The development of the exploitation of products from *Capra* and *Ovis* (meat, milk and fleece) from the PPNB to the Early Bronze in the northern Near East (8700 to 2000 BC cal.)

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ABSTRACT
The identification of the exploitation of products from small domestic ruminants in prehistory is only possible through an archaeozoological and ethological approach, as each type of exploitation implies particular culling strategies. Thus by establishing mortality profiles it is possible to infer the products sought. The advances made in archaeozoological techniques for the interpretation of culling profiles and for the determination of the seasonality of animal husbandry practices have allowed us to interpret 49 culling profiles of Caprinae from the PPNB to the Early Bronze. These profiles are distributed among 24 sites, of which 5 are unpublished. The methods for age estimation to establish the culling profiles are those established by Helmer (1995, 2000a) and Vila (1998), and for the *Ovis-Capra* distinction, those of Helmer (2000b) and Halstead *et al.* (2002). The interpretations are based on statistics (Correspondence Analysis and Cluster Analysis), on economic and ethnological data and on the biological constraints of Caprinae. These interpretations

reveal, among other elements, the main products used and the diachronic evolution of the exploitation of these various animal products. Thus the rate of exploitation of the tender meat of young animals, milk and fleece varies strongly: milk was exploited from the beginning of the middle PPNB, a major change in the exploitation of meat occurred at about 7000 BC cal. and, at the same time, the use of fleece can be evidenced (appearance of groups of consumers and of producers). In the Early Bronze Age, these practices intensified.

KEY WORDS
Caprinae,
animal products,
Near East,
producers/consumers,
8700-2000 BC cal.

RÉSUMÉ

Le développement de l'exploitation des produits issus des chèvres et des moutons (viande, lait et laine) du PPNB jusqu'au Bronze ancien au Proche-Orient septentrional (8700 à 2000 BC cal.).

La mise en évidence de l'exploitation des produits fournis par les petits ruminants domestiques n'est seulement possible en Préhistoire que par une approche archéozoologique et éthologique, chaque type d'exploitation induisant des stratégies d'abattage particulières. Ainsi en établissant des profils de mortalité, il est possible de déduire les produits recherchés. L'avancée des techniques archéozoologiques dans l'interprétation des courbes d'abattage et dans la mise en évidence de la saisonnalité des pratiques d'élevage nous a permis d'interpréter 49 profils d'abattage de caprinés allant du PPNB jusqu'au Bronze ancien. Ces profils sont répartis dans 24 sites dont 5 sont inédits. Les méthodes d'estimation des âges pour établir les profils d'abattage sont celles établis par Helmer (1995, 2000a) et Vila (1998), et pour la distinction *Ovis-Capra*, celles de Helmer (2000b) et Halstead *et al.* (2002). Les interprétations s'appuient sur les statistiques (*Correspondence Analysis and Cluster Analysis*) ainsi que sur les données ethnologiques, économiques et les contraintes biologiques des caprinés. Ces interprétations nous renseignent, entre autres, sur les principaux produits exploités et l'évolution diachronique de l'exploitation de ces divers produits animaux. Ainsi les taux d'exploitation de la viande tendre, du lait et des toisons varient fortement : d'une part le lait est exploité depuis le début du PPNB moyen, d'autre part un changement majeur dans l'exploitation de la viande tendre se manifeste aux alentours de 7000 avant J.-C. calibré, accompagné par la mise en évidence de celle des toisons (apparition des groupes de consommateurs et de producteurs). Au Bronze ancien, ces pratiques s'intensifient.

MOTS CLÉS
Caprinés,
productions animales,
Proche-Orient,
producteurs/consommateurs,
8700-2000 BC cal.

RESUMEN

El desarrollo de la explotación de productos de Capra y Ovis (carne, leche y vellón) desde el PPNB al Bronce Temprano en el Cercano Oriente septentrional (8700-2000 cal AC).

La identificación de la explotación de productos de rumiantes domesticados pequeños en la prehistoria sólo es posible a través de un enfoque arqueozoológico y etológico, dado que cada tipo de explotación implica estrategias particulares de matanza selectiva. Por eso, estableciendo perfiles de mortalidad es posible inferir la búsqueda de ciertos productos. Los avances efectuados en las técnicas arqueozoológicas para la interpretación de perfiles de matanza selectiva y para la determinación de la estacionalidad en las prácticas de cría nos ha permitido interpretar 49 perfiles de matanza selectiva de Caprinae desde el PPNB hasta el Bronce Temprano. Estos perfiles provienen de 24 sitios, de los cuales 5 no están publicados. Los métodos para la estimación de la edad con el fin de establecer los perfiles de matanza selectiva son los establecidos por

Helmer (1995, 2000a) y Vila (1998), y para la distinción entre *Ovis-Capra*, aquellos de Helmer (2000b) y Halstead *et al.* (2002). Las interpretaciones se basan en estadísticas (*Análisis de Correspondencia y Análisis de Conglomerados*) de datos económicos, etológicos y sobre las restricciones biológicas de Caprinae. Estas interpretaciones revelan, entre otros elementos, los principales productos utilizados y la evolución diacrónica de la explotación de estos varios productos animales. Por eso la tasa de explotación de la carne tierna de animales jóvenes, leche y vellón varía ampliamente : la leche fue explotada desde el comienzo del PPNB medio, un cambio importante en la explotación de la carne ocurió alrededor de 7000 cal.AC y, al mismo tiempo, puede ser evidenciado el uso del vellón (aparición de grupos de consumidores y productores). Estas prácticas se intensificaron en la Edad de Bronce Temprana.

PALABRAS CLAVE
Caprinae,
productos animales,
Cercano Oriente,
productores/consumidores,
8700-2000 cal. AC.

INTRODUCTION

The research tools likely to provide information about past herding societies require objectives and methods which are reliable and detailed (Vigne *et al.* 2005). Indeed, the modes of exploitation of the herds were complex and dependent on biological and environmental constraints, on the needs of the societies, on the ways in which other resources, whether food or not, were exploited, on the systems of mental representation, particularly sensitive in relation to herding, and on knowledge accumulated through tradition. The technical systems organized for the exploitation of the herds resulted from a balance achieved between these constraints (Vigne 1998). Among these research tools, the culling profiles which have been established based on dental age are all the more important as they are usually direct evidence for the management choices made by the herders. Moreover, from a methodological viewpoint, the sequences of eruption and replacement of teeth in mammals vary little within the same species and allow reliable estimations of age.

The goal of this paper is research into the development of herding practices for sheep and goats in the northern Near East from the beginnings of animal domestication during the 9th millennium BC cal. up to the development of urbanism in the 3rd millennium BC (Early Bronze Age). The main objective is to reveal herding practices through the exploitation strategies which were oriented towards the acquisition of certain products.

We are particularly interested in the question of the emergence of the production of milk and fleece, termed "secondary" in relation to the exploitation of meat, which is usually called "primary". This concept, formulated by Sherratt (1981, 1983) to explain his theory on the "secondary products revolution" and still commonly accepted, is today questionable. These products were to be termed "final" for meat and "antemortem" for those exploited during the life of the animal (milk, fleece, and strength) (Vigne & Helmer 2007). The revelation of a significant caprine milk production in southern France since the early Neolithic (Vigne & Helmer 1999), following the discovery, in the Near East and Greece, of evidence for the exploitation of milk and fleece beginning in the 8th and 7th millennia (Helmer 1992, 1995, 2000a), led us to criticize Sherratt's concept (Helmer & Vigne 2004). Moreover, the use of cow's milk had been discovered for the middle Neolithic in the Parisian basin (Tresset 1996; Balasse *et al.* 1997, 2000). The present work is intended to complete this outline in focusing on the Near East, where sheep and goat were first domesticated (Peters *et al.* 2005; Helmer, in press). The issues are guided by three questions:

1. – Was there a development in economic practices from the appearance of herding up to the Bronze Age?
2. – If so, was this development gradual or abrupt?
3. – Finally, when did groups of producers, in the sense of specialized production, and their corresponding consumers appear?
This approach was conducted by the analysis of culling profiles, which are based on the analysis of dental wear. This presupposes two fundamental principles:
– the method used to determine individual age must be relatively reliable and precise;
– the interpretation of these profiles should be carried out based on exact models which reflect in the most complete way possible the exploitation of the different products, whether final (meat) or ante-mortem (milk and fleece).

THE MATERIAL STUDIED

Regions and periods studied

The region studied is the Near East, and particularly the northern part including Lebanon, Syria, south-eastern Turkey and north-western Iraq[1] (Fig. 1). The periods are the following, from the earliest to the latest: Early PPNB (EPPNB, 8700-8200 BC cal.), Middle PPNB (MPPNB, 8200-7500 BC), Late PPNB (LPPNB, 7500-7000 BC), Final PPNB (FPPNB, 7000-6500 BC), Pottery Neolithic (PN, 7000-6000 BC), Halaf (6000-4500 BC), Ubaid (5300-3700 BC), Uruk (3700-3000 BC) and Early Bronze Age (EBA, 3000-2000 BC).

The corpus of culling profiles

We collected 49 culling profiles from 24 sites, distinguished according to the principal occupation phases of the site in question or by periods. All the original data come from our own respective studies (published or unpublished), using the same methods of recording, except for Halula (Saña Seguí 1999, personal communication). The specimens consist of 4817 teeth which are grouped from 12 to 644 in number according to the site. The teeth were included in mandibles or maxillae or were found isolated but, as explained in the following methodological part, only those yielding an estimation of age (lower and upper dP4, M1, M2 and M3) were used here. Two-thirds of the profiles are based on more than 35 teeth each, which taking into account the taphonomy of the assemblages, appears to represent a sufficient number of individuals to avoid the statistical bias related to too small samples. This corpus covers all the periods with, however, fewer numbers for the early PPNB as well as the 6th and 5th millennia (Halaf and Ubaid).
To apply correspondence analysis, we have added the profiles from south-eastern France as a methodological counterweight (1601 teeth from 23 sites with a total of 29 profiles) (Helmer & Vigne 2004, Helmer *et al.* 2005). Indeed, a study in progress shows that the oppositions and links between the age classes are similar for the two regions. The fact that we find comparable results in different periods and regions could mean that these oppositions between the age classes are a signature of some natural constraints universally encountered by the herding of small ruminants.

