absence of all but fragmentary remains of antlers. Incidentally, red deer normally shed the antlers in the early spring, but we do not suggest that Palegawra was occupied only during periods when no antlers were being carried.

In terms of modern conditions, we usually relate the presence of large deer to forest conditions. Kretzoi (1968, *in* Gábori-Csànk, 1968, p. 82) also expressed surprise to find *Cervus elaphus* in the oldest and driest of the Middle Paleolithic strata of the excavation at Erd, Hungary. Reconsidering, we realize that as long as sufficient food is available, *Cervus elaphus* could just as well have occupied sparsely wooded cold steppe such as the Zagros foothills presumably were. In a letter to Reed, F. Frazier Darling (April, 1967) agreed that this could be the case; he

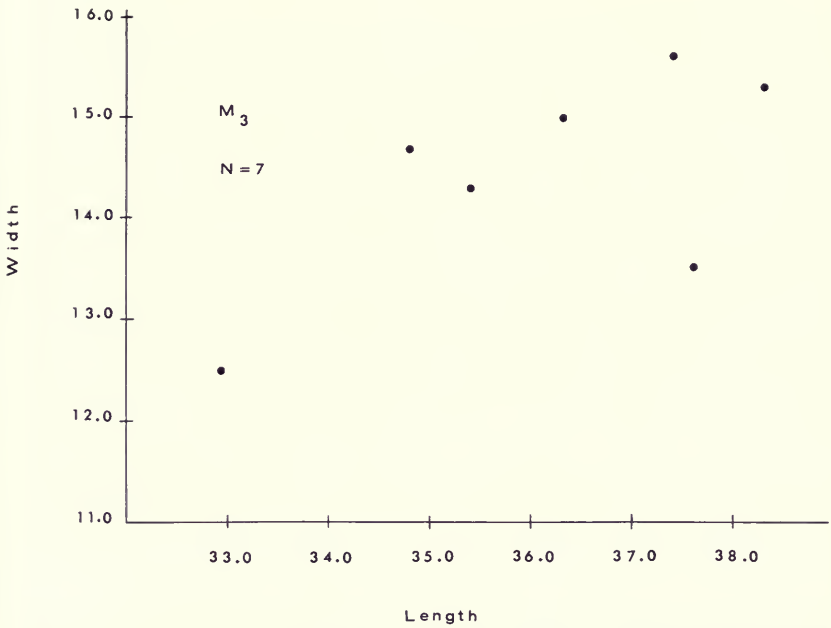

FIG. 7. *Cervus elaphus*, Palegawra; scatter diagram of seven $M_{\overline{3}}$. The three smallest specimens are unworn teeth. Width measured anteriorly at widest part of crown. Length measured perpendicular to width at crown level (Pl. Xa). All measurements in millimeters.

remarked that many areas inhabited by the red deer in the Scottish Highlands are quite without trees, and pointed out that red deer in Kashmir are occupying treeless country even now. Furthermore, Darling has informed us that the Island of Harris in the Outer Hebrides "is completely treeless, extremely rough and rocky, and such herbage as there is, is very short. The acreage is 55,000, rising from sea level to 2,600 feet, and there is no record of deer ever having been exterminated. Presumably they have been there since the glaciers receded." Hence evidence for predominantly steppe environment is not in any way in conflict with the presence in some abundance of the red deer.

In an earlier preliminary report on Palegawra (Braidwood and Howe, 1960, p. 59), based on field identifications, *Capreolus* was mentioned as presumably present. However, under the conditions of laboratory study, no bone that could be identified as roe deer was seen among the several thousand fragments examined.

C. FAUNA OTHER THAN MAMMALS. Numerous long-bones of birds were found at all levels. In the absence of available comparative

