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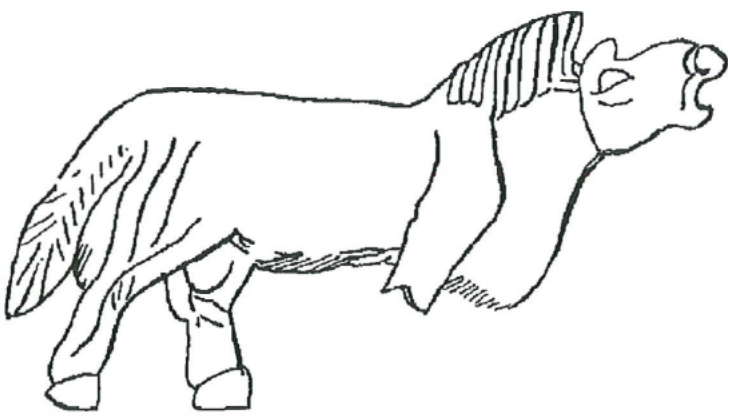

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VOLUME B

THE CONTEXT OF ANIMAL DOMESTICATION IN SOUTHWESTERN ASIA

Ofer Bar-Yosef[1]

Abstract

This paper discusses the geographic origins of the domestication of goats and sheep, against the background of the onset of agriculture in the Near East. The archaeobotanical evidence indicates that cultivation began in this area one thousand years earlier than the first domestication of goats an sheep and that primary penning of these animals was probably carried out by sedentary societies of foragers who inhabited the Taurus-Zagros region, where goats and sheep had been hunted for many millennia.

Résumé

Dans cette étude, l'origine géographique de la domestication de la chèvre et du mouton sont débattues par rapport à l'antériorité de l'apparition de l'agriculture au Proche Orient. Les données archéobotaniques indiquent que la culture commença dans cette région un millénaire avant les premières domestications de la chèvre et du mouton et que les premiers apprivoisements de ces animaux ont sans doute été effectués par les sociétés sédentaires et semi sédentaires d'agriculteurs qui habitaient la région du Taurus-Zagros, où la chèvre et le mouton étaient chassés depuis plusieurs millénaires.

Key words: Animal Domestication, Neolithic Revolution, Sedentary Foragers, Anatolia, Taurus-Zagros

Mots Clés: Domestication animale, Révolution Néolithique, Agriculture sédentaire, Anatolie, Taurus-Zagros

Human history was and is directly affected by decision-making. The results of past decisions have been critical for subsequent generations as much as current decisions determine the nature of numerous social, economic and environmental issues in the future. In prehistory, as now, decisions were made intuitively or intentionally, in reaction to immediate or foreseen necessities. Often, major decisions were aimed at mitigating a crisis, be it a matter of physical or social survival. The operating considerations could be driven by biological, socio-economic, religious, political or a mixture of motives, but the outcomes of all major past decisions are expressed in the archaeological record. In evaluating the potential list of major impacts in the course of human history, perhaps the most important decisions were those that resulted in what is called today the Neolithic Revolution. This technological revolution was a socio-economic threshold that, as seen in about a 10,000 years retrospective, changed the face of planet Earth.

The archaeological sequence of the Neolithic Revolution, as is known today, began with the cultivation of the 'founder crops' in a particular area, namely, the western wing of the Fertile Crescent, or the Levant (e.g., Hillman 1996; Zohary 1996; Cauvin *et al.* 1997; Kislev 1997; Bar-Yosef 1998a,b; Harris 1998). Information gathered from archaeobotanical studies and pollen diagrams across the region has facilitated the reconstruction of the past distribution of vegetation belts. Moreover, the latitudinal, longitudinal and altitudinal shifts of the various belts, such as the oak forest or the pistachio-almond parkland, can be correlated on the basis of AMS radiocarbon calibrated dates to the climatic changes recorded in the Greenland ice cores. When all these data sets are put together, a new

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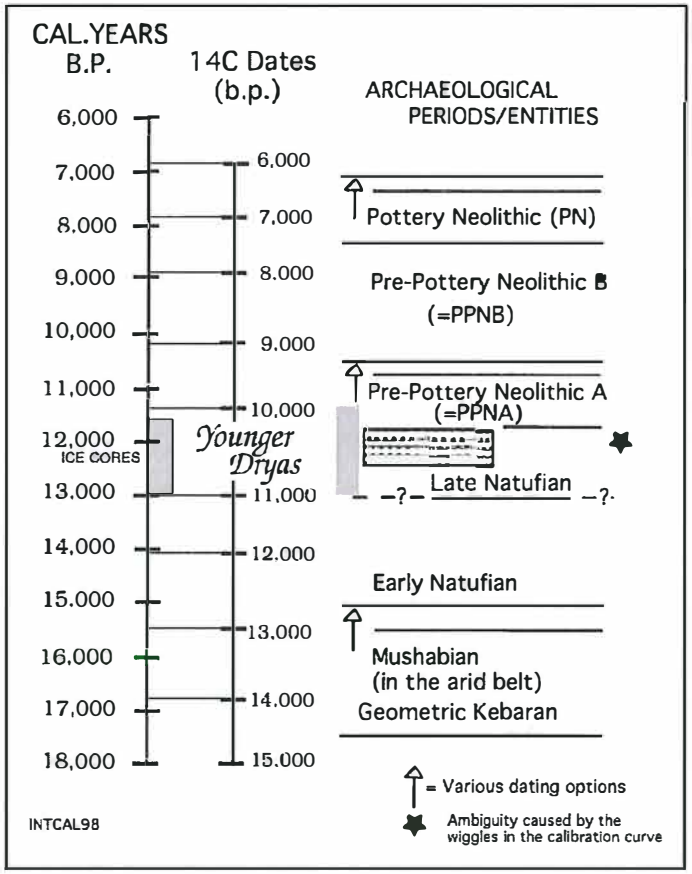

Fig. 1. Chronological chart with calibrated (based on Calib.4, 1998) and uncalibrated scales.

picture of the Neolithic Revolution emerges. It clearly demonstrates that the origins of agriculture took place within a core area and dispersed into the peripheries.

