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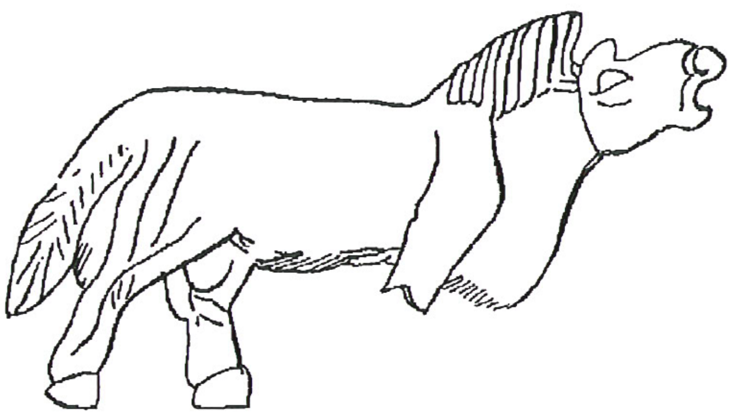

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HUNTING STRATEGIES OF LATE PLEISTOCENE ZARZIAN POPULATIONS FROM PALEGAWRA CAVE, IRAQ AND WARWASI ROCK SHELTER, IRAN

Deborah Bakken[1]

Abstract

Palegawra Cave and Warwasi rock shelter are late Pleistocene, Zarzian occupation sites excavated by Braidwood, Howe, and Reed as part of the Iraq-Jarmo Project. Both sites have abundant lithic components, and both are high in faunal remains. The initial analysis by Turnbull and Reed demonstrated a faunal suite indicative of dry grassland regimes similar to those seen today in this area. Taxonomically, the majority of identified elements in both caves belong to the onager, *Equus hemionus*. Turnbull and Reed argued that the onagers were the result of human hunting, but they did not examine the type of hunting strategy favored by the Zarzian occupants of the caves. All equids were under some degree of hunting pressure at the end of the Pleistocene as they were highly prized food sources, and they are common components of archaeological site faunas. Both Palegawra and Warwasi document the exploitation of local equids; by integrating mortality data available from dental remains with behavioral evidence drawn from modern onager populations, hunting strategies at use during the formation of both sites are reconstructed. These are examined in light of behavioral differences between onagers and the more familiar horses found at other sites documenting equid exploitation such as Solutré in France and Dereivka in the Ukraine.

Résumé

La grotte de Palegawra et l'abri sous roche de Warwasi sont des sites d'occupations de la fin du Pleistocène, zarziens fouillés par Braidwood, Howe et Reed faisant partie du projet Iraq-Jarmo. Les deux sites contiennent d'abondants objets lithiques et tous deux ont fourni de nombreux vestiges fauniques. L'analyse initiale par Turnbull et Reed a révélé un assemblage faunique indicateur de la présence d'une prairie de type aride proche de celle visible actuellement dans la zone d'étude. Sur le plan taxinomique la majorité des éléments identifiés dans les deux grottes appartiennent à l'onagre. Turnbull et Reed ont avancé que les restes d'onagre résultaient de la chasse par l'homme, mais ils n'ont pas examiné le type de stratégie de chasse choisi par les occupants zarziens des deux sites. Tous les équidés étaient à un certain degré sous pression de la chasse à la fin du Pléistocène du fait qu'ils étaient des sources de nourriture très prisées et qu'ils sont des composants courants des faunes archéologiques. Palegawra et Warwasi documentent l'exploitation locale des équidés ; en intégrant les données sur la mortalité à partir des restes dentaires et les données comportementales des populations actuelles d'onagres, les stratégies de chasse en vigueur durant la formation des deux sites sont reconstitués. Celles-ci sont examinés au vu des différences comportementales entre l'onagre et le cheval, rencontré plus couramment dans d'autres sites qui nous renseignent sur l'exploitation des équidés comme Solutré en France et Dereivka en Ukraine.

Key Words: Palegawra Cave, Warwasi Rock Shelter, Equids, Mortality Profils

Mots Clés: Grotte de Palegawra, Abri sous roche de Warwasi, Equidés, Courbes d'abattage

Introduction

Humans had become efficient hunters of large animals at least by the Upper Paleolithic. That large game were highly prized in temperate grassland and woodland environments is attested to by their continued and selective presence in archaeological faunas. Not only did large game provide food, they also yielded useful products such as skins, bone, antler, and sinew for tools and other material goods.