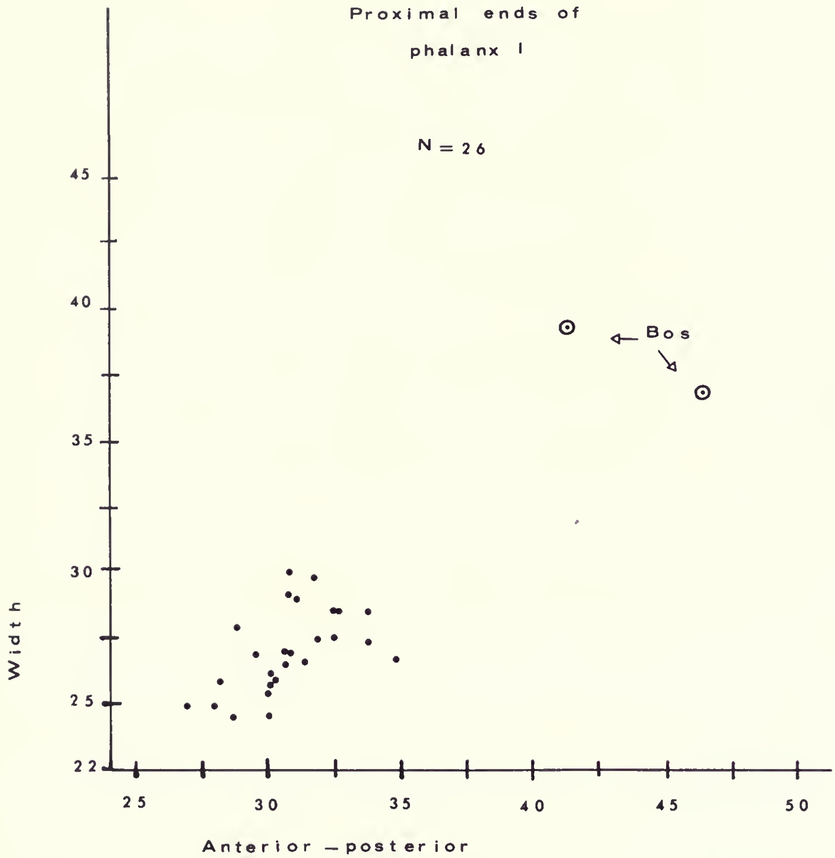

FIG. 8. *Cervus elaphus*, Palegawra; scatter diagram of 26 proximal ends of first phalanges. For comparison measurements of two specimens of *Bos* from Palegawra are shown. Width measured at proximal end. The antero-posterior dimension is the maximum at the proximal end (Pl. Xe, right). All measurements in millimeters.

materials of avian skeletons in the Field Museum, Dr. Eitan Tchernov of The Hebrew University in Jerusalem has generously taken the time to identify the bird bones from Palegawra. He (pers. comm.) reports the following avifauna:

Alectornis graeca, rock partridge
Tadorna tadorna, sheldrake
Anas ?acuta, pintail duck
A. ?platyrhinchos, mallard
Haliaetus sp., eagle
Falco cf. *tinnunculis*, kesterel
Ciconia sp. (*?ciconia* or *?nigra*), stork

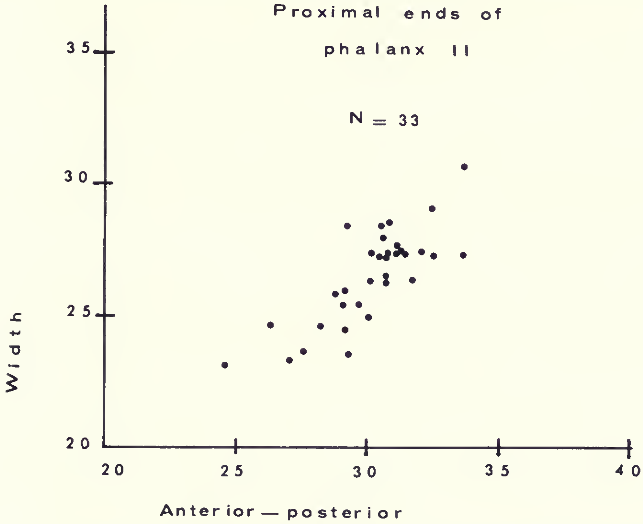

FIG. 9. *Cervus elaphus*, Palegawra; scatter diagram of 33 proximal ends of second phalanges. Measured as in Figure 8 (Pl. Xf). All measurements in millimeters.