Every recent review of the archaeobotanical evidence stresses the two phases of plant exploitation (e.g. Bar-Yosef 1998; Harris 1998). In the first phase, plants were only cultivated, and in the second they were genetically altered to become what we call 'domesticated species' (see Zohary 1996 for details and references therein). In accordance with other scholars, I believe that we cannot understand the domestication of goat, sheep, pig and cattle without understanding how semi-sedentary or fully sedentary communities of farmers and foragers had emerged first. It was, in evolutionary terms, a necessary step before animal penning and eventual domestication occurred.

In order to review the origins of cultivating communities we need to begin with the current proposed reconstruction for the distribution of wild cereals prior to the Younger Dryas (Fig. 1). During the Bölling-Allerød period (13,000-11,000 b.p. uncalibrated; see Fig. 1 for the calibrated dates, based on Stuiver *et al.* 1998), the three main vegetation belts in the Near East expanded, as demonstrated by Hillman (1996; Fig. 10.10). This is the time during which the Natufian culture flourished (Bar-Yosef 1998a,b,c). However, the main change occurred during the Younger Dryas, often dated to 11,000-10,000 b.p. and correlated with the Late Natufian. The Younger Dryas is known today as a global cold and dry period, and in calibrated dates lasted at least for about 1,300±70 years (Mayewski *et al.* 1993). Plant remains from various sites support the notion that during that time wild cereals were available only in the Levantine region (Fig. 2). This means that those individuals or communities who initiated cultivation were located in this narrow region or immediately along its margins. It is therefore not surprising that the earliest large communities of farmers, who continued to gather wild fruits and seeds and hunt, were established in this nuclear Levantine corridor.

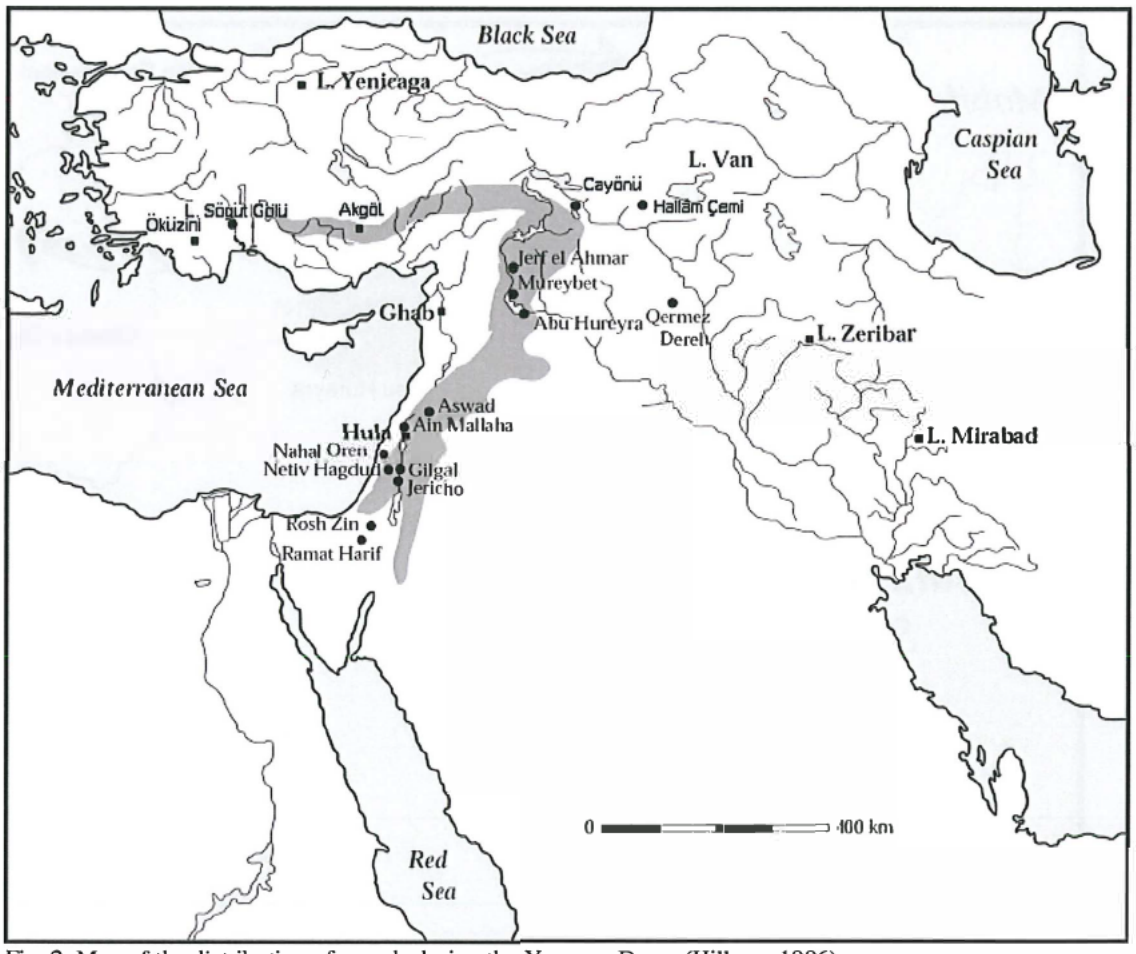

Fig. 2. Map of the distribution of cereals during the Younger Dryas (Hillman 1996).

The decision to cultivate was probably encouraged by the already semi or full sedentism practised by Natufian communities (Tchernov 1991). It has been suggested that the decision to cultivate was triggered by the realization that yields of the wild stands were decreasing annually. This depletion of wild fields could have been the result of decreasing CO_2 during the Younger Dryas, which affected the cereals, a C3 suite of plants. In such a situation humans had the option either to move and take control of additional food resources, or to stay and practise a new technique that would secure next year's harvest. The decision to stay in the same territories and to practice cultivation in order to supply basic dietary needs may have been influenced by the knowledge that the territories of the Levant were relatively densely populated.

Hence, it seems that predictable security of staple food was achieved by planting cereals, possibly by females who according to all ethnographic evidence are responsible for gathering. This practical shift in subsistence strategy happened, if the earliest radiocarbon readings for the PPNA layers can be substantiated, just before the end of the Younger Dryas (Fig. 3). Archaeologically, the initiative was taken by the Late Natufian populations or perhaps the very early Neolithic entities (such as those classified as Khiamian).