METHODS

The first procedure for normalised quantitative treatment of age data for the Bovidae was proposed by P. Ducos (1968). Then S. Payne (1973, 1987) developed for the caprines a more adapted system of classes by age. He established the first quantitative frames of reference which enabled interpretation in terms of type of product (meat, milk, fleece) by much more clearly distinguishing the culling profiles from the demographic structures of the herds on the hoof. The work was resumed later, and to offset the limitations of these first methodological tools, the effort was

1. See the appendix at the end of the article.

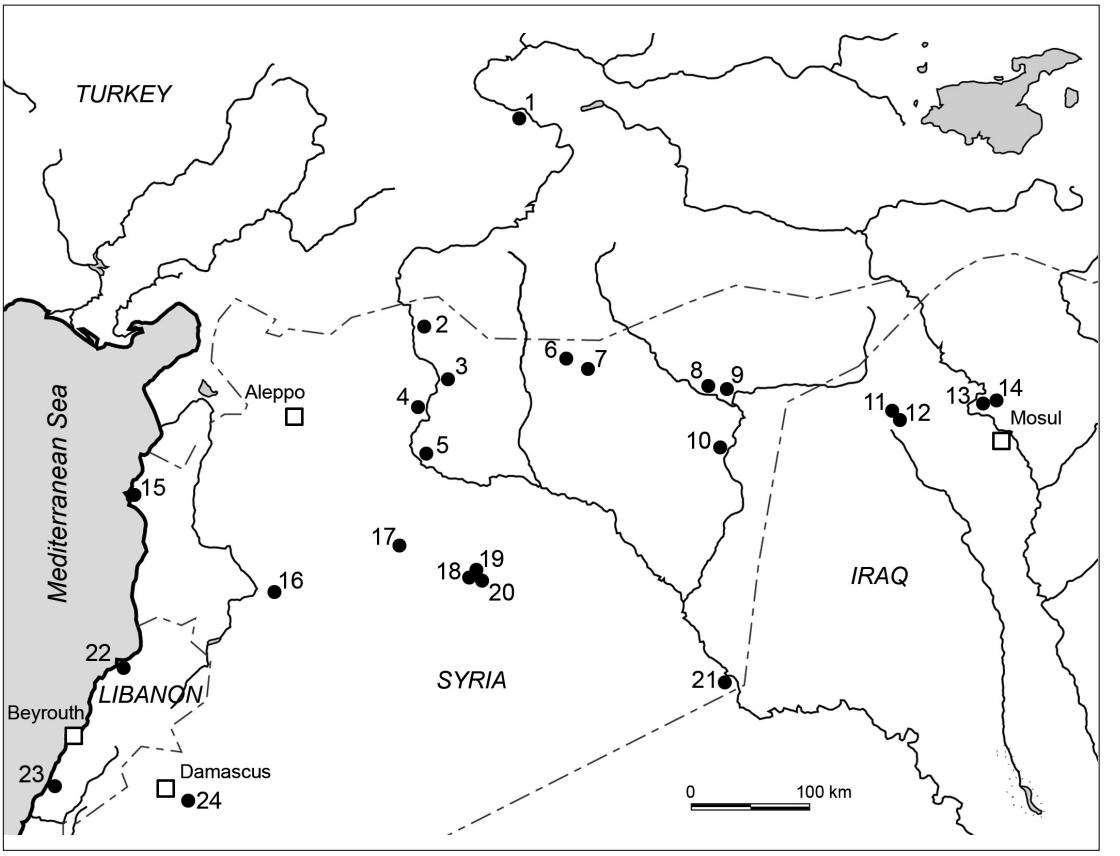

FIG. 1. – Map showing the sites mentioned in the text. 1 - Cafer Höyük; 2 - Shiukh Fawqani; 3 - Kosak Shamali; 4 - Halula; 5 - Sheikh Hassan; 6 - Chuera; 7 - Kharab Sajjar; 8 - Tell Seker al Aheimar; 9 - Mashnaqa; 10 - Knedig; 11 - Maghzalia; 12 - Tell Sotto; 13 - Derak; 14 - Kutan; 15 - Ras Shamra; 16 - Mishrife; 17 - Rawda; 18 - Qdeir; 19 - Umm el Tlel; 20 - El Kowm 2; 21 - Mari; 22 - Byblos; 23 - Sidon; 24 - Aswad. (Drawing L. Gourichon).

oriented in three complementary directions: the development of more reliable methods for the determination of age and taxa from the teeth, the search for new present-day biological collections of reference for testing, completing and refining those of Payne, and the constitution of a corpus of archaeological culling profiles likely to portray the diversity of prehistoric situations, as much from the technical as the taphonomic point of view (Grant 1978, 1982; Halstead 1992, 1998; Helmer 1992, 1995, 2000a; Balasse *et al.* 1997, 2000; Vila 1998; Balasse & Tresset 2002; Halstead *et al.* 2002; Gourichon 2004; Helmer & Vigne 2004; Blaise 2005, 2006; Helmer *et al.* 2005).

AGE ESTIMATION

Among the different methods used to estimate the age of the sheep and goats, we have employed for this work a method developed by one of us (Helmer 1995, 2000a; Helmer & Vigne 2004). This method combines observations of the occlusal surface of the teeth according to Payne (1973) and the rate of tooth wear with the calculation of the height index by dividing the dental crown height by the vestibulo-lingual diameter taken at the collar according to Ducos (1968). The frame of reference was established based on a group of present-day animals in south-eastern France (mainly sheep of the Préalpes breed, Corso-Sardinian mouflons and goats). The

relation between morphology and age established by Payne was verified on this sample: the results are identical for both sheep and goats.

The age profiles were established by calculating the NISP frequencies for each class, i.e. the frequencies based on the number of teeth in this case (*cf.* Vigne 1998). Then these frequencies were corrected, since the age classes are of unequal amplitude. This method is totally compatible with that of Payne (1973). Moreover, it is applicable on isolated teeth and also on upper teeth (Fig. 2).

There are several advantages with this method compared to that of Payne. First of all, we can assign an age as easily to an entire mandible as to an isolated tooth, the sample is all the more increased; Payne's method favours the teeth of young individuals (or penalizes older teeth) for the simple reason that they are easier to attribute, while for worn teeth a minimum of two contiguous teeth or even three is necessary. Our method makes up for this bias by allowing age attribution to isolated teeth, even if highly worn. It must be remembered that the frequent loosening of older teeth, accentuated by the frequent breaking of the mandibles due to human or taphonomic causes, results in an over-evaluation of the youngest age classes (Vigne 1998). To illustrate this, we may take as an example the Grotte de l'Église (Chassean, middle Neolithic of south-eastern France) where 32 samples were attributed with the Payne method and 83 by ours: the two profiles have a similar pattern but the differences in frequency are clear for the younger classes (Fig. 3). These differences in amplitude affect the interpretation, especially for the older classes.

Recent studies on the anatomy of the lower teeth of domestic sheep and goats from independent corpuses have demonstrated the existence of criteria which enable distinction between *Ovis* and *Capra* (Helmer 2000b, Halstead *et al.* 2002; Balasse & Ambrose 2005). These studies complement that of Payne (1985) about the lower deciduous teeth, and make possible the development of separate culling profiles for sheep and goats, to better define the purposes of the exploitation of each of these domestic ruminants.

Age classes		Lower teeth				Upper teeth				Corr.
Payne	Range	Dp_4	M_1	M_2	M_3	Dp^4	M^1	M^2	M^3	
A	0 - 0.2 mo									x 6
B	0.2 - 0.5 mo		5.0				3.0			x 3
C	0.5 - 1 mo		4.1	5.5			2.5	3.5		x 2
D	1 - 2 y		3.5	4.9	5.5		2.0	3.0	3.4	x 1
EF	2 - 4 y		2.5	3.5	4.7		1.5	2.2	2.8	x 0.5
G	4 - 6 y		1.5	2.4	3.35		1.0	1.8	2.0	x 0.5
HI	> 6 y									x 0.25

FIG. 2. – Limit values of the crown height index (measurements according to Ducos 1968) and wear state symbols (from Payne 1973) for different age classes of domestic caprines (modified from Helmer 1995). This index is calculated by dividing the dental crown height by the vestibulo-lingual diameter taken at the collar.

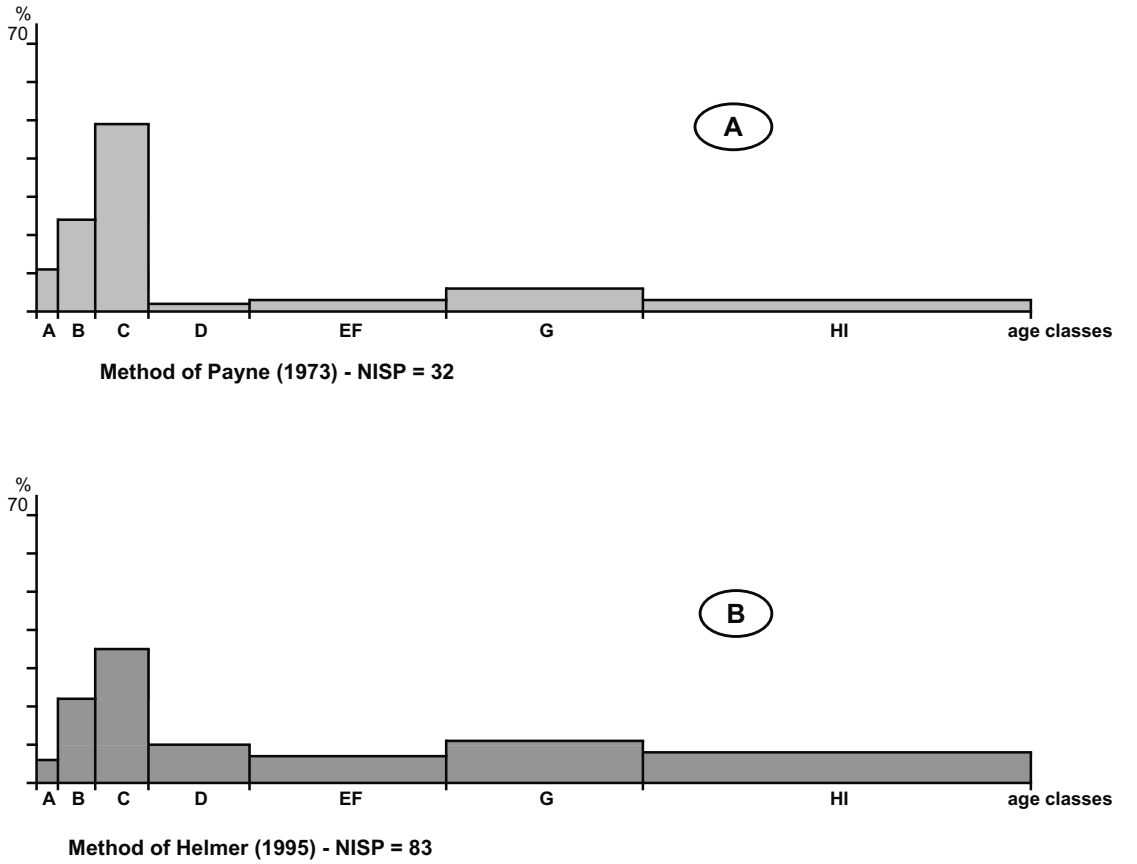

FIG. 3. – Comparison of two methods of age estimation of Caprinae for establishing culling profiles. Site of l'Eglise supérieure (Middle Neolithic, South-East of France). The method of Payne uses almost only mandibules whereas the second method takes into account the mandibles and the upper teeth as well as the isolated teeth.

Unfortunately, the development of these profiles requires quite large faunas in order to have a large enough sample for each species, which few Neolithic sites have produced. Moreover, a good number of our profiles were established before the diffusion of the methods for distinguishing the two taxa. In consequence, for this study the commitment is to use overall culling profiles.

For the interpretation, it must be remembered, according to Halstead (1998), that the systems of exploitation inferred from the examination of culling profiles are more "potential than actual", that is that we should reason more in terms of probability than certainty. Major trends of exploitation have to be detected so far as possible, but it is also necessary to pay attention to small irregularities in the profiles in order to discover certain secondary though significant characteristics of the exploitation of other products.

Typology and functional interpretation of the profiles

The study of the culling profiles for southern France (Helmer 1992, Helmer & Vigne 2004) showed that Payne (1973)'s pure types (meat, milk, hair/wool) were rare. Most of them are mixed. The profiles are obviously the result of the accumulation of bone remains over a certain time period during which the ways of exploitation could have varied. The ethno-historical examples

(see in particular Rendu 2000) show that they are sometimes highly flexible within one century. On the other hand, the profiles of "pure" type indicate the long recurrence of the ways in which herds were exploited in a particular place. In the Near East these "pure" types are very rare and the "mixed" type profiles are the norm. The latter probably indicate ways of exploitation which are more nuanced than Payne's clear-cut models. This is what happens in modern extensive herding. Allotment could be at the origin of certain pure types (example in the French Neolithic, Helmer *et al.* 2005). Indeed, there may exist simultaneously within the same community of herders several production strategies each oriented towards a specific product. If these distinct strategies are coexistent, complementary and applied to separate groups of animals (lots), then they fit well with the definition of allotment. This practice is common in extensive herding today for sedentary populations as well as for nomads (D'Hont 1994).