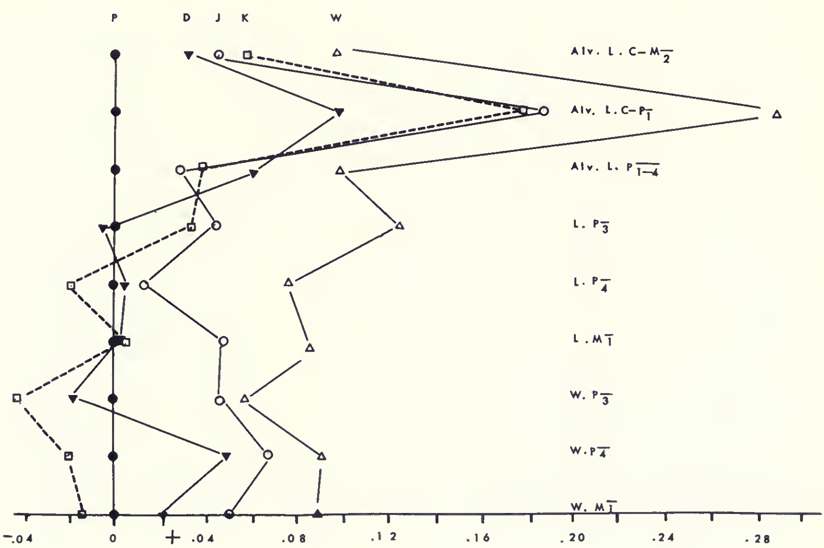

FIG. 10. Ratio diagram of logarithmic differences between various length and width measurements comparing the Palegawra canid (dark circles labeled P) as the standard with the mean values for dingo (dark triangles labeled D), Jarmo dogs (light circles, J), Kurdish dog (light squares, K), and Zagros wolves (light triangles, W). L. = length; W. = width.

Tyto alba, barn owl
Ceryle rudis, pied kingfisher
Neophron percnoptera, Egyptian vulture
Turdus-sized passeriform, thrush
Sturnus vulgaris, starling
Petronia cf. *petronia*, rock sparrow

Remains of tortoises, *Testudo graeca*, are abundant at all levels, and must have furnished a definite addition to the diet. These tortoises have wide environmental tolerances (Reed and Marx, 1959) and live today in Iraq from the lower foothills of the Zagros to the higher grassy slopes above timberline, where the winters are cold with deep snows. Thus the presence of *Testudo graeca* in the Palegawra area at the close of the Pleistocene is not unusual, as the tortoises would have been active during the summer and then burrowed below the frost-line to survive the winter.

A few jaws of unidentified lizards and many limb bones of a toad, *Bufo viridis*, were recovered. These animals probably were merely incidental residents in the cave or at its mouth. Indeed, a few of the toads, seeking dampness, were found to be living in the cave at the time it was excavated.

Zarzian and some later peoples of the Zagros area have long been known to be snail-eaters, and in correlation we found numerous shells of the edible snail, *Helix salomonica*, which were undoubtedly used for food. As with other such snail eaters of the general time and area, a larger snail (*Levantina* sp.), actually as edible as *Helix* (Reed, 1962), was generally ignored. We recovered 196 shells of *Helix* and 20 of *Levantina*, a higher proportion for the latter than in early Recent sites in the Zagros area.

A few shells of a local fresh-water clam, *Unio tigridis*, were also found, and the meat of these clams was probably occasionally used for food, as was true — sometimes more intensively — elsewhere in the Zagros during the late Pleistocene (Reed, 1962). The shells we recovered at Palegawra showed no evidence of human modification.

A number of claws of crabs, *Potamon potamios*, freshwater inhabitants of the stream below the cave, are present in the cave residues and are evidence of the availability of such crustaceans as well as for the variety of food enjoyed by the Zarzians. Each such claw is invariably only the terminal segment (dactylopodite) from a first walking leg. Some have the distal tip broken to form a tiny hole. Probably the crabs were eaten at the streamside where captured but the sharp terminal segments of the first walking legs were saved, to be taken to the cave and used for probing and picking until the tip was broken.

Several fossil echinoid spines were found and present an interesting situation. Were they of use to the Zarzian cave dwellers as probes; were they collected as curiosities; or were they merely coincidently preserved in the accumulation of refuse on the cave floor? There are but five, all from the 40-60 cm. level; and none has been altered beyond the breaking of a tip. Were they found locally in a nearby fossiliferous rock stratum, or were they transported from other places? These questions cannot be answered at present.

Miss Carol Wagner, working with Dr. Wyatt Durham, University of California at Berkeley, has kindly examined several of the spines. She concluded (pers. comm.) that they are indeed fossil and represent the genus *Eucidaris*, and probably the species *metularia* or its ancestor. *E. metularia* lives today in littoral situations along the northeast coast of Africa, throughout the Red Sea and the Indo-Pacific all the way to Japan and Hawaii. It could probably inhabit the Persian Gulf as well. Miss Wagner pointed out that *Eucidaris* is known from Eocene and Oligocene deposits of New Zealand, and from Miocene strata of Australasia and America. Our guess is that the derivation of the Palegawra spines is from the local limestone, but neither the stratigraphy nor the paleontology of the general area has been sufficiently studied to allow determination of the geological age of the spines.