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Equids were an important component of the large game faunas that humans favored. All equids, in fact, were under some degree of hunting pressure at the end of the Pleistocene. They are commonly found at archaeological sites of this period, and in some sites they dominate the fauna (Clutton-Brock 1992; Levine 1979; Olsen 1989). This is the pattern seen at two late Pleistocene sites from the Near East, Palegawra Cave and Warwasi rock shelter. How were such high quality prey collected? What sort of hunting strategy was employed? In this paper I use dental wear and attrition data to generate age class frequencies that may be used to interpret the probable hunting strategy used at Palegawra and Warwasi.

Site Background

The archaeological site of Warwasi rock shelter lies in Kurdistan province in west central Iran. It was excavated by Robert Braidwood, in the 1960s. Warwasi yielded blade industries ranging from Mousterian, through Baradostian and Zarzian at different depths within the deposits. The earliest level dates to 40,000 BP, and the latest level dates to 10,000 BP. Priscilla Turnbull conducted the faunal analysis (Turnbull 1967, 1975). She described a small suite, consisting of onager, sheep, goat, rodents, and lagomorphs. This material will be discussed later in this paper.

The site of Palegawra Cave lies further east, in northeastern Iraq. It was excavated during the 1950s as part of the Iraq-Jarmo project, under the general direction of Robert Braidwood and Bruce Howe (Braidwood *et al.* 1960). Palegawra is a late Pleistocene aged site dated to between 12,000 and 14,000 BP based on radiocarbon dates (Turnbull and Reed 1974). It is situated in a small cave in the Baranand Dagh, the foothills of the Zagros Mountains. The cave is located about 70 meters above the valley floor, at an elevation of 990 meters above sea level. Abundant stone tools were recovered from Palegawra; the assemblage is microlithic, and characteristic of Zarzian toolkits (Turnbull 1967).

The faunal analysis at Palegawra was conducted by Priscilla Turnbull along with Charles Reed (1974). They described a modern fauna representative of similar environmental conditions as those currently in effect. Most taxa occur in the region today, or at least were known to occur within historic times. The climate at Palegawra was broadly similar to that seen today, but very likely cooler and drier. This area saw extensive local glaciation at the last glacial maximum, and abatement of that extreme climate was well underway by 18 to 16,000 years ago. Pollen samples are indicative of a relatively dry, sagebrush or *Artemisia* steppe environment.

Turnbull and Reed (1974) identified a diverse assemblage consisting of 26 genera of mammals (see also Turnbull 1986 for a discussion of equid species identification). Notable among the specimens was a canid mandible that Reed argued was evidence of the first domesticated dog yet found. For a time, this made Palegawra the earliest animal domestication site identified in the archaeological record. Palegawra has since been superceded by an earlier specimen, and the domestic nature of the canid mandible has also been questioned (Olsen 1985).

Onagers are especially common at both Palegawra and Warwasi, constituting the majority of faunal elements at both sites (Table 1). The onager, *Equus hemionus*, also known as the half-ass, is one of several species of Asiatic wild ass. It is closely related to the kulan, the gor-khar, and the Syrian ass. It is distinguished by its long metapodials and renowned for being a strong and graceful runner with a great deal of stamina. Onagers, like all equids, are grazers that subsist primarily on grasses though they will consume other kinds of vegetation as well (Groves 1974; Willoughby 1974).

Though other species of equids were under population pressure at the end of the Pleistocene, onagers living in the arid and semi-desert country of the Near East were apparently stable during that period. The warming of global climates at the end of the last glaciation contributed to habitat loss as grasslands were replaced with forest cover.

Table 1. Numbers of identified specimens and minimum numbers of individuals for selected taxa from Palegawra Cave (FMNH paleontology collections)

	NISP	MNI
Equus hemionus (onager)	1121	27
Cervus elephas (red deer)	456	12
Ovis orientalis (sheep)	134	10
Capra hircus (goat)	97	8
Gazella subgutturosa (gazelle)	95	7
Sus scrofa (pig)	68	3
Bos primigenius (cattle)	19	2

Equids in North and South America were extinct by 10,000 years ago, and the European wild horse had become rare by 7,000 years ago (Clutton-Brock 1992: 24). Onager populations at Palegawra and Warwasi may have been stable between 14,000 and 10,000 years ago, due to overall stability in climatic conditions and persistence of grassland vegetation (Turnbull and Reed 1974).