Interpretation of profiles

The analysis of the profiles also shows that a single form of management does not exist for milk or for tender meat but that each of these systems of exploitation comprises (at least) two methods of procedure which are seen in different types of profiles. This analysis was inferred from conversations with herders in southern France but was not the object of a proper study (Helmer 1992, Helmer & Vigne 2004). This was carried out by Blaise (2005, 2006) who confirmed and completed the first data. The main trends are synthesized in the table 1.

The exploitation of the meat

The interpretation of Neolithic profiles from south-east France led to distinguishing several

Table 1. – Caprine management within the present-day herding systems in South-East of France (Helmer unpublished, 1992; Helmer & Vigne 2004; Blaise 2005, 2006); the age classes are correlated with the sought products.

Class A 0-2 months	■ "Milk lambs" if killed before 2 months ■ Culling at birth indicates a search of high production of milk.	Milk type A
Class B 2-6 months	■ "Heavy lambs" when 3-4 months old ■ End of the milk A exploitation and first lambs killed for the meat	Meat type A
Class C 6-12 months	■ "Yearlings" ■ Exploitation focused on tender meat	
Class D 1-2 years	■ Tender meat at the maximum weight (males) ■ Elimination of the barren females	Meat type B
Class EF 2-4 years	■ Culling of some females because of decreased milk yield or lamb production	Milk type B
Class G 4-6 years	■ Continuation of the culling because of decreased milk yield ■ Culling because of decreased quality of fleece	Fleece
Class HI 6+ years	■ Continuation of the culling because of decreased quality of fleece and culling for general herd management (adjustment)	**Final adjustment**

systems of exploitation (Helmer & Vigne 2004). As a reminder, we have distinguished for the meat a type A, characterised by the majority culling of lambs of class C (6 months to 1 year; *e.g.* Maghzaliya, Fig. 4A), and a type B, in which the culling affects preferentially young adults of class D (1 to 2 years, *e.g.* Sheikh Hassan, middle Uruk of Syria, Fig. 4B). In the first type, the most exploited classes are B, C and D, with a peak in C, the whole representing 90% of the number. In the second, the dominant classes are C, D and EF, with a maximum in D (we shall see farther on that the strong percentage in EF indicates an exploitation of milk which, here, predominates over that of meat). Thus, type B could correspond to obtaining animals whose flesh was still tender and at their maximum weight, by preserving the lambs and fattening them. It could then be a system which enables an increase in the profitability of the meat in the herds. As for type A, it could correspond to a domestic consumption, at the level of the family or household.

The exploitation of milk and its derivatives

For the exploitation of milk (and its derivatives), a type A, in which the milk lambs were slaughtered before weaning (class A, between birth and two to three months; *e.g.* Combe Obscure c5, Fig. 4C), was distinguished from a type B (*e.g.* Ras Shamra VC, Fig. 4D). The latter, widespread in traditional Mediterranean and Near Eastern herding today, is characterised by the fact that the unweaned lambs are kept alive, but distanced from their mothers according to different processes (see Papoli-Yazdi 1991, Halstead 1998, Rendu 2000, Helmer & Vigne 2004, Vigne 2006) in order that a part of the milk production be exploited by humans without affecting the survival of the young. Type A is characteristic, according to Halstead (1998), of seeking a surplus production intended for trade or commerce. Type B is indicated only by the culling of older females, when their milk production decreases, which is characterised by a peak concentrated on classes EF (2 to 4 years) and, to a lesser degree, G (4 to 6 years).

The exploitation of fleece [2]

Finally, for the exploitation of fleece, let us remember that it is not useful to slaughter an animal to obtain its fleece and it follows that the exploitation of fleece is very difficult to demonstrate. On the other hand, the appearance of the fine hairs characteristic of wool result from a process of selection which does not seem to have occurred, for either sheep or goats, until the Bronze Age; the first real fleece, in which the woolly hair is dominant, is even later (Ryder 1992, 1993)[3]. This usage is only observable when it is practiced to a high degree, when we detect an unusual percentage of older animals (class G — 4 to 6 years —, and especially HI — more than 6 years; e.g. El Kowm 2 PN, Fig. 4E) because the herders keep the animals longer and cull them only when the fleece loses its quality.

It is often difficult to differentiate this case from that of the milk exploitation of type B because of the partial superimposition of the peaks of culling the older animals. The interpretation is thus more or less subjective and in general holds to the form of the profile. The two examples in figure 4 (D and E) are a good illustration.

RESULTS

Chronological disparities and chi-square test

To verify possible variations in the major trends of the caprine exploitation across the time in the northern Near East, we applied the chi-square test between cumulated age profiles for different chrono-cultural periods. For this, it was necessary to establish global profiles by summing up the

2. Note that "fleece" here has to be intended in its largest sense, whatever the nature of the animal fibres (hair or wool).

3. Morphometric changes of sheep bones from Early Bronze Age probably indicate a tremendous increase in the breading of a woolly type fleece sheep (Vila 2002).

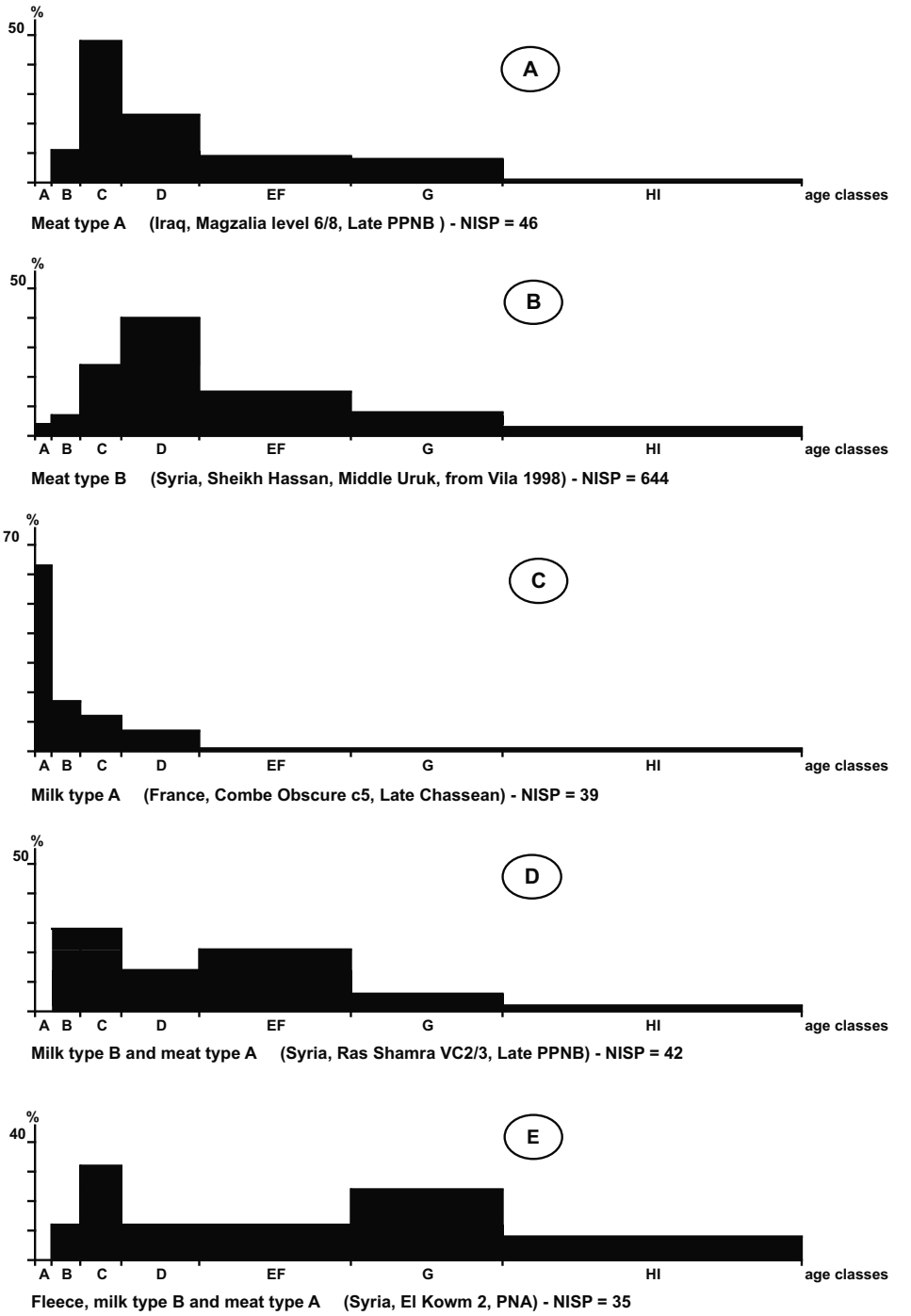

Fig. 4. – Exemples of interpretations of different types of culling profiles.
A - Maghzaliyah (Iraq, Late PPNB, NISP = 22): Meat type A; B - Sheikh Hassan (Syria, middle Uruk, NISP = 644): Meat type B; C - Combe Obscure (France, Late Chassean, NISP = 39): Lait type A; D - Ras Shamra (Syria, Late PPNB, NISP = 60): Milk type B and meat type A; E - El Kowm 2 (Syria, PN, NISP = 35): Milk type B and meat type A.

NISP of each age class for series of profiles grouped according to the period considered. At first, we distinguished the three following major periods: (i) PPNB (Pre-Pottery Neolithic B: Early, Middle and Late), (ii) PN (Pottery Neolithic) and FPPNB (the latter being contemporary with the first groups having pottery), and (iii) Halaf to Early Bronze Age (EBA). Afterward, a finer division was made (EPPNB/MPPNB, LPPNB, PN/FPPNB, Uruk, EBA). The Halaf to Ubaid period was not part of this detailed study as too little data exist. The profiles are presented in figure 5.

The chi-square value between the PPNB, the PN/FPPNB and Halaf to EBA is 123.57 (ddl = 12), which is highly significant. The relative contributions to the chi-square are as follows regarding the periods: PPNB = 46.4%; Halaf to EBA = 36.8%; PN/FPPNB = 16.7%. For the age classes, it is class C which has the highest contribution (60.5%) then class HI (14.0%).

This initial result shows the importance of classes C and HI, which can be interpreted as an opposition between two types of product (meat A and fleece). But beyond this duality, should not there also be seen an opposition between final product (tender meat) and ante-mortem product, or more generally between "active" culling (for a given product) and culling related to decreased usefulness of the animal?

The chi-square for the EPPNB/MPPNB, LPPNB, PN/FPPNB, Uruk and EBA global profiles is 231.12 (ddl = 24) which is highly significant. The contributions are as follows for the periods: EPPNB/MPPNB (16.6%), EBA (29.5%), Uruk (35.6%); for the age classes: D (31%) and C (33%).

These two classes are clearly distinguished from each other, which reinforces the interpretations concerning the producers/consumers given above, during the analysis of the profiles.

The test applied to the main periods shows that there are clear differences in the exploitation of caprines across the time, at least between some periods. What could be the possible explanations for this heterogeneity? Differences in the proportions of the diverse types of exploitation within each period, or effects of an evolution of the herding strategies (*i.e.* appearance or amplification of some practices)? The chi-square test is not really informative about this point and does not answer directly to our initial questions. However, we can notice that three age classes (C, D and HI) contribute very strongly to the differences between the periods, which seems to be related to distinct finalities (final or ante-mortem products). In this sense, we think that an evolution in the caprine exploitation is highly probable. In order to better determine the relations of age classes between each other as well as those of the different uses, we have used another methodological approach: the correspondence analysis.