D. Animals Not Present. We can derive intellectual profit from a consideration of the animals probably present in the area of Palegawra ca. 12,000 and more years ago, but whose remains are not found in the cave. Thus we perceive instantly that the Zarzian people, although they did capture foxes (see above), probably rarely hunted the other large or small carnivores — bear, leopard, wolf, jackal, hyaena, badger, lynx, and smaller cats (and also possibly lion and/or tiger) — some or all of which were probably in the area. Or, if killed occasionally (as badger, lynx, and small cats were; Table 1) the bones of these animals were not often taken to the cave; possibly the meat of such carnivores simply was not sought. Furthermore, to hunt such animals entailed difficulty or danger or both far out of proportion to the rewards to be expected from the routine hunting — whatever the routine may have been — of the few standard game herbivores.

The absence in the cave deposits of bones or scat of the hyena, *Hyaena hyaena* would seem to be a mystery. If the cave were sporadically occupied, as we think to be true, hyenas would be expected to enter whenever the human occupants had left, to feed on or carry away the bones of the most recently-killed animals. However, none of the bones in the cave show evidence of crushing by hyena, nor is there — with one possible exception (p. 106) — any of their typical bone-filled scat preserved, as probably it would be if it were ever present. Indeed, in reviewing mentally the remains of caves and middens one of us (Reed) has known in northeastern Iraq, we are impressed with the total absence of evidence of the hyena in all such sites[1]. The animal was obviously not a food item, but as an obligate scavenger one would expect to find an occasional bit of evidence of its presence.

Possibly the absence of *Dama mesopotamica* and *Capreolus capreolus* from the cave deposits may mean that the fallow deer and roe deer were not present in the area at the time of Zarzian occupation, probably because of the absence of sufficient forest cover. Certainly a hunting people who successfully killed *Cervus elaphus*, the big red deer, would have also killed smaller cervids if they had been available. Within the late Pleistocene and into the Recent, *Dama* has had a wide distribution in southwestern Asia, from the central Persian plateau into Palestine and perhaps into Egypt (Haltenorth, 1959), thus ranging over a territory with considerable environmental variation. In northern Iraq in 1954, Reed saw roe deer in country more mountainous but more heavily forested than was that around Palegawra 12,000-14,000 years ago. Both of these deer have lived within historical time in areas of southwestern Asia with snow and sub-freezing temperatures but both are deer which probably require more of a forested environment than we have imagined for the Palegawra area at the end of the Pleistocene. Thus their absence from the cave deposits would seem to indicate their absence from the area at the end of the Pleistocene.

IV. THE FAUNA AND HUMAN HUNTING

The analysis of the faunal remains yields information primarily related to the hunting and butchering activities of the Zarzian peoples. Some of this information has been mentioned in discussing remains of individual species, but a more detailed and statistical survey produces further information.

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[1] Hyaena scat was found at Warwasi in west-central Iran (Turnbull, MS).

Table 1 lists the species (minimal possible number of each) of the fauna in terms of decreasing percentage of the total. It is obvious that food animals of medium-to-large size make up the major proportion of the list. As the amount of meat on an onager is less than half that of a cow, it is to be wondered that so little *Bos* and/or *Bison* occurs. We think it probable that the large bovids were scarce in the area at this time. Additionally, a herd of horned cattle present more danger than do equids to a small hunting party, and it is possible that selection of deer and onager in preference to cattle reflect conditions of choice rather than scarcity. In terms of Palegawra's location in the Zagros hills, it would appear cattle would be more apt to have been found south and west of the immediate area of the cave. Perkin's "schlepp" effect must also contribute to the sparse occurrence of bones of *Bos*, for these heavy pieces would have been abandoned after the meat was stripped.

Some of the rodents found at Palegawra probably lived with man, or lived in the cave between human occupations. However, the commensal house mouse, *Mus musculus*, native to the area today, is absent from our list. One rodent which must have been purposely collected, undoubtedly for food, is a burrowing form, *Spalax leucodon*. We suggest that probably the way that prehistoric people caught them was to watch for their rare emergence above ground at night, as does occasionally happen (Reed, 1958). Once above ground, they are quite helpless and can easily be picked up. *Spalax* would not be a normal inhabitant of a cave or rock-shelter.

Another rodent found at Palegawra which must have been carried there, presumably by man, is the water vole (*Arvicola terrestris*). These rodents typically burrow in deep wet soil adjacent to streams but may emerge from their burrows to feed in streamside vegetation (Lay, 1967, p. 161). They are neither large enough, or numerous enough in the Palegawra fauna, to have been an important item of diet, but seemingly they were occasionally caught, possibly in traps.