It has been observed that, similarly to other technological revolutions, the onset of cultivation resulted in numerous social and economic changes (e.g. Bar-Yosef and Belfer-Cohen 1992; Cauvin *et al.* 1997; Bar-Yosef 1998b,c). Not least of these was the shifting role of males and females within the farming communities. Such changes are expressed archaeologically in mortuary practices, types of figurines and other symbolic presentations. They reflect new ideological realms and cosmological configurations, as pointed out by Cauvin (Cauvin *et al.* 1997) and other scholars (e.g. Marshack 1997).

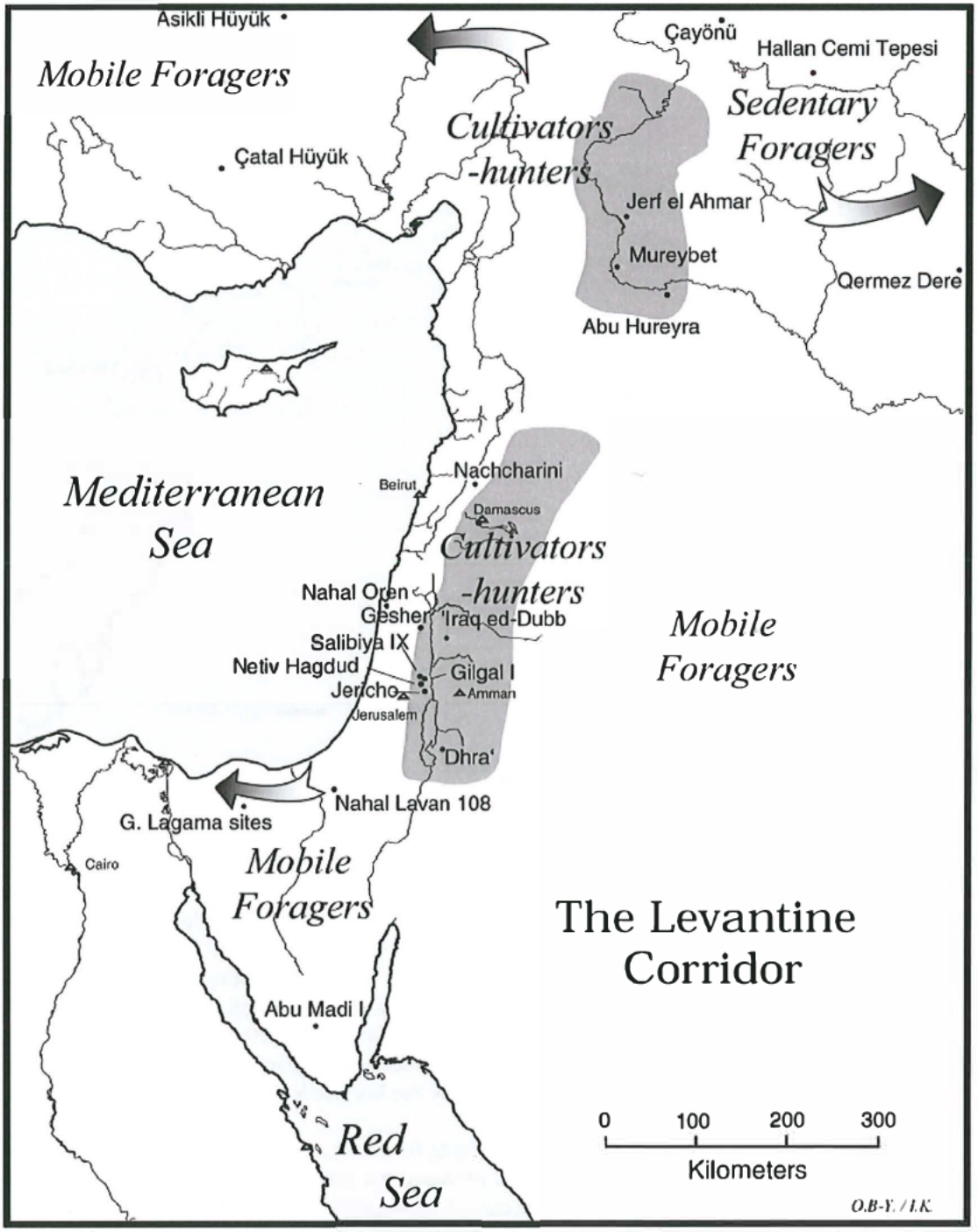

Fig. 3. PPNA Levantine corridor, showing the earliest farming communities and contemporary sites

Therefore, it is in the Levant that we find the early Neolithic (known as PPNA) villages, which are mostly located inside the Levantine corridor. The PPNA period lasted from about 10,300 to 9,600 or 9,300 bp, or in calibrated dates from 12,300/12,100 (with a range of 12,500-11,800) to 11,100/10,700 or 10,700/10,300 BP calibrated, indicating a potential time range of 1000 to 1,800 calendrical years. The practice of cultivation of wild emmer and einkorn wheat, barley, and rye was the first phase, and may have started on a small scale during the Late Natufian (Hillman 1996). The second phase occurred when genetic changes resulted in what are known today as the domesticated species (e.g., Hillman and Davies 1992; Zohary 1996; Kislev 1997). The genetic change, as most authorities agree,

occurred through the process of annual sowing and harvesting. The amount of time needed for most of the harvested ears to become the domesticated forms is unknown, as is the degree of conscious intervention by humans, although I believe this to be significant (*contra* Zohary *et al.* 1998). Time estimates range from a few decades to several centuries.

The Neolithic Revolution was thus established by the first communities of cultivators, who continued to hunt, trap, fish and gather a large array of wild species of fruits, leaves, roots and tubers. It is not impossible that they even tended fruit trees such as figs, as suggested by Kislev (1997). Maintaining specific wild fruit trees is a known technique among recent foragers in both Africa and South America (Laden 1992).