Correspondence analysis

The correspondence analysis (CA) was applied on the NISP per site (or occupation phase) and per age classes (Fig. 6 and Tab. 2). As counterweight, the data from Neolithic sites of south-eastern France (Helmer & Vigne 2004, Helmer *et al.* 2005) were added to those of the Near-eastern sites. The results are as follows:

– Axis 1 (34.67%): the highest contributions are those of class A (64.6%, coordinates 1.67), class B (13.3%, coordinates 0.52) and class C (7.4%, coordinates 0.20). These three classes have positive coordinates while all the others have negative coordinates, the highest being HI with 6.5%, coordinates -0.24. It would seem then that there is an opposition between the culling of the youngest animals and that of older animals.

The exploitation of milk A (Payne's "pure" type), in the sense that it has been defined for the Neolithic of south-east France (Helmer & Vigne 2004), does not appear in the Near East.

– Axis 2 (23.20%): D (23.0%, coordinate -0.25) and C (15.5%, coordinate -0.24) are opposed to HI (39.7%, coordinate 0.48) and G (12.2%, coordinate 0.22). There is thus a strong opposition between the culling of older animals (and the exploitation of fleece) and meat for consumption.

More generally, these two axes show in a certain way the opposition between the exploitation of meat and the exploitation of ante-mortem

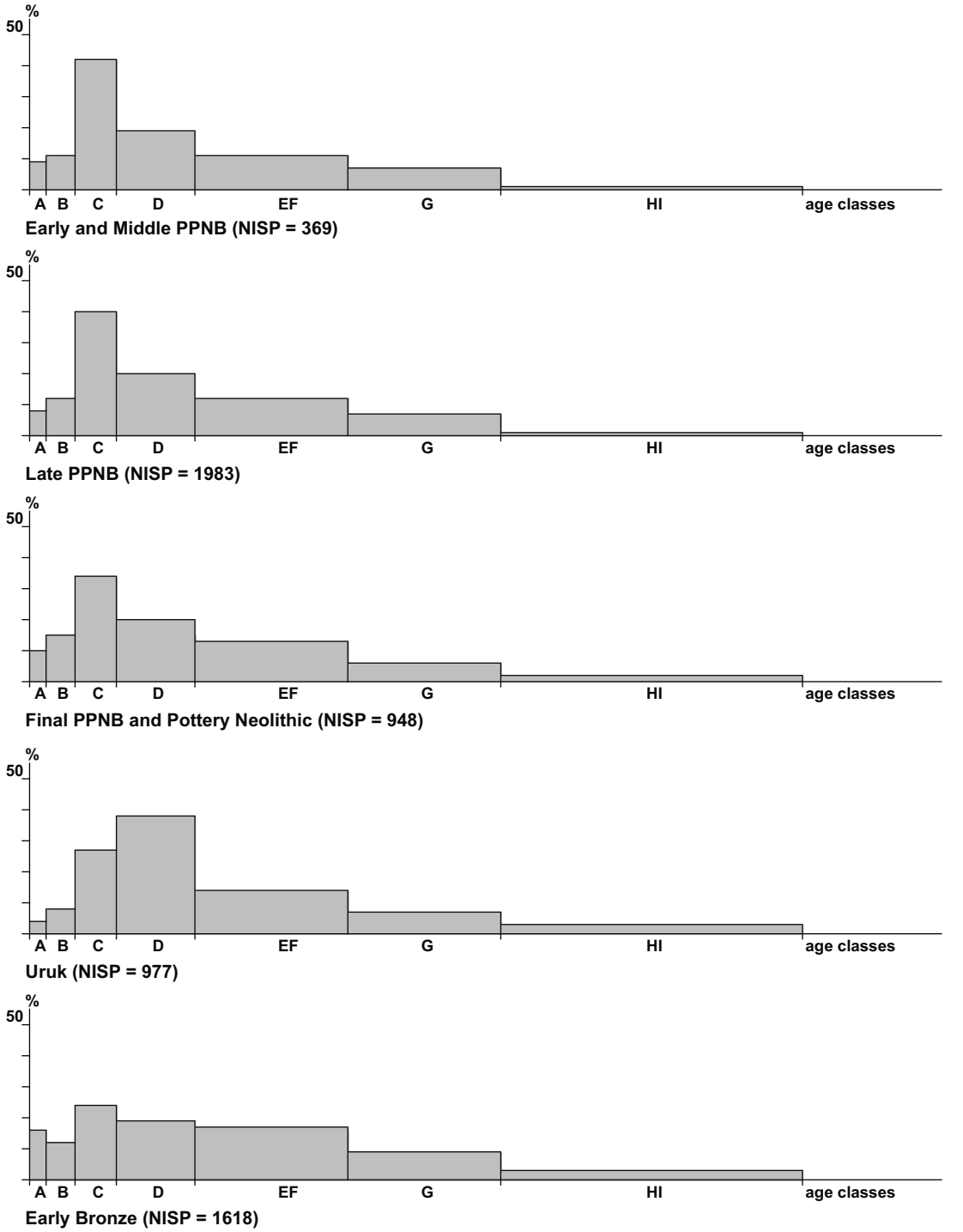

FIG. 5. – Cumulated culling profiles by large chrono-cultural sequences.

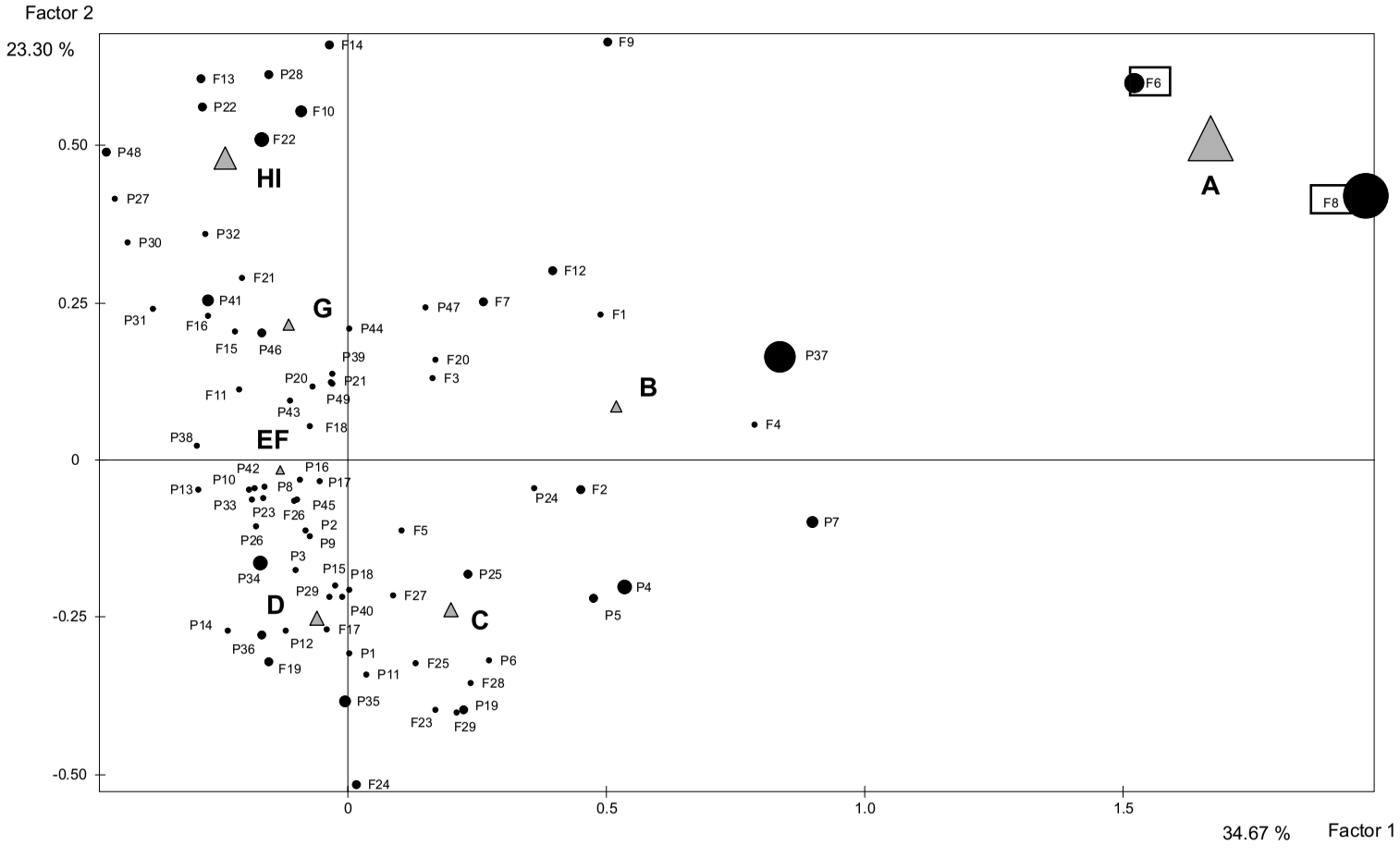

FIG. 6A. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts indicate sites with evidence of production of milk type A. They are absent from the Near East.

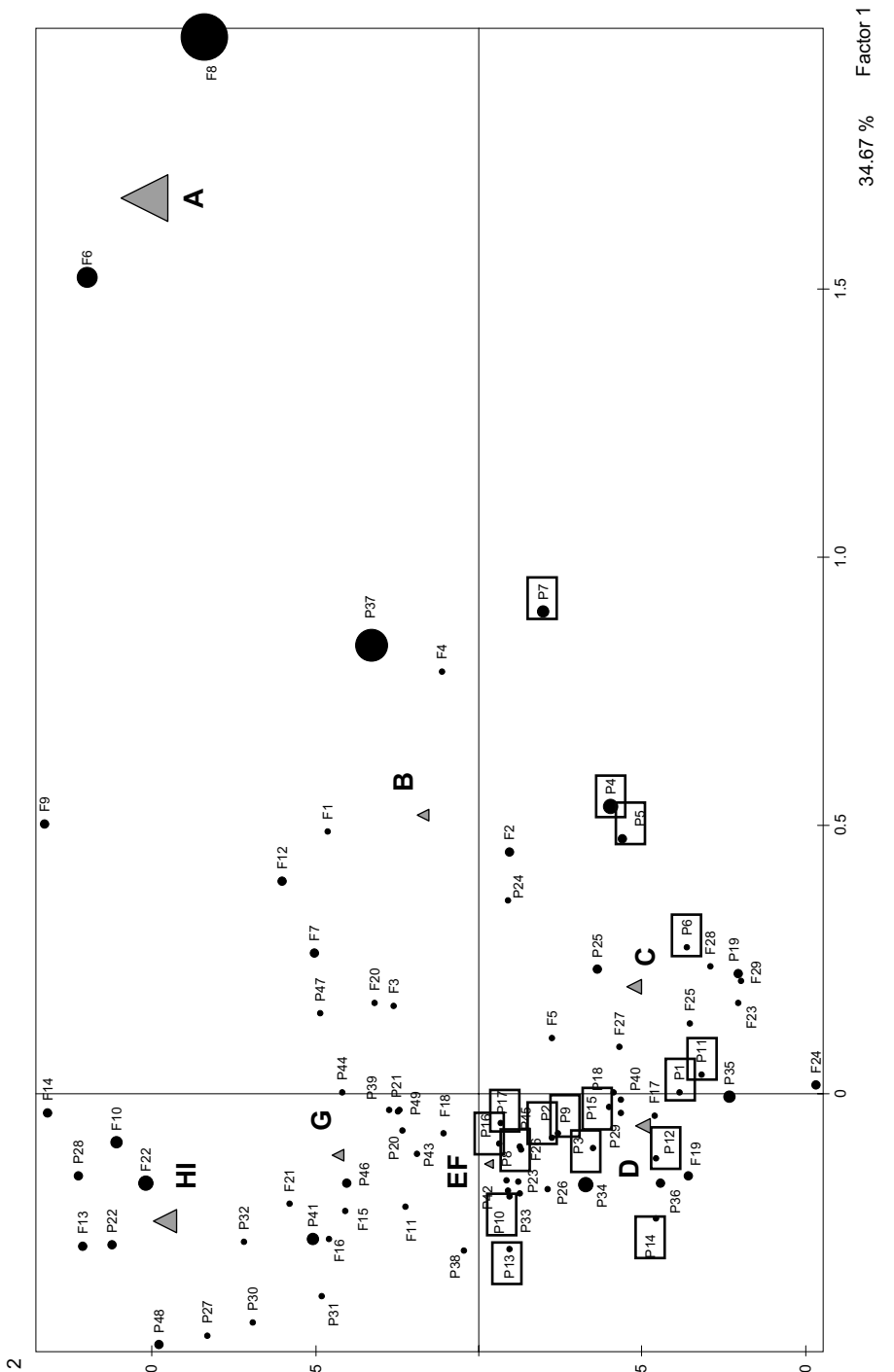

FIG. 6B. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts are sites dating to the Early to Late PPNB.