Table 2 presents, in addition to the minimum numbers of individuals and percentages of the game mammals, the minimum amounts of available meat represented by the cave remains. Calculations are based upon half the live weights given by Walker (1964), as tempered by Reed's experiences with most of the species. There is evidence that nearly seven times as much meat from equids as from sheep/goat was available to the Palegawrans,

TABLE 3. Kinds of bones of game animals represented in the remains from Palegawra Cave.

	Equus hemionus	*Sus scrofa*	*Bos primigenius*	*Cervus elaphus*	*Ovis/ Capra*	*Ovis orientalis*	*Capra hircus aegagrus*	*Gazella subgutturosa*
Fragment of antler or horn core				12			1	6
Skull fragments	6				2	1	3	
Individual teeth	390	10	2	65	122	6	13	
Maxillary fragments with or without teeth	25	3		1	5			3
Mandibular fragments with or without teeth	42	3	1	22	30	3	13	19
Vertebrae	28	2		3	26			2
Scapulae	15	1		6	15			
Humeri	11	4		2	18	7	2	3
Radii-ulnae	23	1	3	14	34	2	2	3
Carpal bones	45	3	1	15	13			
Metacarpals	13	7		3		12	4	1
Pelvic fragments	12			1	3			
Femora	25	2		7	10	1	1	
Patellae	23			1	4			
Tibiae-fibulae	20	1	2	7	20			
Tarsal bones	39	5		20	16	11	9	5
Metatarsals	3	1		2	7	6	2	2
Sesamoids	53			10				
Metapodials indet.	67	6	1	29	26		1	11
Phalanges 1	97	6	6	107	21	24	19	28
Phalanges 2	103	7	1	80	17	36	17	11
Phalanges 3	76	6	2	49	7	18	8	1

TABLE 4. Least number of individuals of different game animals as determined by the presence of different bones of limbs and jaws; based on the raw data from Table 3.

Equus hemionus		*Cervus elaphus*		*Ovis/Capra*		*Gazella subgutturosa*	
Phalanx II	27	Phalanx I	14	Mandible	23	Mandible	10
Phalanx I	25	Mandible	11	Radius-ulna	19	Metapodials	4
Metapodials	21	Phalanx II	10	Metapodials	15	Phalanx I	4
Mandible	21	Metapodials	9	Humerus	14	Phalanx II	2
Phalanx III	19	Phalanx III	7	Tibia	10	Humerus	2
Femur	13	Radius-ulna	7	Phalanx II	10	Radius-ulna	2
Maxilla	13	Tibia	4	Phalanx I	8	Maxilla	2
Patella	12	Femur	4	Scapula	8	Phalanx III	1
Radius-ulna	12	Scapula	3	Femur	6		
Tibia	10	Maxilla	1	Phalanx III	5		
Scapula	8	Humerus	1	Maxilla	3		
Humerus	6	Patella	1	Patella	2		

and nearly four times as much as from deer. Considering the greater difficulty and hazards of hunting hemiones over hunting the smaller game, it would seem the trouble was well worth the energy expended to hunt, kill, butcher, and "schlepp" the equids. Useful as sheep/goat remains are to the anthropologist interested in domestication, the Palegawrans simply were more interested in the then present potentials of the equids than in the future use to which their descendants put sheep and goats! Despite the paucity of *Bos*, discussed above, a significant part of the diet consisted of beef — cattle may have been scarce, but individually they are large, and beef must have been a welcome dietary bonanza.

Table 3 lists the kinds of bones present for each of the large game animals, and gives a record of the numbers of each kind of bone identified.

For the more numerous ungulates (onagers, red deer, sheep/goat, and gazelles), Table 4 translates the data of Table 3 from a census of individual bones to determinations of the minimal

TABLE 5. Data for determining ages of large game animals from Palegawra

Species	TEETH				LIMB BONES				
	Unerupted	Little wear	Moderate wear	Very worn		Epiphyses unfused	Fusion beginning	Fusion advanced	Fusion complete
Equus hemionus									
M^3_3	4	19	25	23	Distal radius/ulna	2		2	7
Other	18	25	172	50	Distal tibia	3		1	4
Ps and Ms					Distal metapodials		1	13	46
					Proximal phalanx I	2	2	11	25
					Proximal phalanx II	1	9	34	55
Sus scrofa									
M^3_3	1	1			Distal radius	1			
Other	4	2	2		Distal metapodial	2		2	5
Ps and Ms					Proximal phalanx I	1		2	2
					Proximal phalanx II	1		7	2
Bos primigenius			1		Distal metapodial			1	
					Proximal phalanx I			1	3
					Proximal phalanx II			1	
Cervus elaphus									
M^3_3	1	4	9	2	Distal metapodial	5			25
Other					Proximal phalanx I	1		6	32
Ps and Ms	4	26	24	6	Proximal phalanx II	1		5	34
Ovis orientalis									
M^3_3		4	1		Distal metapodials	5	2	4	6
Other					Proximal phalanx I	4	1	4	10
Ps and Ms	1		3		Proximal phalanx II			6	26