In brief, PPNA hunters probably continued to operate as task groups from a home base, and hunt and trap the same species as their Late Natufian predecessors (Fig. 4). In addition to the hunted mammals, they exploited reptiles, waterfowl and fish. It would be interesting, when a greater number of well-dated zooarchaeological assemblages have been studied, to reconstruct the distribution of the various species during the Younger Dryas in Southwestern Asia. Among the changes that are already known to have taken place within Natufian communities is an increase in the use of waterfowl, as demonstrated by Tchernov (1994) and Pichon (1994). This could be explained as an increase in demand for meat and feathers. Trapping the birds was facilitated as fresh water bodies formed in the Jordan Valley and other inland basins as a result of the rapid climatic improvement immediately following the termination of the Younger Dryas. In addition, the Jordan Valley and the Israeli coastal plains are along the main routes of migratory birds. Thus the inhabitants of Netiv Hagdud, Gilgal, Hatoula and probably other sites were able to exploit these seasonal sources (Pichon 1989, 1994; Davis *et al.* 1994; Tchernov 1994).

Farmers hunting is a common phenomenon (Kent 1989). It is a strategy embedded in the lifeways of semi and fully sedentary cultivators. Members of human groups, either foragers or farmers, have an in-depth knowledge of the behavior of the common species (whether mammals, reptiles or birds) that

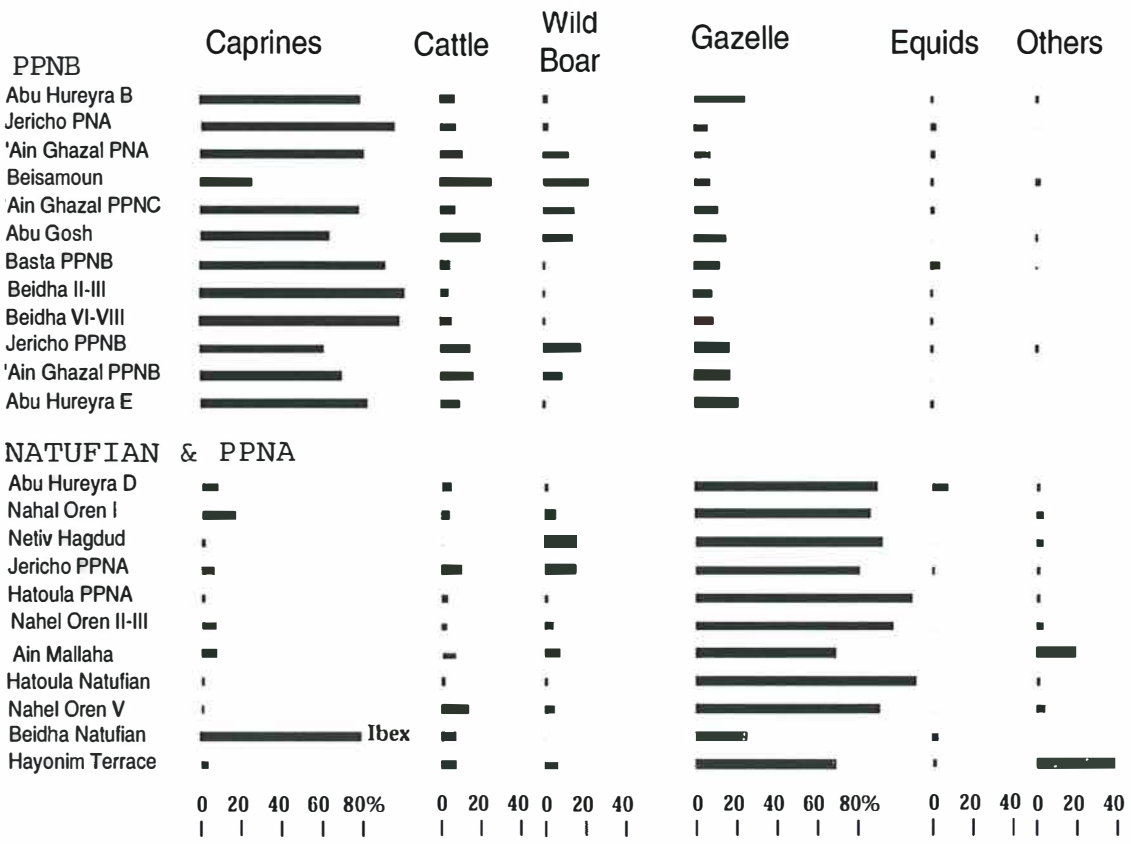

Fig. 4. Frequencies of animal bones at Natufian, PPNA and PPNB sites

inhabit their territories. One does not need to possess a scientific knowledge of reproduction for humans or for animals, to recognize the basic phenomenon and cycles of animals producing offspring, and hunters are obsessive collectors of behavioral information on the location of seasonal pastures, mobility patterns, herd composition and so on of mammals, and the nesting grounds of birds. Often it is the women and children who capture reptiles such as tortoises and lizards. In addition, peculiar topographic features, particular living creatures and special plants present in a community's surroundings become elements in cosmological constructs.

Sedentism, even if not practised as year-round residency, resulted in changing attitudes toward nature. In early villages, penning of wild animals could have been an additional strategy for securing meat and hides. What was not a practical strategy for mobile foragers was a viable and perhaps even a tempting option for semi-sedentary or sedentary hunter-gatherers. Perhaps it is in this context that pigs were penned in Hallan Çemi around 10,500 b.p. (e.g., Rosenberg *et al.* 1998). The study of their bones led Redding (in Rosenberg *et al.* 1998) to interpret this bone assemblage as indicative of domestication. However, the evidence for the domestication of pigs gathered earlier by Flannery (1983) does not demonstrate morphological changes before about 8,000 bp. In view of the evidence from Hallan Çemi, it is appropriate to mention the hypothesis of Higgs and others (in Simmons and Ilany 1975-77), suggesting human intervention concerning gazelles. However, it is known that domesticating gazelles is not a viable option, and this information would have been part and parcel of the knowledge of the Natufians and early Neolithic groups in the Levant. Therefore, most authorities agree that there is no convincing evidence in Levantine PPNA contexts for the presence of any domesticated form of goat, sheep or cattle.

The best documented evidence for high frequencies of caprines (both goats and sheep) is in PPNB assemblages (Fig. 4). The recurrent questions of 'when' and 'where' also pertain to the context of goat, sheep and cattle domestication. I will not discuss the morphological, metrical or other types of osteological evidence for the domestication of these species here, as these are reported in zooarchaeological studies (e.g. Ducos 1968, 1991, 1993, 1997; Clutton-Brock 1979; Davis 1987; Uerpmann 1987, 1996; Helmer 1992; Legge 1996 and references therein). However, I would like to contribute a few comments to the on-going discussion on the 'where' and 'when' issues.