Behaviorally, onagers differ from the pattern shown by the more familiar horses, in which territories are not defended but stallions instead maintain and defend harems of females with associated foals (Type 1 behavior of Klingel 1974; Berger 1986). Onagers exhibit Type 2 behavior as do the kiang, the African wild ass, Grevy's zebra, and the domestic donkey, (Clutton-Brock 1992: 23; Klingel 1974; Berger 1986). The males are territorial, and may defend territories successfully for over ten years. Females range across several male territories, and they do not form harem groups connected with a particular male. Females will only mate with males that maintain territories, and they may mate with each male in the several territories that constitute their range. Young males unable to defend a territory form bachelor groups, and they do not mate. Group size tends to be fluid; seasonal concentrations of individuals in large groups may occur in early to mid-summer when foals are about to be born. Clutton-Brock (1992: 23) and others have argued that this is a behavior pattern that is adapted to resources that are predictable but specialized, such as those found in arid and semi-desert regions.

Onagers were kept and bred in later sites within this region, however, it is likely that onagers were never truly domesticated. Modern West Asian domestic donkeys produce fertile offspring with the African wild ass, *Equus africanus*, but they produce infertile offspring with onagers (Clutton-Brock 1992: 37). That they were kept and used as draught animals is apparent from a number of sites such as Ur (2,500 BC; Olsen 1988). The earliest site for the possible domestication of any equids is Dereivka, Ukraine, dated to ca. 4,000 BC (Bökönyi 1984; Levine 1990). This site has been reanalyzed by Levine (1990), and she argues that the remains do not represent domestication but rather the exploitation by hunting of prime age adults, between 5-8 years of age, from wild populations.

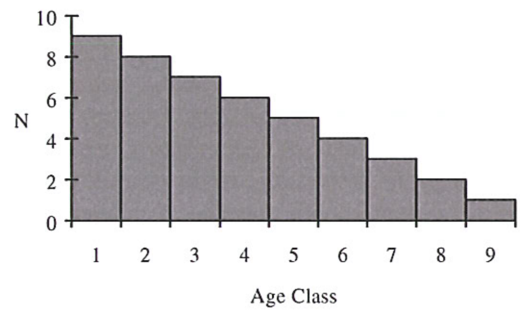

Fig. 1. Theoretically derived living structure or catastrophic mortality profile (Klein 1982; Stiner 1994).

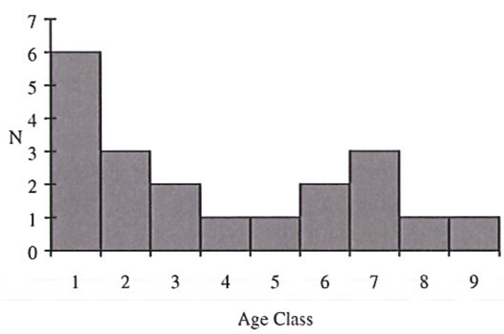

Fig. 2. Theoretically derived attritional or U-shaped mortality profile (Klein 1982; Stiner 1994).

That onagers were clearly a highly valued resource is evident by their abundance within the Palegawra assemblage (Table 1). Turnbull and Reed (1974) and Turnbull (1967) argued that the fauna was accumulated as the result of human hunting, and I would agree based on my own observations of the faunal remains.

In order to look more closely at the hunting strategy practiced at Palegawra, I generated mortality profiles to examine the represented ages of the individual onagers present in the assemblage. A population rich in prime age adults is indicated in Turnbull and Reed's analysis (1974). I concur, but base our estimates on slightly different criteria.

Mortality profiles

Mortality profiles have been used extensively to look at the nature of a death assemblage (Kurtén 1953; Lyman 1994; Voorhies 1969). Two common patterns have been identified, with certain forms of variation within each type. A catastrophic or living-structure assemblage is characterized by large numbers of young and juveniles succeeded by progressively smaller categories of prime age adults and old individuals (Hillson 1986; Klein 1982; Lyman 1994; Stiner 1994). This is the profile demonstrated by a living group of gregarious mammals (Fig. 1). Catastrophic assemblages may result from any event that kills all the members of a living group, such as a flood. Attritional or U-shaped profiles are composed of an essentially bimodal distribution of very young and very old animals with relatively few prime age adults (Hillson 1986; Klein 1982; Lyman 1994; Stiner 1994). These assemblages may reflect any event that selects those animals that are easiest to remove from a living population, such as the young, old, and weak (Fig. 2). Attritional profiles are commonly produced through hunting or scavenging from a living group, although it is worth remembering that a series of phenomena, such as accidents and disease, may contribute to an attritional pattern from an archaeofauna.