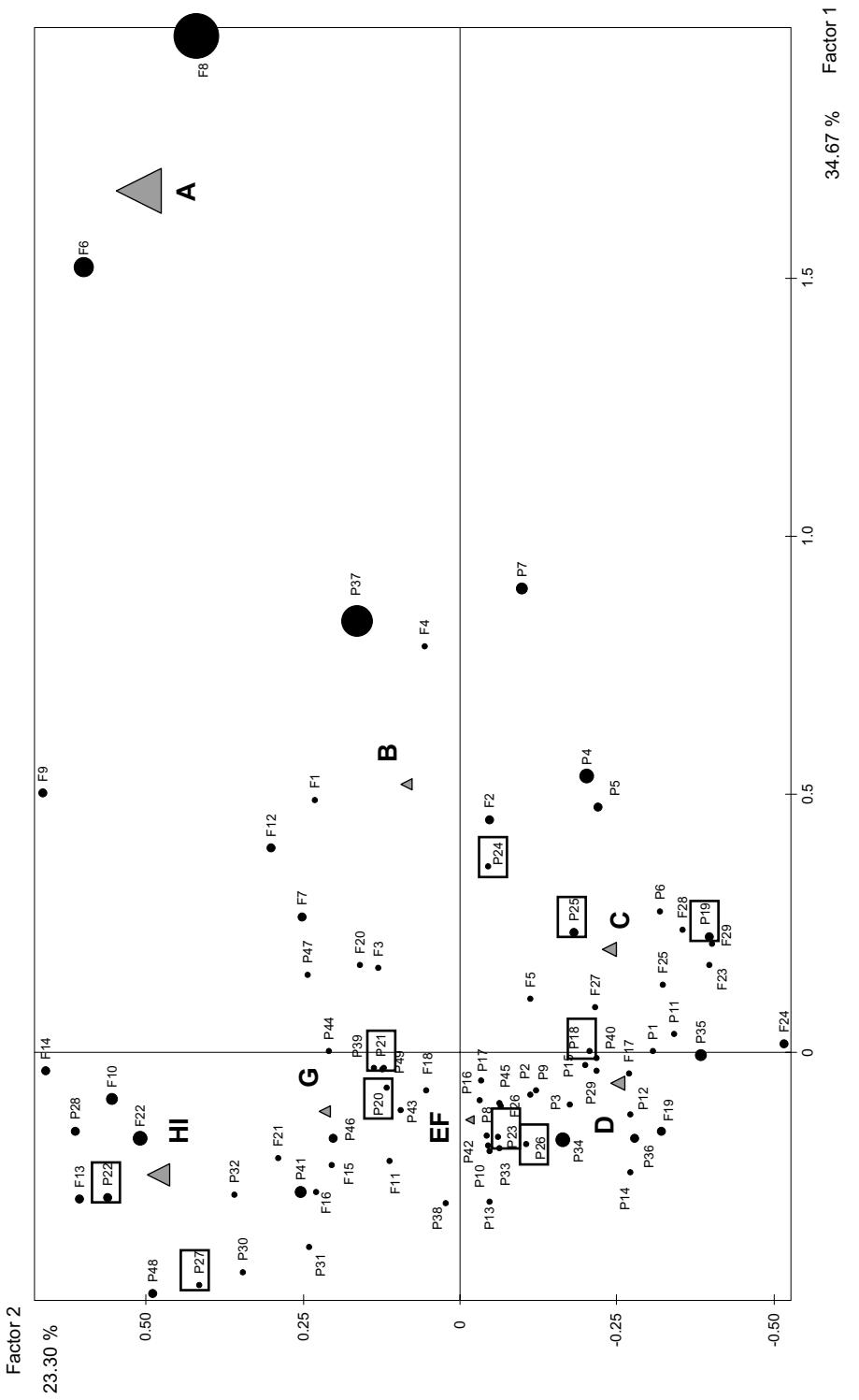

FIG. 6C. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts are sites dating to the Final PPNB and Pottery Neolithic.

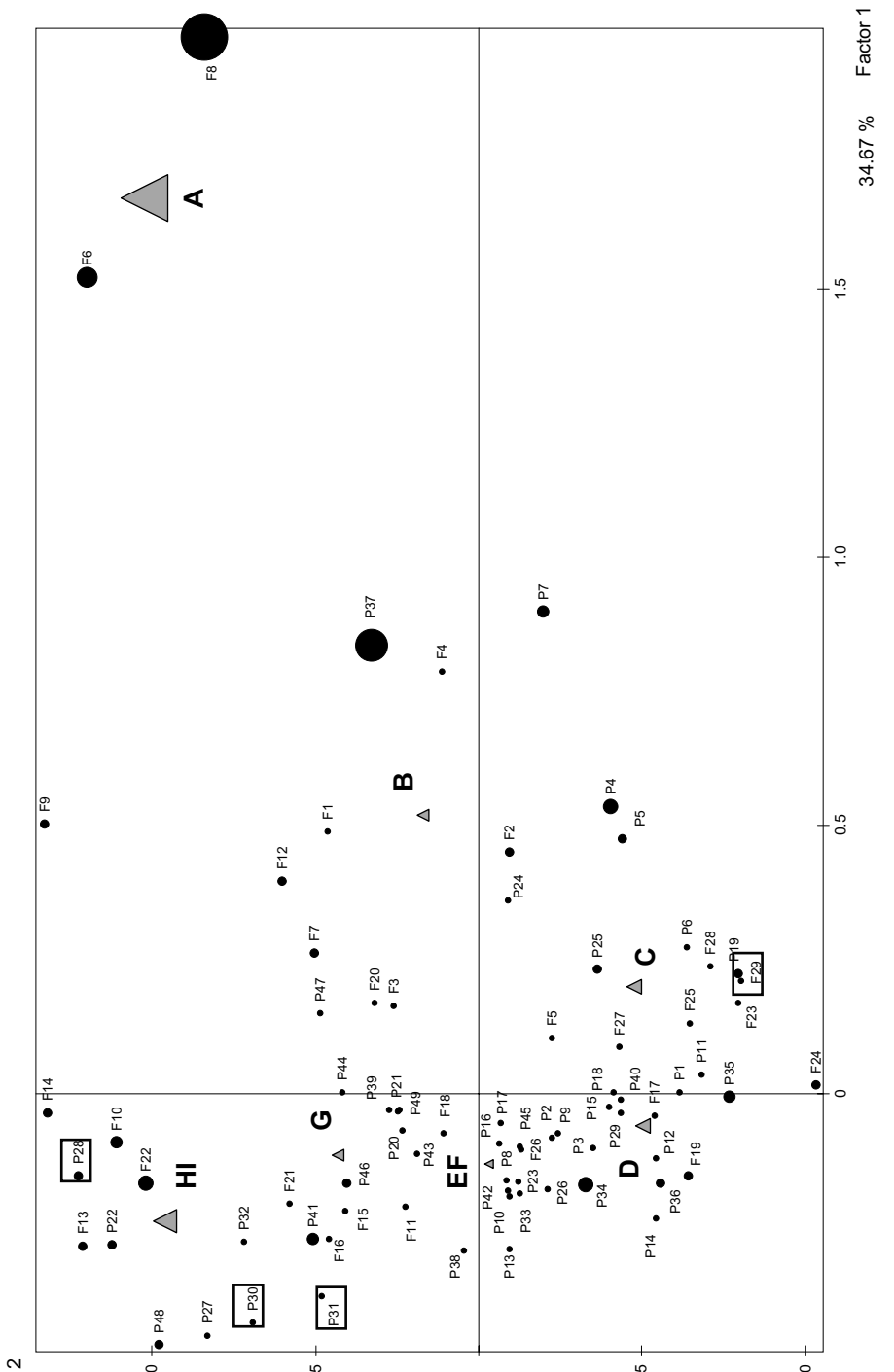

FIG. 6D. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts are sites dating to Halaf to Ubaid cultures.

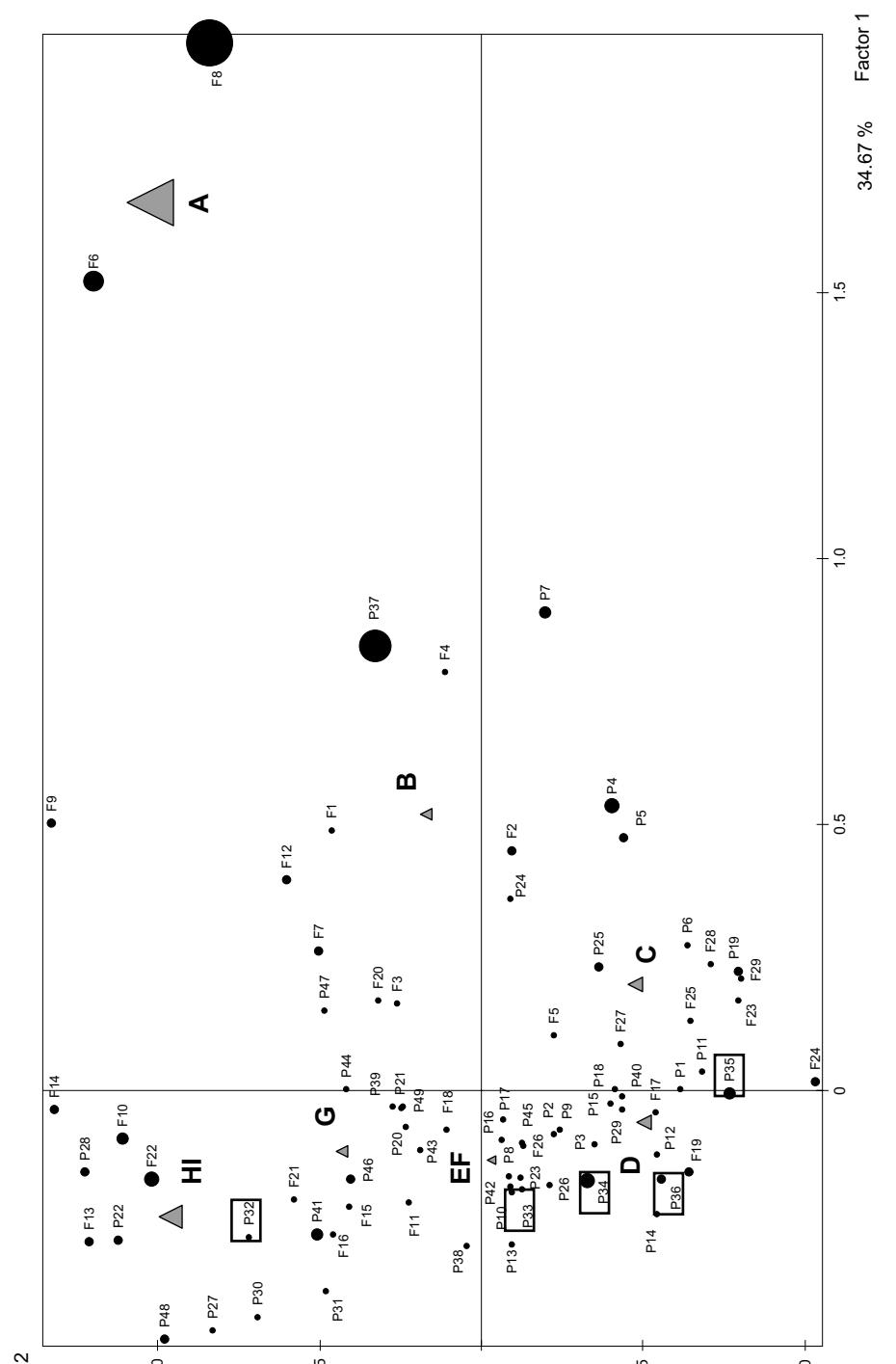

FIG. 6E. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts are sites dating to Uruk culture.