Lessons from the more recent history of technology indicate that a suite of innovations do not necessarily happen in one locus alone. Often, a new technology created by one group may be adopted by other groups. In this process those who consider the new technology as useless or opposed to their beliefs will not adopt it. Others, however, may adopt the new technology and modify it to suit their needs or local constraints (Basalla 1988). While it is relatively easy to adopt a certain kind of food resource such as grain or a type of legume, the adoption of an animal, either from its natural environment or from human breeders, requires a behavioral shift. It seems that the archaeological data reflect this variability in human attitudes. Hence, the domestication of goat and sheep and later of cattle did not take place in the same region where cultivation began.

The prerequisite for the penning and eventual domestication of herd animals, was the establishment of semi-sedentary communities, a move that also reflects the degree of control exerted by each human group over a particular territory. Other changes include the participation of males, perhaps only partially, in the preparation for cultivation through felling trees, tilling small plots with hand picks, building fences, and the like. At the same time, they probably continued to hunt. Women, who were usually the main plant food collectors, became the main cultivators. In addition they were responsible for food processing, which perhaps did not mark a major shift in a post-Natufian society. Grinding and pounding require continuous energy expenditure. The advantages of the new economy were crucial. First, sedentism and steady food supplies prolonged the total fertility rate of females, which was lower among mobile foragers, thus leading to a more rapid population increase. Second, weaning foods secured the lives of babies. Third, longevity of females (and some males) increased the number of group members who cared for the young children.

In this context, food provisioning was often based on delayed returns, requiring extensive and perhaps intensive use of storage. In such a social context, members of the community were ready for a psychological shift by treating certain animals as walking larders. This could have come through the 'instinct of nursing' as suggested by Uerpmann (1996) in which women and children played the major

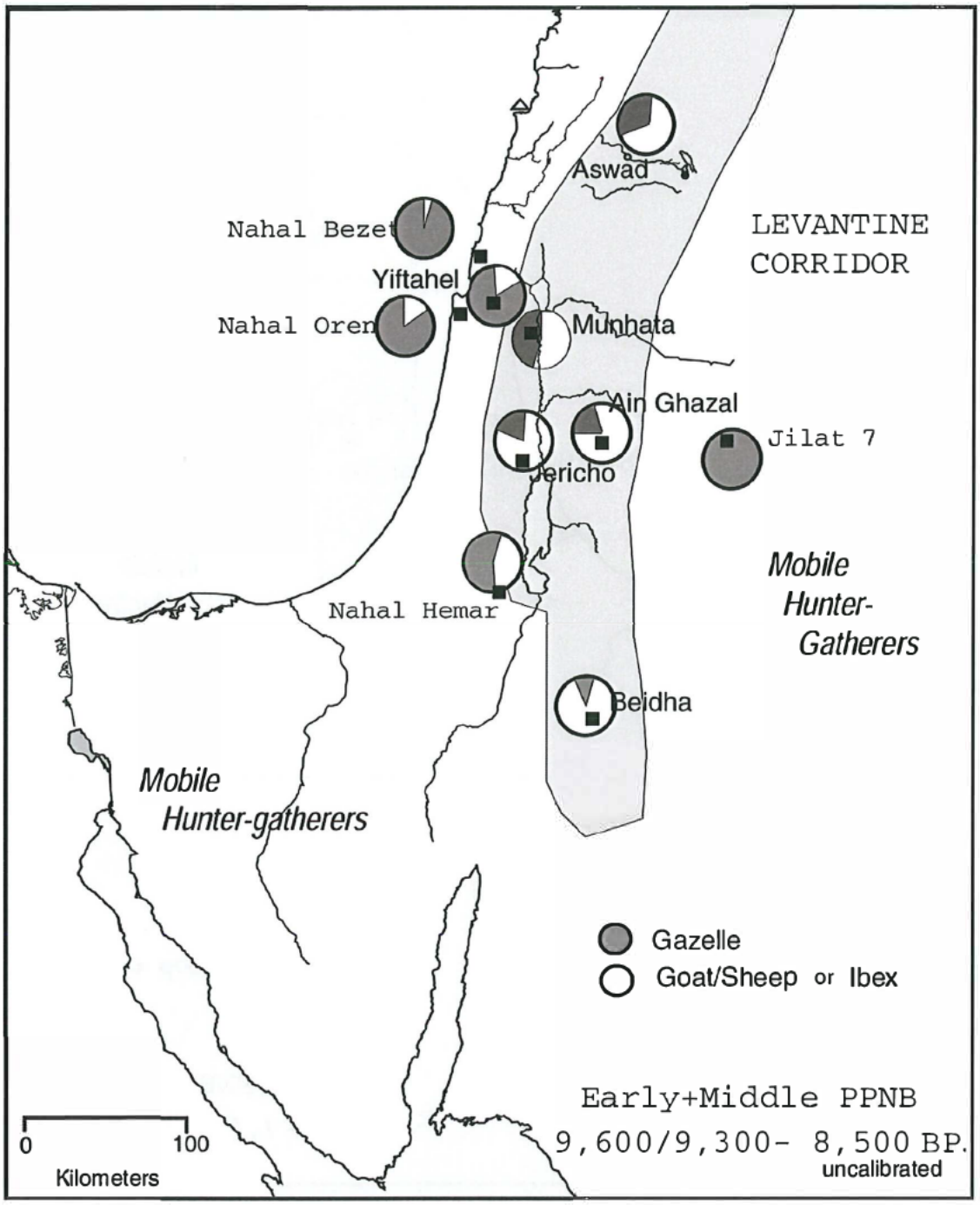

Fig. 5. The southern Levant distribution of Goat/Gazelle - Early and Middle PPNB (based on Kolska Horwitz 1993 and Garrard *et al.* 1996)

role. Keeping pets, except for dogs, was and is easier for sedentary villagers than for mobile groups of foragers. But as recorded in Levantine archaeological bone assemblages, the shift for domesticable species, namely goat and sheep, took place only during the PPNB and not during the Late Natufian and PPNA (called 'proto-Neolithic' by the Tübingen school). This means that we can see the evidence for domestication, as marked by a shift in the spectrum of mammalian bones, only about 1000 years after the establishment of Levantine farming communities.