Construction of a mortality profile begins with the identification of some element that changes progressively throughout the life of the animal. Within the high-crowned ungulates a variety of methods are available based on incremental growth and wear in the dentition. Common methods include eruption and wear stages of tooth rows (e.g. Lowe 1967), and the quadratic crown height method (e.g. Klein 1982). All are based on the observation that teeth are continuously worn away through use.

Equid tooth eruption and wear are processes that are not as tightly constrained as in some other ungulate taxa. Tooth eruption and wear have, however, been successfully used by researchers to reconstruct seasonality and mortality characteristics in populations of equids (Levine 1983; Stiner 1994). Dental eruption sequences are complex for equids due to the high number of teeth and the ever-growing nature of the permanent teeth, which continue to erupt until late in life (Clutton-Brock 1992: 20). Equine teeth are in flux in the mouth from birth to five years, at which time the full adult complement of teeth (36 of them) are present in the mouth (Levine 1983). The roots of the permanent teeth are not fully developed until five years (Clutton-Brock 1992: 20). All teeth at five years are also completely mineralized and have ceased growing (Levine, 1983). Teeth only become fully rooted later in life.

The quadratic crown height method is based on an algebraic transformation of a formula that predicts that hypsodont teeth are worn as a square root function of preceding height (see Klein and Cruz-Uribe 1984 for formulas, and Lyman 1994 for discussion). Measurement of the remaining crown heights generates data indicating the amount of occlusal wear in the sample. Quadratic regression formulae may then be applied to the data to reconstruct age classes (Klein and Cruz-Uribe 1984; Kurtén 1953). The number of cases within each class determines the shape of the mortality profile.

Two kinds of teeth are required; one must be a deciduous tooth, ideally one already erupted at birth, and one must be a permanent tooth that erupts before the deciduous tooth is shed. For this sample, the deciduous fourth premolar and second molar were chosen for analysis. The permanent second molar erupts at 24 months while the deciduous fourth premolar is not shed until 36 months (Groves 1974; Klingel and Klingel 1966). Crown height was taken as the measurement of the distance from the base of the crown to the occlusal surface of the tooth. In addition, for the quadratic crown height regression, an estimate of the potential ecological longevity in wild populations must be drawn from the wildlife biology literature. For this study an estimated potential longevity of 25 years is used based on studies of several species of wild equids.

The resulting mortality profile age estimates are finally clustered into age classes, typically in one year or ten percent of lifespan increments. They may also, however, be reproduced as frequencies that demarcate the three major stages within the life cycle (Tables 2 and 3). These are juveniles, prime age adults, and old individuals. Juvenile describes the interval between birth and the loss of the deciduous fourth premolar; prime age adult describes the interval between loss of the deciduous fourth premolar and roughly 61-65%

Table 2. Frequencies of juvenile prime age and old individuals in living structure and catastrophic or U-shaped populations. Data from Stiner (1994:295-303) and Lyman (1987)

	Juvenile	Prime	Old
Living structure †Lyman 1987 n=55	0.34	0.45	0.21
Mass death (volcano) Mt. St. Helens n=86	0.38	0.57	0.05
Non-predated U-shaped †Stiner 1994 –	0.59	0.22	0.19
fallow deer n=170	0.68	0.15	0.18
Predated			
tiger on chital n=98	0.18	0.45	0.36
tiger on sambar n=56	0.13	0.38	0.48
hyena on zebra n=26	0.19	0.40	0.40

† modeled population

Table 3. Frequencies of juvenile prime age and old individuals of onager. Wear class data based on incisor rows and on mandibular tooth rows (Klingel and Klingel 1966; Levine 1983). For the regression formula juvenile is based on duration of the deciduous premolar. Prime age is loss of the deciduous premolar until 60% of potential longevity. Old age is 61% of potential longevity or greater (Stiner 1994). Data for Dereivka from Levine (1990), data for Mt. St. Helens from Lyman (1987). Other frequencies from Stiner (1994: 295-303)

	Juvenile	Prime	Old
Palegawra incisor wear n=10	0.20	0.70	0.10
Palegawra molar wear n=28	0.21	0.64	0.14
Palegawra quadratic n=32	0.23	0.77	0.00
Warwasi quadratic n=9	0.45	0.55	0.00
Hunted			
Dereivka *	0.07	0.82	0.11
Mass death (volcano)			
Mt. St. Helens n=86	0.38	0.57	0.05
Living structure			
†Lyman 1987 n=55	0.34	0.45	0.21
Non-predated U-shaped			
†Stiner 1994 –	0.59	0.22	0.19
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* my estimate
† modeled population

of potential ecological longevity or crown reduction such that somewhat more than half of the permanent tooth crown is worn away. Old adult describes the interval between 61-65% potential ecological longevity and maximum potential longevity, or permanent crown worn to zero height. Using these three stages focuses on life cycle divisions that are meaningful at the population level, and lessens the potential for errors in assignment (see Stiner 1994 for discussion).