TABLE 5. Data for determining ages of large game animals from Palegawra — *Continued.*

Species	TEETH Unerupted	Little wear	Moderate wear	Very worn		LIMB BONES Epiphyses unfused	Fusion beginning	Fusion advanced	Fusion complete
Capra hircus aegagrus									
$M\frac{3}{3}$	3	2	8		Distal metapodials	3	1		2
Other					Proximal phalanx I	4	2	7	6
Ps and Ms	5	1	7		Proximal phalanx II	3	1	4	9
Ovis/Capra									
$M\frac{3}{3}$	3	9	4	4	Distal radius	8			1
Other	7	11	34	17	Distal tibia	4	1		6
Ps and Ms					Distal metapodials	2	1	2	1
					Proximal phalanx I	6		1	2
					Proximal phalanx II	2	1		6
Gazella subgutturosa									
$M\frac{3}{3}$	1	3	1		Distal metapodial	1		4	6
Other	2	7	7		Proximal phalanx I			6	10
Ps and Ms					Proximal phalanx II	1		4	7

numbers of animals which would have been derived from an analysis of those bones. The relatively high proportion of numbers of individuals which would have been counted on the bases of mandibles and distal bones of the limbs, as compared with maxillae and more proximal bones of the limbs, is apparent. The mandibles and bones of the feet were more often carried or dragged to the cave, and the disproportion of these bones we attribute to "schlepping" (Perkins and Daly, 1968). From Table 4 we also derive the information that third phalanges (the most distal ones), are erratically preserved in such zoo-archeological collections, probably due to the small size of these bones, and are not dependable indicators of absolute numbers or relative population densities.

Table 5 summarizes the ages of the larger mammals as reflected in a study of dental wear, the sequence of eruption of teeth, and epiphyseal fusion. Numbers in the chart refer to actual numbers of individual bones. If a jaw contained an $M_{\overline{3}}$ along with other teeth, only the $M_{\overline{3}}$ was considered. Thus, most "other teeth" represent loose teeth. From the evidence shown here, most of the mammals whose bones were preserved at Palegawra were adults with teeth moderately worn and with all or almost all epiphyses fused. Thus we conclude that the Zarzian hunters were not concentrating on the groups of very young or very old, but attacked and killed any animal they could, getting a somewhat random sample of the hunted population. They may even have avoided killing the very young individuals, or, if killing these, may sometimes not have carried the parts to the cave. The bones of very young animals are also fragile and less certain of preservation.

In Table 6 we have applied the conclusions derived from the known data on dental wear for the American elk, *Cervus canadensis*, to the teeth of *C. elaphus* from Palegawra, although we realize these two forms[1] lived in different environments. Quimby and Gaab (1957) developed a series of diagnostic criteria, which, when applied to lower cheek teeth in *Cervus canadensis*, gave at least a good approximation of individual age.[2] The results of applying the characters of Quimby and Gaab for 2, 3, and 4 year old *C. canadensis* to our collection of *C. elaphus* are shown in

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[1] The American elk, *Cervus canadensis*, and the red deer, *C. elaphus*, are probably no more than sub-specifically distinct.

[2] We have not counted the growth layers in dental cement, a technique used for determination of age of red deer by Mitchell (1963).

TABLE 6. Aging *Cervus elaphus*, using the criteria of Quimby and Gaab, 1957.