Following the comments above, it seems safe to assume that goats and sheep were domesticated by semi-sedentary hunter-gatherers/early horticulturists in the habitats where these animals

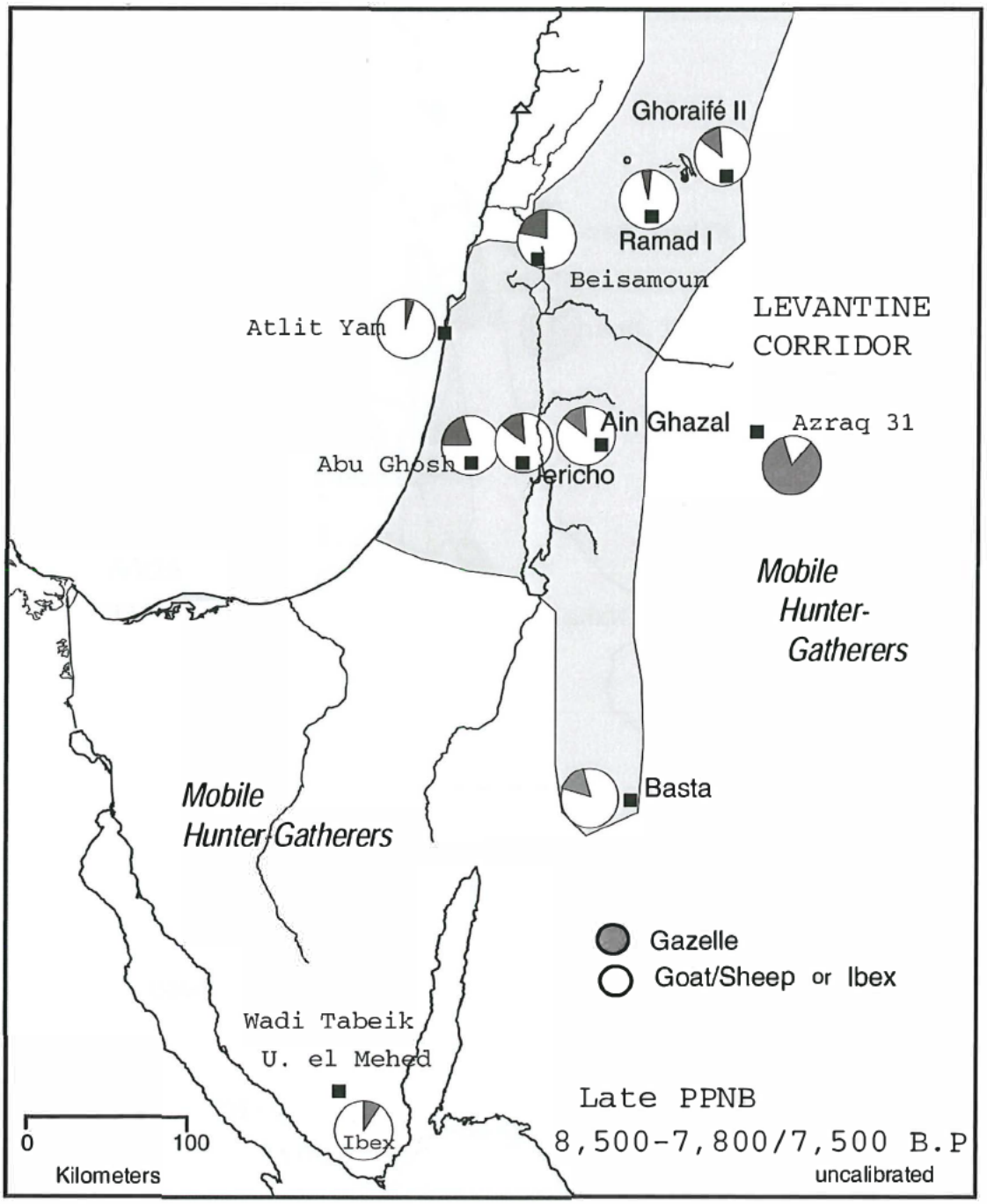

Fig. 6. The southern Levant - distribution of Goat/Gazelle - Late and Final PPNB (based on Kolska Horwitz 1993 and Garrard *et al.* 1996)

proliferated. It is therefore not surprising that the early domesticates are known from the Taurus and Zagros foothills (e.g. Hesse 1984; Legge 1996). Unfortunately, little is known about the Epi-Paleolithic foragers of Anatolia and western Iran. However, in the faunal assemblages from Karain and Öküzini caves in the west or Shanidar and Palegawra in the east, goats and sheep have dominated the mammalian spectra since the Middle Paleolithic (Evins 1982; Hesse 1984; Albrecht *et al.* 1992; Bar-Yosef and Meadow 1995; Yalçinkaya *et al.* 1995; Hole 1996; Legge 1996; Léotard *et al.* 1996). Husbandry, therefore, began in these areas, but was not established, as far as we know today, before

the adoption in this region of cereal cultivation as a new subsistence system. This sequence is clearly represented in various sites such as Aşikli, Çayönü, Ganj Dareh and others.

As indicated by Legge (1996) and Hole (1996), many of the faunal assemblages are not published in detail and there remain some chronological problems that require direct dating of bones by AMS. But the trend over the entire Near East is clear: the domestication of goat and sheep took place in the Taurus-Zagros ranges and their foothills from where they were later herded to the south. However, genetic data clearly indicate that the domestication of cattle occurred in more than one place (Bradley *et al.* 1998), as predicted by Meadow (1984, 1993) and Grigson (1991), and it follows that the possibility that goats and also sheep were domesticated in one or two loci needs to be examined. Complicating the investigation is the fact that the morphometrics of the same species may vary by geographical area. Genetic data are useful, but it would be better to have information from ancient DNA from bones in well preserved archaeological contexts.