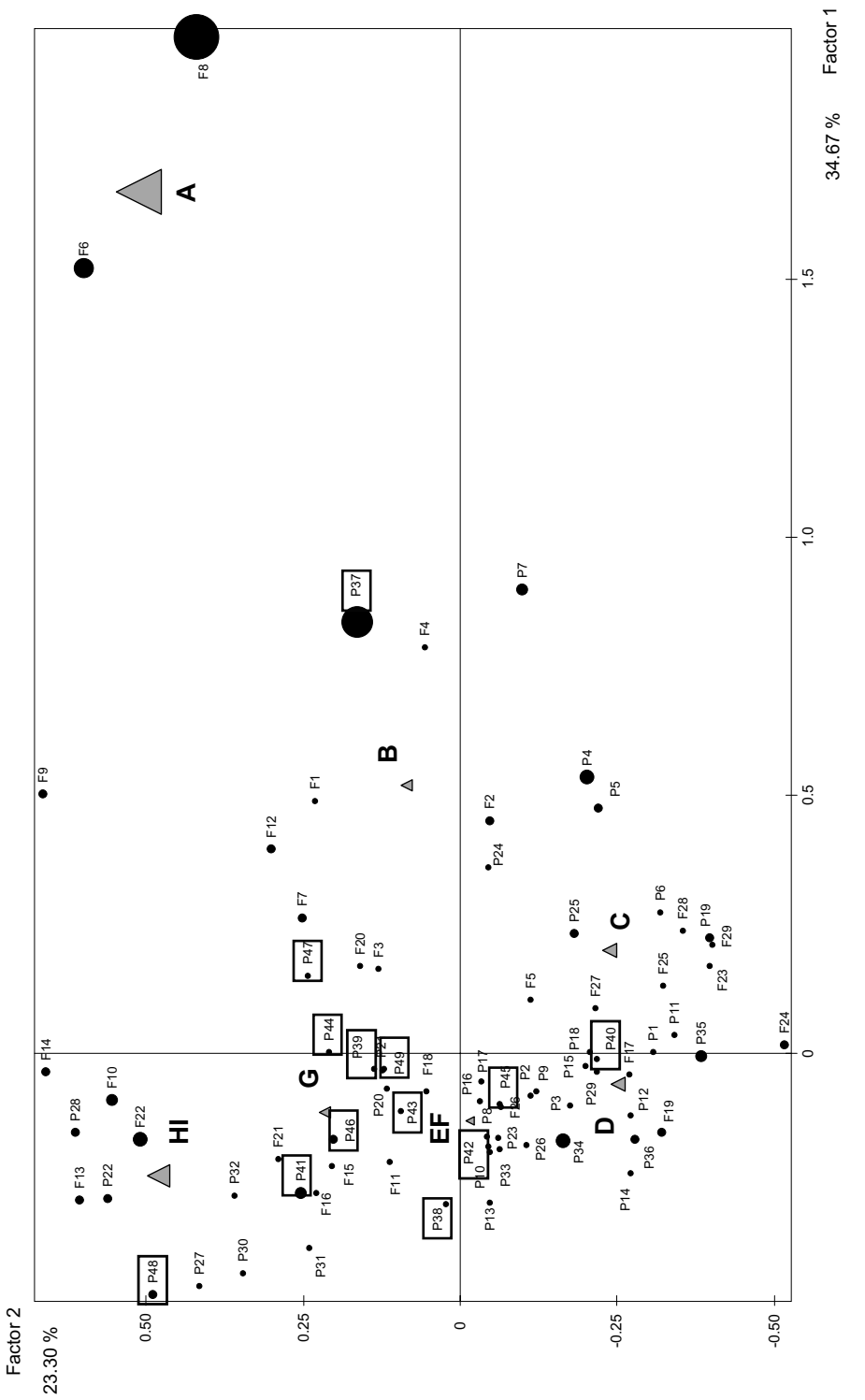

FIG. 6F. – Correspondence analysis of the mortality data of Caprinae (age classes, NISP) from Neolithic sites of Near East and South-East of France: the framed texts are sites dating to Early Bronze Age.

TABLE 2. – Results of the correspondence analysis for the age classes (active frequencies, coordinates, contributions and square cosines for axes 1 to 5). "Disto" is the square of the distance between a given point and the centre of gravity of the scatterplot.

Frequencies			Coordinates					Contributions					Square cosines				
Age class	Relative weight	Disto	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
A	2,12	3,45	1,67	0,51	0,56	– 0,1	– 0	64,6	9,1	12,2	1	0	0,81	0,08	0,09	0	0
B	4,52	0,56	0,52	0,08	– 0,1	0,13	0,11	13,3	0,5	1,3	3,4	3,1	0,48	0,01	0,03	0,03	0,02
C	16,63	0,28	0,2	– 0,2	– 0,4	0,02	0	7,4	15,5	51,5	0,4	0	0,15	0,21	0,62	0	0
D	22,28	0,16	– 0,1	– 0,3	0,27	0,14	– 0,1	0,8	23	28,5	18,2	7,2	0,02	0,39	0,44	0,12	0,04
EF	27,94	0,07	– 0,1	– 0	0,08	– 0,2	0,15	5,2	0,1	3,6	29,6	33,6	0,24	0	0,1	0,35	0,3
G	15,99	0,15	– 0,1	0,22	– 0,1	– 0,2	– 0,2	2,2	12,2	1,5	14,4	51,6	0,09	0,32	0,04	0,14	0,4
HI	10,52	0,38	– 0,2	0,48	– 0,1	0,27	0,09	6,5	39,7	1,4	33,1	4,6	0,15	0,6	0,02	0,19	0,02

products (milk, fleece) visible in the ages of the older animals when culled.

– Axis 3 (20.96%): C (51.5%, coordinate -0.41) opposed to D (28.5%, coordinate 0.27). There is an opposition between the tender meat (domestic consumption of the producers?) and bulk meat (groups of consumers?).

– Axis 4 (8.87%): EF (29.6%, coordinate -0.16) opposed to HI (33.1%, coordinate 0.27). Do these indicate an opposition between culling because of decreased milk yield and general culling (and because of decreased quality of fleece)?

– Axis 5 (6.80%): EF (33.6%, coordinate 0.15) is opposed to G (51.6%; coordinate -0.24). Do these indicate confirmation of the opposition of milk B and culling because of decreased quality of fleece?

Theoretically, the interpretations of archaeological profiles, from observations of modern herding, could have been strongly distorted by subjectivity. The statistical study shows clearly that the differences seen in these profiles are real.

The two last axes could be the result of a certain opposition between the herds for milk surplus and those for fleece. However, axis 3 seems to be central, as it appears to be a signature, easy to read, distinguishing for the most part the groups of consumers and the groups of producers (see also chi-square tests). Nevertheless, this interpretation should be nuanced, because although meat B is clearly related to the selection of animals having still tender meat but also a maximal weight[4], it still remains that the really tender meat comes from the youngest animals. Obviously the context of the habitat is very important for the interpretation, without being totally exclusive. Indeed, in a little village or hamlet, the significance of the culling will not be the same as for material from the excavation of an urban popular quarter or a residential quarter.

The culling of milk lambs (class A) is always difficult to interpret: although in Provence it is often related to a surplus production of milk, this is not necessarily the case in the Near East, as the correspondence analysis shows. In any case, even if the objective is the meat of milk lambs, the milk of nursing ewes would not have been neglected and a joint exploitation of the two products could be envisaged. This is probably the case for Early Bronze 4 at Rawda where this type of culling was associated with an exploitation which

4. This type of exploitation is practised today in Syria and the herds of this age are usually made up of males.

was more modest in the frequency of meat A (class C) and of milk B. In addition this type A meat could have had a connotation of "prestige meat" related partly to practices of sacrifice[5] and reserved for an elite.

DIACHRONIC ANALYSIS

From a chronological point of view, the results given by the CA are significant (axes F1 and F2). The profiles of the early to late PPNB are on the one hand distributed beneath the horizontal axis and have negative coordinates which implies that the final product (meat) is important; on the other hand they are grouped in two loose bunches, one turned towards C and D, the other towards EF. This bi-partition is not chronological as the levels of the middle PPNB of Aswad and Cafer are closer to EF, which confirms that the economic weight of milk products started with domestication (see Vigne & Helmer 2007). Afterward, these products retain a high food value for the human groups, at least in the periods when the number of profiles is high, the Early Bronze and the PN/FPPNB. In this last period strong percentages of classes related to — culling because of decreased usefulness appear, especially class HI (Tell Seker PN and El Kowm 2 PNA), which indicates a very strong exploitation of fleece. The Halaf/Ubaid and Uruk periods also present this tendency with a high exploitation of ante-mortem products (especially fleece), which seems to be in opposition to the sites where the consumption of meat (mainly meat B) is dominant. Beginning in these periods, the profiles are distributed mainly to the left of the vertical axis. The producers/consumers opposition is very clear here. Finally, in the Early Bronze, this bi-partition is not so obvious. Most of the profiles are distributed beneath axis 2 and are grouped around EF and G, which indicates a clear importance of ante-mortem products. Some sites appear to be more specialized, Rawda with an exploitation turned mainly towards milk (types A and B), Tell Shiukh Fawqani towards fleece.

The statistical analyses (CA and chi-square) were carried out on the number of remains and the profiles, established using the corrected frequencies, were all interpreted following the observations of present-day herding. In theory, this could introduce biases and distort the interpretations but all the analyses show the same general tendencies. The statistical study indicates clearly that the differences observed in these profiles are not distributed randomly. Their interpretations match well with those from the zootechnical data. The two methods complement each other (Fig. 7): thus the exploitation of fleece (class HI and to a lesser extent G), which are difficult to differentiate from the exploitation of type B milk because of the partial superimposition of peaks of the culling of animals because of decreased usefulness, is revealed by the CA. On the other hand, the exploitation of meat A and that of meat B, only visible on axis 3 in the CA, is easily seen in the profiles.

To simplify the interpretations we conducted an analysis of profiles re-classed according to diachrony, and according to the zootechnical data, by assigning a degree of certainty to them (Helmer & Vigne 2004) (Fig. 8).