Specimen no.	Yearling	2-year	3-year	4-year	5-year	8+-year
PM 11189, $LM_{\overline{3}}$				X		
PM 11188, $LP_{\overline{2}}$-$M_{\overline{2}}$			X------	X		
PM 10752, $LP_{\overline{3-4}}$						X
PM 10753, $RP_{\overline{4}}$			X------	X		
PM 10163, $RM_{\overline{2-3}}$				X------	X	
PM 10164, $LM_{\overline{3}}$					X	
PM 10165, $RP_{\overline{3}}$			X------	X		
PM 10113, $RM_{\overline{3}}$					X	
PM 10111, $LM_{\overline{1-2}}$				X		
PM 12670, $LM_{\overline{3}}$					X	
PM 12492, $RP_{\overline{4}}$				X		
PM 10677, $RM_{\overline{3}}$				X		
PM 11386, $RP_{\overline{3}}$-$M_{\overline{1}}$			X			
PM 11485, $RP_{\overline{2}}$-$M_{\overline{2}}$			X			
PM 10675, $LP_{\overline{3}}$-$M_{\overline{3}}$			X			
PM 11384, $LP_{\overline{2}}$-$M_{\overline{3}}$					X	
PM 12349, $RM_{\overline{3}}$						X
PM 11934, $LdP_{\overline{2}}$	X					
PM 11935, $LM_{\overline{3}}$				X		
PM 11256, $RP_{\overline{2-4}}$			X------	X		
PM 10517, $LM_{\overline{1-3}}$			X			
PM 11792, $RM_{\overline{2}}$			X			
PM 11628, $LM_{\overline{3}}$			X			

R = Right
L = Left

Table 6. These data are further evidence that the Palegawra hunters were concentrating on mature game animals.

Butchering and retrieval techniques: The favorite butchering technique with a dead ungulate seems to have been to skin it where it fell, leaving the feet and mandibles (less often the maxillae also) in the skin. The meat was then cut off the carcass and piled on the spread skin, after which the feet and jaw provided handles for sometimes dragging ("schlepping") and sometimes carrying the load back to the cave. This explanation fits the facts as we find them at Palegawra (tables 3, 4), and also most probably

TABLE 7. Specimens used as basis for computing minimum number of individuals, game animals only.

Equus hemionus. All specimens in Field Museum of Natural History.

PM 19062-3, 11506, 10139, 10062, 10068, 12695-9, 11067-72, 10084-7, 12614-5, 12617-8, 12474-5, 12478, 12489, 10257, 11615-6, 10491, 10259, 12477, 10656-9, 11398-9, 12771-82, 10779-81, 11170-6, 11449, 11410, 11447, 11697-702, 11932, 10533, 11240-5, 10344-50, 12047-51, 11331, 12100-1, 12007, 11999, 12002-3, 12063, 10224-6.

These represent 103 second phalanges. Simply divided by 4, there would be 26 individuals; one bone was so immature that it had to be considered alone, giving a total of 27 as the minimum number of equids represented.

Sus scrofa. Three right maxillary fragments.

PM 11795, 10182, 11913.

Cervus elaphus. 12 right mandibular rami.

PM 11792, 11256, 11485, 11386, 11358, 12349, 10677, 10753, 10163, 10113, 10165, 11385.

Although 107 first phalanges, divided by 8, would yield 14 animals, several of the phalanges were broken fragments that possibly belong together. The rami are considered the more reliable for counting in this case.

Capra, Ovis, Capra/Ovis. 18 left mandibular rami.

Capra hircus aegagrus. PM 10358, 11942, 11522, 10957, 11525-6, 12180.

Ovis orientalis. PM 10197.

Capra/Ovis. PM 12518, 10022, 10440, 11259, 11666, 12302, 10194, 11754,11524,12402.

Consideration of two different kinds of bones produces an interesting "check" on our estimate. We recognize ten *Ovis* right astragali, and eight *Capra* right $M_{\overline{3}}$s, a total of 18, the same as our total estimate based on jaws. Since there are but five *Capra* right astragali, giving a total of 15 recognizable right astragali for *Capra/Ovis*, we use the somewhat larger figure based on the rami.

Gazella subgutturosa. Seven left mandibular rami.

PM 10020-1, 10433, 10809, 10189, 11914, 12178.

was typical of the hunters at the pre-agricultural village of Suberde in southwestern Anatolia (Perkins and Daly, 1968).

Variations on the typical technique as described above were possible. Reed's experiences with Kurdish hunters in the Zagros Mountains are that a single man can and will carry a whole or gutted carcass of wild sheep, goat, or gazelle several kilometers, and will thus arrive at his village with skeleton intact. Such a practice was seemingly rare among Palegawrans, or, if they did occasionally do so, they still removed the horns and much of the skull before carrying. Particularly in sheep and goats the horns are heavy and have no food value; if not used for artifacts (and seemingly horn cores at least were not so used) the logical thing was to discard them at the site of the kill. Probably the skull was opened and the brain eaten, the horns removed, and the remainder of the skull (except the mandible, still in the skin) discarded. The viscera were probably too valuable, since most of them can be eaten or otherwise utilized, to be discarded and may often have been carried in the carcass to the cave by a solitary man, but of this we have no evidence.