In conclusion, the entire process of goat and sheep domestication was the work of the Taurus-Zagros sedentary foragers, who had been aware of their behavioral features for many generations. Once goat and sheep were penned, they went through a process of human selection for more improved, controlled herd composition. It is only later in time that either herds or just a few animals were traded southward into the central and southern Levant. The movement of the 'walking larder' southward could have occurred along the same routes as the obsidian trade that began in the late Epi-Paleolithic. The northern Levant (the area between the Euphrates and the Taurus foothills) was the first to see the effects of goat and sheep domestication (Legge 1996). The process of controlled animal dispersal through exchange relationships took several centuries. It followed the same trend as the establishment of cultivation, and as testified to in Early and Middle and Late PPNB assemblages (Kolska Horwitz 1993), the process began *inside* the Levantine corridor (Figs. 5, 6) and spread both westward (into the coastal plain), and eastward into the Syro-Arabian desert. The adoption of goats by the inhabitants of the more arid area occurred either during the Pottery Neolithic period or even later (Garrard *et al.* 1996). This means that the emergence of pastoral nomads as archaeologically defined entities was not registered before 7500 B.P. (uncalibrated) or even later.

Although we have a tendency to interpret the penning and eventual domestication of herd animals as initiated by economic demands, it will be useful to test the other hypothesis, namely that cattle, given the ferocious behavior of their wild ancestors, might first have been penned and domesticated for religious reason (e.g., Isaac 1962; Cauvin *et al.* 1997). This is not a new idea. The archaeological evidence from Anatolia, from various sites and especially from Çatal Hüyük, indicates that wild and domesticated cattle were an important symbolic element in the cosmological belief system of the inhabitants of this region. One can not make the same observation in the Levant, suggestin that cattle domestication took place in Anatolia and the new form was later herded southward.

In conclusion, the penning and domestication of goats, sheep and cattle occurred at various loci, mainly in the regions of Anatolia, the Taurus and the Zagros Mountains, and not in the Levant. Social and cosmological issues played an important role in this process, which took place in the context of semi-sedentary and sedentary farming communities.

References

Albrecht, G., B. Albrecht, H. Berke, D. Burger, J. Moser, W. Rähle, W. Schoch, G. Storch, H. P. Uerpmann and B. Urban, 1992. Late Pleistocene and Early Holocene finds from Öküzini: A contribution to settlement history of the Bay of Antalya, Turkey. *Paléorient* 18(2): 123-141.

Bar-Yosef, O., 1998. The Natufian culture in the Levant—Threshold to the origins of agriculture. *Evolutionary Anthropology* 6(3): 159-177

Bar-Yosef, O., 1998. On the nature of transitions: the Middle to Upper Palaeolithic and the Neolithic revolution. *Cambridge Archaeological Journal* 8(2): 141-63.

Bar-Yosef, O., 1998. The transition to agriculture in the Old World. *The Review of Archaeology, Special Issue* 19(2) 1-5

Bar-Yosef, O. and A. Belfer-Cohen, 1992. From foraging to farming in the Mediterranean Levant. In:

A.B. Gebauer and T.D. Price (eds.), *Transitions to agriculture in prehistory*, Madison, Prehistory Press: 21-48.

Bar-Yosef, O. and R. H. Meadow, 1995. The origins of agriculture in the Near East. In: T.D. Price and A.B. Gebauer (eds.), *Last hunters, first farmers. New perspectives on the prehistoric transition to agriculture*. Santa Fe, School of American Research Press: 39-94.

Basalla, G., 1988. *The Evolution of technology*. Cambridge, Cambridge University Press.

Bradley, D. G., R. T. Loftus, P. Cunningham and D. MacHugh, 1998. Genetics and domestic cattle origins. *Evolutionary Anthropology* 6(3): 79-86.

Cauvin, J., M.-C. Cauvin, D. Helmer and G. Willcox, 1997. L'homme et son environnement au Levant nord entre 30 000 et 7 500 BP. *Paléorient* 23(2): 51-70.

Clutton-Brock, J., 1979. The mammalian remains from Jericho Tell. *Proceedings of the Prehistoric Society* 45: 135-157.

Davis, S. J. M., 1987. *The Archaeology of Animals*. London, Batsford.

Davis, S. J. M., O. Lernau and J. Pichon, 1994. The animal remains: New light on the origin of animal husbandry. In: M. Lechevallier and A. Ronen (eds), *Le gisement de Hatoula en Judée occidentale, Israël*. Paris, Association Paléorient: 83-100.

Ducos, P., 1968. *L'origine des animaux domestiques en Palestine*. Bordeaux, Imprimeries Delmas.

Ducos, P., 1991. *Bos*, *Ovis* et *Capra* dans les sites néolithiques du Proche Orient. *Paléorient* 17(1): 161-168.

Ducos, P., 1993. Proto-élevage et élevage au Levant sud au VIIe millénaire B.C. les données de la Damascène. *Paléorient* 19(1): 153-173.

Ducos, P., 1997. A re-evaluation of the fauna from the Neolithic levels of El-Khiam. *Journal of the Israel Prehistoric Society* 27: 75-81.

Evins, M.A., 1982. The fauna from Shanidar Cave: A Mousterian goat exploitation in North-eastern Iraq. *Paléorient* 8(1): 37-58.

Flannery, K.V., 1983. Early pig domestication in the Fertile Crescent, a retrospective look. In: T. C. Young, P. E. L. Smith and P. Mortensen (eds), *The hilly flanks and beyond*. Chicago, Oriental Institute: 163-188.

Garrard, A., S. Colledge and L. Martin, 1996. The emergence of crop cultivation and caprine herding in the "Marginal Zone" of the southern Levant. In: D. Harris (ed), *The origins and spread of agriculture and Pastoralism in Eurasia*. London, UCL Press: 204-226.

Grigson, C., 1991. An African origin for African cattle? - Some archaeological evidence. *The African Archaeological Review* 9: 119-144.

Harris, D.R., 1998. The origins of agriculture in Southwest Asia. *The Review of Archaeology* 19(2): 5-12.

Helmer, D., 1992. *La domestication des animaux par les hommes préhistoriques*. Paris, Masson.

Hesse, B., 1984. These are our goats: The origins of herding in West Central Iran. *Animals and archaeology, Vol 3. Early herders and their flocks*. Oxford, BAR International Series 202: 243-264.

Hillman, G., 1996. Late Pleistocene changes in wild plant-foods available to hunter-gatherers of the Northern Fertile Crescent: Possible preludes to cereal cultivation. In: D. Harris (ed.), *The origins and spread of agriculture and pastoralism in Eurasia*. London, UCL Press: 159-203.