– Type A meat (class C) seems to be the norm in the middle PPNB, the meat of type B appears in the late PPNB, more exactly in the latest part. The example of the site of Maghzaliya shows that the passage from one economy to another can be gradual (Fig. 9).

– Type B milk is exploited beginning in the early PPNB and represents the norm. However, it does not become dominant until the last part of the late PPNB at Maghzaliya 12/14 and Ras Shamra VC 2/3. The exploitation of milk A (Payne's "pure" type), probable in Early Bronze IV at Rawda, does not appear clearly in the Near East so far.

– The exploitation of fleece, perceptible only when there is a surplus, does not appear until the beginning of the Pottery Neolithic.

5. Such as the deposits of lambs that had been eaten in the PPNB at El Kowm (Helmer 2000a).

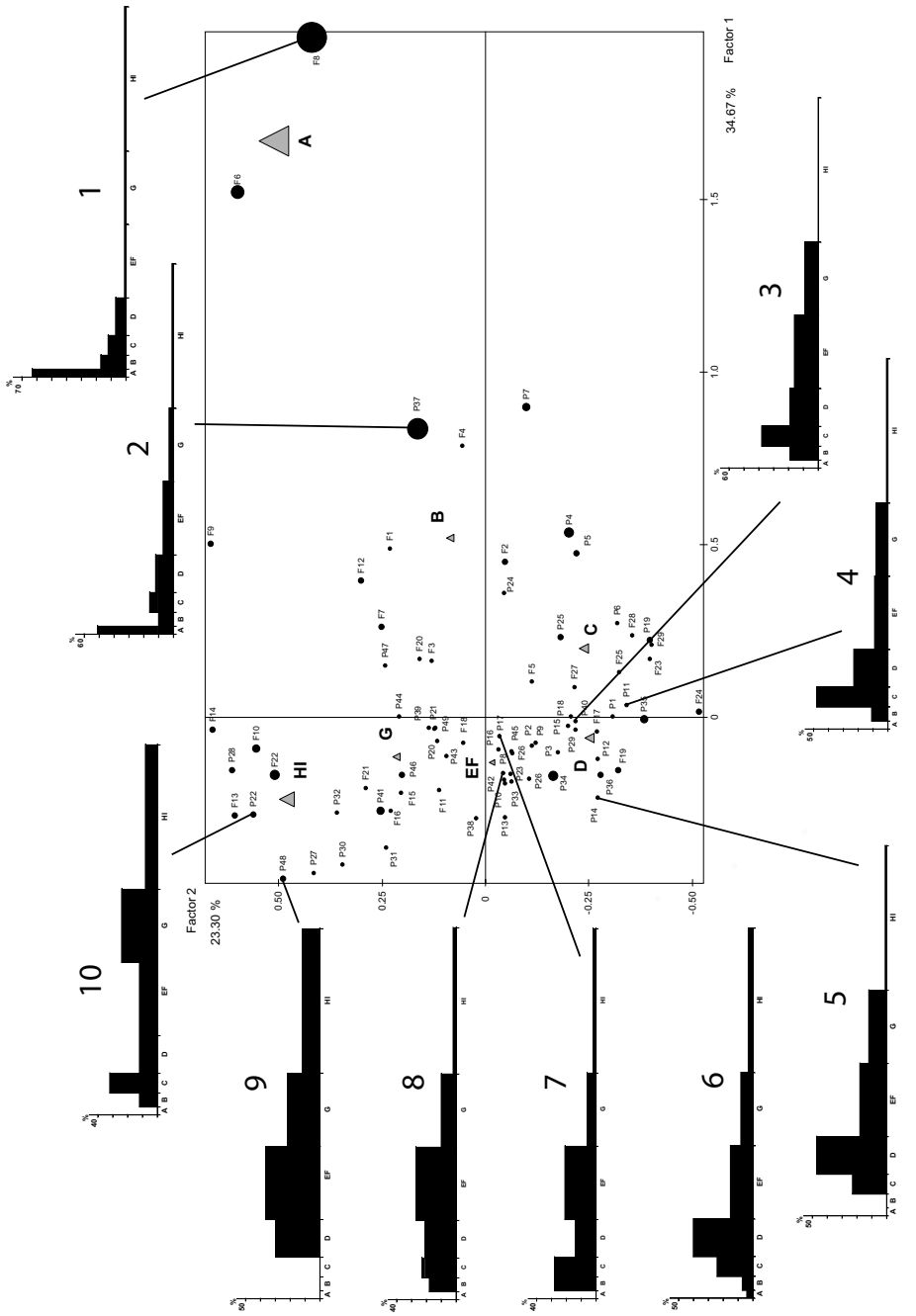

FIG. 7. – Combination of some type-profiles with the correspondence analysis.
Milk A: 1 - Combe Obscure couche 5 (South-East of France, Middle Neolitic): Exploitation type Payne (required allotment); 2 - Rawda (Syria, EBA): Milk A, occurrence of meat A and milk B.
Meat A: 3 - Byblos (Lebanon, EBA): Dominant meat A and milk B; 4 - Maghzaliyah levels 6-8 (Iraq, Late PPNB): Meat A and occurrence milk B.
Meat B: 5 - Maghzaliyah levels 15-16 (Iraq, Late PPNB); 6 - Sheikh Hassan (Syria, Middle Uruk). Both profiles show an occurrence of milk B.
Milk B: 7 - Ras Shamra VC2/3 (Syria, Late PPNB): With occurrence of meat A; 8 - Knedig (Syria, EBA): With occurrence of meat B.
Fleece: 9 - Shiukh Fawqani (Syria, EBA): With occurrence of meat B and milk B; 10 - El Kowm 2 (Syria, PN): With occurrence of meat A and milk B?

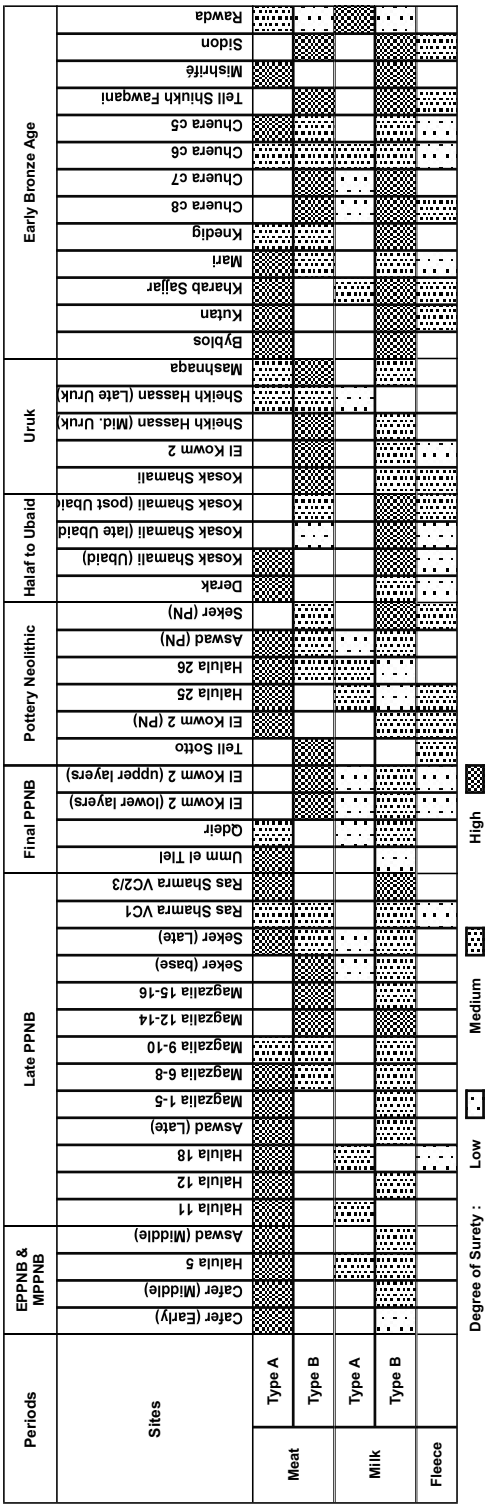

FIG. 8. – Diachronic analysis of the culling profiles according to the sought products.

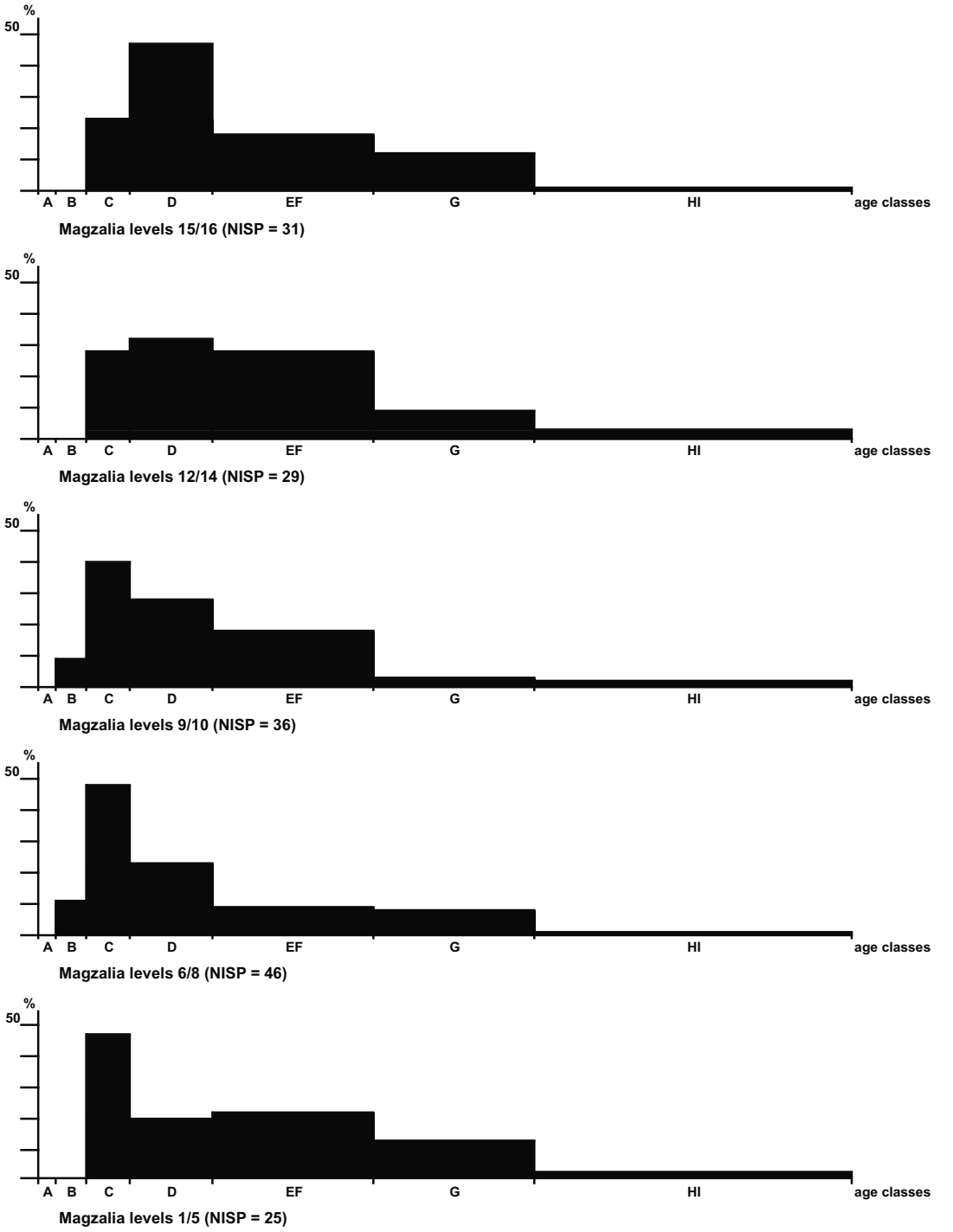

FIG. 9. – Culling profiles of Tell Maghzaliyah (Iraq, Late PPNB). Transition from a village-type economy to an economy of consumers.