As the quadratic crown height method is known to slightly overestimate the youngest age classes, I employed two additional age estimation methods for the onagers. Both methods are based on visible wear stages of groups of associated teeth. Equids have long been aged while on the hoof by examination of the amount of wear to the incisors; Klingel and Klingel's (1966) work with zebra populations is used here (Table 3). While isolated incisors are not common components of the Palegawra fauna, there are several examples of symphyseal fragments that contained the incisors together as a group. In addition, mandibular tooth rows containing the cheek teeth are relatively common at Palegawra. These have been aged based on wear stages developed by Levine (1982; Table 3).

Differential preservation can skew the fossil record against the recovery of immature teeth. While this is certainly true, it is unclear that attempts to correct for poor preservation significantly increase the accuracy of results based only on the existing data set. In the following study there is no attempt to normalize or reconstruct missing data. This is partly warranted by general caution over attempts to reconstruct missing data. Also, bone preservation in the Palegawra sample, while not great, is certainly good, and the quality of tooth preservation is such that immature teeth should not be under especial preservation disadvantage. In addition, both unfused and partly fused epiphyses may be found among the bony elements; this is an indication that even though their bones are not as dense as in the adults, the remains of immature individuals are indeed a part of the sample.

Results

Table 3 displays the results for the quadratic crown height regressions, incisor age estimation, and mandibular tooth row estimation. They indicate a population rich in young and prime age adults, with few old individuals. The three methods employed to age the dental sample correspond well with each other, and I would argue that the incisor estimation is the most accurate representation of the population. This is an artifact of preservation in that the wear stages on the incisors are slightly more distinguishable than on the molar series.

Warwasi is also rich in juvenile and prime age adults, but the sample from the upper level at Warwasi is very small. I do not, therefore, have as much confidence that these frequencies adequately represent the site. Also, due to the small sample size of the Warwasi fauna, there was no way to compare the earlier Mousterian level with the later Zarzian level.

In contrast, the living structure or catastrophic profiles shown in Table 3 (Mt. St. Helens, Lyman model living structure) display higher frequencies of juveniles and lower frequencies of prime adults. In addition, various taxa of ambush and cursorial predators also may be seen to generate different frequencies in prey populations; old animals are more common in these samples than in either the Palegawra and Warwasi samples or the living structure and catastrophic samples. Palegawra and Warwasi are, however, similar in structure to the pattern seen at Dereivka (these frequencies are my estimates based on data from Levine 1990). Earlier sites with an abundant equid fauna, such as Solutré (not listed in Table 3; Olsen 1989) also document a sample rich in prime adult animals.

The inhabitants of Palegawra, and probably of Warwasi as well, were clearly able to selectively target prime age adult onagers. The position of the site above the valley floor provided a vantage point from which to watch for seasonal movements and aggregations of onagers. Groups of onagers would generally have been of two types; either groups of females with associated young, or bachelor groups of males yet unable to successfully hold a territory. The presence of juveniles argues against exclusive selection of bachelor group males, however, as they would be composed of prime age adults and older individuals.

Exploitation of prime adult individuals from local equid populations is a broadly similar strategy as that seen at earlier sites such as Solutré (Olsen 1989) and later sites such as Dereivka (Levine 1990). Levine argues that the Dereivka sample does not contain many individuals less than four years of age, or many greater than eight to ten years old. The assemblage instead is rich in prime adults between five and eight years old. These individuals represent an extremely high quality resource that was both valuable and useful to the local inhabitants.

Additional information comes from a look at frequencies of elements. Limb elements are common in the sample, but axial elements such as ribs and vertebrae are rare (Turnbull and Reed 1974; Turnbull 1975). Turnbull and Reed argued that this indicated that carcasses were partially dressed in the field, and only certain parts of the body brought back to the cave. They also noted that while mandibles are common, skulls are rare. This is true, however, maxillary teeth, and to some extent maxillary tooth rows are common, indicating that head parts were a component of the assemblage.

In sum, Palegawra most likely represents a residence site rather than a kill site, and it is one which was used intensively by local Zarzian period hunters. Warwasi may represent the same kind of occupation, but one of much shorter duration. Local hunting practices at the end of the Pleistocene favored organized and targeted exploitation of large-bodied, high quality resources.

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