Hillman, G.C., and M.S. Davies, 1992. Domestication rate in wild wheats and barley under primitive cultivation: Preliminary results and the archaeological implications of field measurements of selection coefficient. In: P.C. Anderson-Gerfaud (ed.), *Préhistoire de l'Agriculture*. Paris, CNRS: 119-158.

Hole, F., 1996. The context of caprine domestication in the Zagros region. In: D. Harris (ed.), *The origins and spread of agriculture and pastoralism in Eurasia*. London, UCL Press: 263-281.

Isaac, E., 1962. On the domestication of cattle. *Science* 137: 195-204.

Kent, S., (ed.) 1989. *Farmers as hunters: The implications of sedentism*. New directions in archaeology. Cambridge, Cambridge University Press.

Kislev, M., 1997. Early agriculture and paleoecology of Netiv Hagdud. In: O. Bar-Yosef and A. Gopher (eds), *An early Neolithic village in the Jordan Valley Part I: The archaeology of Netiv Hagdud*. Cambridge, Peabody Museum of Archaeology and Ethnology, Harvard University: 209-236.

Kolska Horwitz, L., 1993. The development of Ovicaprine domestication during the PPNB of the Southern Levant. In: H. Buitenhuis and A. T. Clason (eds.), *Archaeozoology of the Near East I. Proceedings of the first international symposium on the archaeozoology of Southwestern Asia and adjacent areas*. Leiden, Universal Book Services/Dr. W. Backhuys: 27-36.

Laden, G., 1992. Ethnoarchaeology and land use ecology of the Efe (Pygmies) of the Ituri Rain Forest, Zaire: A behavioral ecological study of land use patterns and foraging behavior. *Department of Anthropology*. Cambridge, Harvard University: 198.

Legge, T., 1996. The beginning of caprine domestication in Southwest Asia. In: D. Harris (ed.), *The origins and spread of agriculture and pastoralism in Eurasia*. London, UCL Press: 238-262.

Léotard, J.-M., M. Otte, I. López-Bayón, I. Yalçinkaya and M. Kartal, 1996. Le Tardiglaciaire de la grotte d'Öküzini (sud-ouest de l'Anatolie). *Anthropologie et Préhistoire* 107: 157-170.

Marshack, A., 1997. Paleolithic image making and symboling in Europe and the Middle East: A comparative review. In: M. Conkey, O. Soffer, D. Stratmann and N.G. Jablonski. (eds.), *Beyond art: Pleistocene image and symbol*. San Francisco, Memoirs of California Academy of Sciences. 23: 53-91.

Mayewski, P.A., L.D. Meeker, S. Whitlow, M.S. Twickler, M.C. Morrison, R.B. Alley, R. Bloomfield and K. Taylor, 1993. The atmosphere during the Younger Dryas. *Science* 261: 195-197.

Meadow, R.H., 1984. Animal domestication in the Middle East: A view from the Eastern margin. In: J. Clutton-Brock and C. Grigson (eds.), *Animals and archaeology, Vol 3. Early herders and Their flocks*. Oxford, BAR International Series 202: 309-337.

Meadow, R.H., 1993. Animal Domestication in the Middle East: A revised view from the Eastern Margin. In: G. Possehl (ed), *Harappan Civilisation*. New Delhi, Oxford & IBH: 295-320

Pichon, J., 1989. L'environnement du Natoufien en Israël. In: O. Bar-Yosef and B. Vandermeersch (eds.), *Investigations in South Levantine Prehistory*. Oxford, BAR International Series 497: 61-74.

Pichon, J., 1994. L'avifaune. In: M. Lechevallier and A. Ronen (ed.), *Le gisement de Hatoula en Judée occidentale, Israel*. Paris, Association Paléorient: 101-110.

Rosenberg, M., R. Nesbitt, R.W. Redding and B.L. Peasnall, 1998. Hallan Çemi, pig husbandry and post Pleistocene adaptations among the Taurus-Zagros Arc (Turkey). *Paléorient* 24(1): 25-41.

Simmons, A.H. and G. Ilany, 1975-77. What mean these bones? *Paléorient* 3: 269-274.

Stuiver, M., P.J. Reimer, E. Bard, J.W. Beck, G.S. Burr, K.A. Hughen, B. Kromer, G. McCormac, J. van der Plicht and M. Spurk, 1998. INTCAL98 Radiocarbon Age Calibration, 24 000 cal BP. *Radiocarbon* 40(3): 1041-1084.

Tchernov, E., 1991. Biological evidence for human sedentism in southwest Asia during the Natufian. In: O. Bar-Yosef and F.R. Valla (eds.), *The Natufian culture in the Levant*. Ann Arbor International Monographs in Prehistory: 315-340.

Tchernov, E., 1994. *An early Neolithic village in the Jordan Valley II: The fauna of Netiv Hagdud*. Cambridge, Peabody Museum of Archaeology and Ethnography, Harvard University.

Uerpmann, H.-P., 1987. *The ancient distribution of ungulate mammals in the Middle East*. Weisbaden, Ludwig Reichert Verlag.

Uerpmann, H.-P., 1996. Animal domestication - Accident or intention? In: D. Harris (ed.), *The origins and spread of agriculture and pastoralism in Eurasia*. London, UCL Press: 227-237.

Yalçinkaya, I., J.M. Léotard, M. Kartal, M. Otte, O. Bar-Yosef, I. Carmi, A. Gautier, E. Gilot, P. Goldberg, J.K. Kozlowski, D. Lieberman, I. López-Bayón, M. Pawlikowski, S. Thiebault, V. Ancion, M. Patou, A. Barbier and D. Bonjean, 1995. Les occupations tardiglaciaires du site d'Öküzini (sud-ouest de la Turquie): Résultats préliminaires. *L'Anthropologie* 100(4): 562-585.

Zohary, D., 1996. The mode of domestication of the founder crops of Southwest Asian agriculture. In: D. Harris (ed), *The Origins and Spread of Agriculture and Pastoralism in Eurasia*. London, UCL Press: 142-158.

Zohary, D., E. Tchernov and L. Kolska Horwitz, 1998. The role of unconscious selection in the domestication of sheep and goats. *Journal of Zoology* 245: 129-135.