The schlepping and carrying of the meat of a single onager or red deer to the cave was necessarily a laborious job, requiring the co-operation of several men. They would, under these circumstances, probably have discarded as much bone as possible. Therefore, the presence of several large limb bones (table 4) among the remains of these animals demands an explanation, and we suggest that these two large ungulates (and particularly the onagers) were often killed close enough to the cave — perhaps in the valley below the cave — that whole limbs, or segments of them, with their contained bone could be individually carried up to the cave. Indeed, onagers particularly but perhaps deer also may have been purposely and slowly driven toward the cave before killing.

For some of the game animals, proximal limb bones were recovered in greater numbers than were more distal bones in the same limb (table 4); for some other limbs and/or other animals the reverse is true. We assume, considering the size of the sample available, that chance alone — random chances of bones getting into the cave and being preserved there — accounts for the differences found.

The bones of the game animals are often charred, and broken in ways not usual in nature, surely evidence that most of the animals in this cave were utilized for food. Numbers of the bones are scratched and chipped as though with a tool. A few have holes bored into them and several have been gnawed by rodents.

V. CONCLUSIONS

Of the 26 mammalian genera represented in the Palegawra fauna, seven of them (*Equus*, *Cervus*, *Ovis*, *Capra*, *Gazella*, *Sus*, and *Vulpes*) account for at least 50 per cent of the minimum number of individuals and 92 per cent of the total bone present. These were the major food animals hunted by the Zarzians who utilized the Palegawra shelter. The smaller game and rodents either were occasionally caught, perhaps by the women and children close to camp, or entered the cave during times when it was unoccupied. We have already speculated that *Bos*, because of its size and strength, was possibly not sought as a food animal; it is also probable that, following the cold dry conditions that prevailed following the Würm maximum in the Zagros foothills, the cattle were simply rather uncommon.

Considering the three most common groups — equid, cervid, and sheep/goat — in the sense that each of these are represented by many more hundreds of bones than are *Sus*, *Gazella*, or *Bos* — it may be imagined that the Palegawran hunters came into this small Bazian valley for the purpose of seeking onagers and deer as larger game, plus the smaller sheep and goats. The cave was small and would not comfortably accommodate a large hunting party or make a good permanent camp. The season or seasons of occupation each year, if indeed there was any such annual regularity, cannot be determined from the mammal bones, most of which were from adult animals and none of which were from animals whose age can be determined so precisely as to suggest seasonal occupation (tables 5, 6). The snails, which come to the surface to feed only after rains (Reed, 1962) could not have been gathered in the summer heat, during freezing weather, or while snow covered the ground. At the same time, Palegawra is a "wet" cave, with water dripping from the roof after prolonged rains, and would have been an uncomfortable dwelling throughout most of the season from November into April.

Furthermore, the lack of hearths would argue against prolonged winter occupation, when fires in the cave would seem to have been a necessity. Fires were assuredly present, to cook the snails or the meat; indeed some of the bones are charred from having been in fire, but the major fires here presumably were outside the lip of the cave, where the remains would have been long lost down the slope.

Perhaps there was no regularity to the occupation of Palegawra, but it may have been used sporadically by one or a few families after making a kill, when gathering snails, or for shelter from a violent storm. It would have been then, as it is now, a pleasant retreat from summer sun.

Having found and killed their quarry down in the valley or on the slopes at some little distance from the shelter, the hunters proceeded to butcher. The data in Tables 3 and 4 indicate that few skulls or vertebrae were carried up to the cave. Fore-and-hind-quarters, mandibles, and maxillaries (see above) were by far the commonest parts preserved. Some skulls and other bones were fragmented beyond recognition and there is a certain amount of indeterminate material. Pieces of rib are fairly abundant, but not identifiable as to animal. Little vertebral material is identifiable unless it consists of more than just centra. Very few horn cores or antlers are found, and what are present are mere bits and pieces. The evidence indicates that entire carcasses were not dragged 70 m. upslope to be butchered, but rather that butchering was accomplished on the spot of the kill, skulls perhaps being broken open for the immediate consumption of the brains, and fore and hind quarters reserved for transport ot the cave. Backbones, tails, and crania were abandoned except for the rather enigmatic salvaging of the jaws, and mostly of lower jaws, perhaps used as handles in carrying skins of meat to the shelter.

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