– A mixed exploitation of milk ewes (type B milk) and meat either of type A or type B is apparent in the Early Bronze (the two dominant products in the majority of cases). This joint exploitation is quite characteristic of this period, but does not appear so clearly in the preceding periods. It is probably the result of selection by the herders for supplying consumers and could be an indication of an economy of complex societies.

CONCLUSIONS

The examination of an appreciably large number of culling profiles and the comparative study of the chrono-cultural sequences has enabled documentation of the general history of the exploitation of small ruminants in the Near East. Thanks to a refined analysis of the typology of the profiles, it is possible to propose functional interpretations. In spite of the fact that the two species, sheep and goat, played different but probably complementary roles in the technical systems of meat and milk, certain overall culling profiles provide unambiguous evidence for the exploitation of milk, indicated in middle PPNB levels and in the single early PPNB profile, that is at the beginning of animal domestication. Moreover, from the final PPNB, the diversity which appears in the types of exploitation suggests a surplus production and implies very structured systems for the management of animal resources. The exploitation of fleece, probably of sheep, seems to have been later, as the first indications are not observed before the Pottery Neolithic. In the Early Bronze Age, the management of herds, even if it is advisable to refine the analysis afterward according to the sites, in this context of distinct settlement patterns (villages and towns) and thus economic systems, suggests an exploitation of milk ewes in conjunction with an optimised production of meat.

The progressive structuring of the economy indicated in the preceding chapter is clear if we look at the coordinates of the sites according to F2 (Fig. 10). There is a division into three groups: E/MPPNB to LPPNB, PN/LPPNB to Uruk, and finally EBA. The first group is based on the exploitation of meat (A and B) and milk, the second is characterised by an opposition between sites with high exploitation of meat (especially B) and sites with high exploitation of milk and fleece; finally the third is almost entirely recentred on the ante-mortem products. This development goes together with the increased complexity of the societies. It is difficult to speak of rupture as the behaviour observed persists from the PPNB to the Early Bronze. We can only affirm that this structuring of the system became set into place from the end of the late PPNB, when a producers/consumers division seems to be one of the factors of a new social organisation.

According to certain examples (El Kowm, Qdeir, Aswad), the complementarity of the exploitation of sheep and goats occurred in the usual sense — sheep were more generally exploited for tender meat and fleece and goats for milk. Of course there can be various combinations, as in the case of the Early Bronze of Mari, for which the separate analysis of sheep and goats shows clearly different exploitation. The goats were exploited for type A milk and tender meat (classes B and C dominant), whereas the sheep were exploited for type B meat, type B milk and fleece (classes D and EF dominant). As a consequence, in order to explore farther this research, it will be very interesting to take also into account the proportions of sheep and goats in each profile (sheep being often dominant in this study).

Finally, the increasing appearance of an exploitation of the milk of domestic ruminants from the earliest phases of the Neolithic confirms that we can no longer speak of milk as a "secondary" product, as proposed and recently demonstrated by one of us and J.-D. Vigne (Helmer & Vigne 2004; Vigne & Helmer 2007). It seems not to be secondary in either the chronology of the development of herding, nor in the importance that it could have had here and there in human food. The question remains to know whether in the end the quest for milk was one of the main factors of interest in the animals which led to domestication.

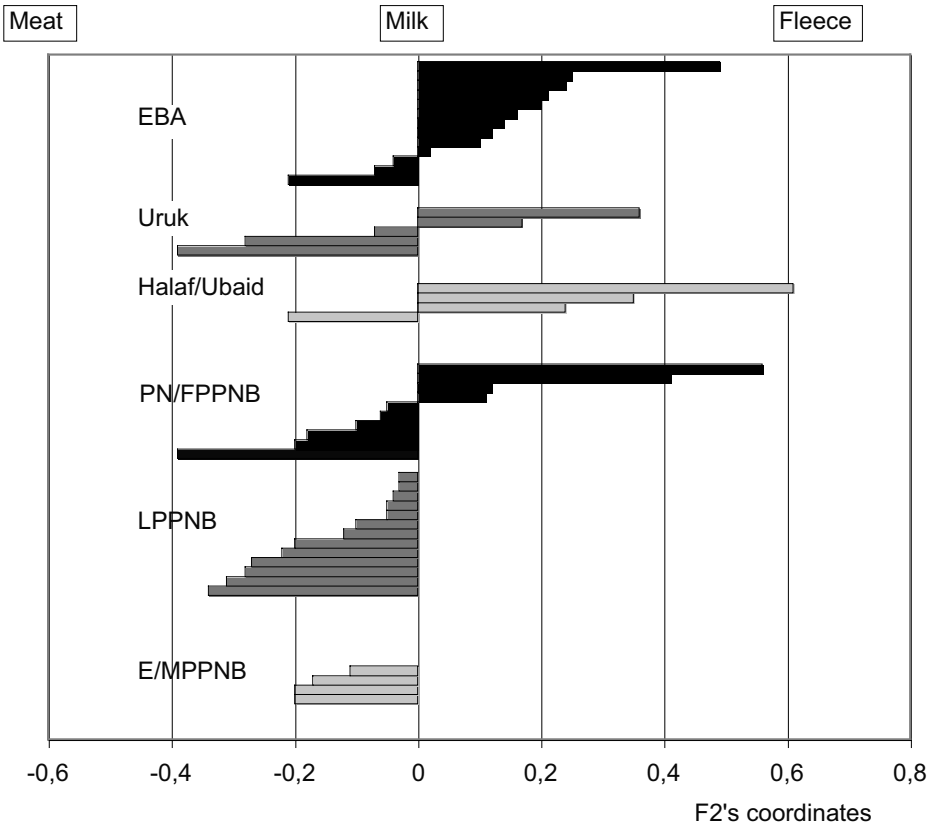

FIG. 10. – Distribution of the coordinate values for axis 2 from the correspondence analysis. The interpretations of the main products are infered from the analysis of the profiles. Three major patterns can be observed: 1 - E/MPPNB and LPPNB: Exploitation of meat and milk A and B; 2 - PN/FPPNB to Uruk: Bipartition between "final product (meat)" sites and "ante-mortem product"

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APPENDIX

Listing of the age profiles established from different archaeological sites of northern Near East and south-eastern France.
The NISP presented in columns A, B, C, D, EF, G and HI are raw data (i.e. not corrected). Nb: codes of the age profiles used in the correspondence analysis.

Near-eastern sites	Nb	A	B	C	D	EF	G	HI	NISP	Period	Reference
Cafer Höyük	P1	0	0	8	4	5	2	2	**21**	EPPNB	Helmer, in press
Cafer Höyük	P2	0	3	43	28	53	38	11	**176**	MPPNB	Helmer, in press
Aswad	P3	0	1	25	21	27	14	9	**97**	MPPNB	Helmer & Gourichon, in p.
Halula 5	P4	9	12	39	30	25	14	4	**133**	MPPNB	Saña Segui, pers. comm.
Halula 11	P5	3	9	24	14	12	8	3	**73**	LPPNB	Saña Segui, pers. comm.
Halula 12	P6	0	4	12	4	8	3	1	**32**	LPPNB	Saña Segui, pers. comm.
Halula 18	P7	3	4	9	5	4	2	1	**28**	LPPNB	Saña Segui, pers. comm.
Seker (base)	P8	1	0	1	13	10	4	4	**33**	LPPNB	Gourichon, unpublished
Aswad	P9	0	1	33	22	25	25	10	**116**	LPPNB	Helmer & Gourichon, in p.
Maghzaliyah 1/5	P10	0	0	5	4	9	5	2	**25**	LPPNB	Helmer, unpublished
Maghzaliyah 6/8	P11	0	2	13	12	10	8	1	**46**	LPPNB	Helmer, unpublished
Maghzaliyah 9/10	P12	0	1	7	10	13	2	3	**36**	LPPNB	Helmer, unpublished
Maghzaliyah 12/14	P13	0	0	3	7	12	4	3	**29**	LPPNB	Helmer, unpublished
Maghzaliyah 15/16	P14	0	0	3	12	9	6	1	**31**	LPPNB	Helmer, unpublished
Seker (Late)	P15	2	1	22	29	31	17	6	**108**	LPPNB	Gourichon, unpublished
Ras Shamra VC1	P16	0	2	4	7	8	9	1	**31**	LPPNB	Helmer, unpublished
Ras Shamra VC2/3	P17	0	4	6	6	18	5	3	**42**	LPPNB	Helmer, unpublished
Qdeir	P18	1	8	42	50,5	71,5	23,5	9	**205,5**	FPPNB	Gourichon 2004
Umm el Tlell	P19	0	4	52	4	28	8	4	**100**	FPPNB	Helmer & Saña 1993
El Kowm 2 (lower levels)	P20	3	4	10	27,5	36	19	13	**112,5**	FPPNB	Gourichon 2004
El Kowm 2 (lower levels)	P21	3	5	6	18	38	2	14	**86**	FPPNB	Gourichon 2004
El Kowm 2 (PN)	P22	0	1	4	3	6	12	8	**34**	PN	Helmer 2000a
Sotto	P23	0	0	2	3	2	5	0	**12**	PN	Helmer, unpublished
Halula 25	P24	3	6	12	14	10	11	3	**59**	PN	Saña Segui, pers. comm.
Halula 26	P25	8	25	48	74	56	22	18	**251**	PN	Saña Segui, pers. comm.
Aswad	P26	0	1	10	13	21	9	5	**59**	PN	Helmer & Gourichon, in p.
Seker (PN)	P27	0	0	0	5	11	7	6	**29**	PN	Gourichon, unpublished
Khirbet Derak	P28	1	1	6	2	10	9	12	**41**	Halaf	Helmer, unpublished
Kosak Shamali (Ubaid)	P29	0	1	3	2	7	0	1	**14**	Ubaid	Gourichon & Helmer 2003
Kosak Shamali (Late Ubaid)	P30	0	0	0	2	9	6	2	**19**	Late Ubaid	Gourichon & Helmer 2003
Kosak Shamali (Post Ubaid)	P31	0	0	1	4	11	7	3	**26**	Post Ubaid	Gourichon & Helmer 2003
Kosak Shamali (Uruk)	P32	0	1	2	5	6	8	5	**27**	Uruk	Gourichon & Helmer 2003
El Kowm 2 (Uruk)	P33	0	7	14	49	36	11	23	**140**	Uruk	Vila 1998
Sheikh Hassan (Mid. Uruk)	P34	4	13	71	233	173	88	62	**644**	Uruk	Vila 1998
Sheikh Hassan (Late Uruk)	P35	2	2	38	63	33	19	9	**166**	Uruk	Vila 1998
Mashnaqa	P36	0	3	23	49	58	21	6	**160**	Uruk	Vila, unpublished
Rawda	P37	22	9	21	30	36	16	7	**141**	EBA	Vila & Al Basso 2005
Sidon	P38	0	1	3	12	19	6	6	**47**	EBA	Vila 2006
Mishrife	P39	0	4	7	3	14	8	4	**40**	EBA	Vila, unpublished
Byblos	P40	0	1	3	3	5	3	0	**15**	EBA	Vila 1998

Near-eastern sites	Nb	A	B	C	D	EF	G	HI	NISP	Period	Reference
Kutan	P41	0	1	33	20	67	33	39	**193**	EBA	Vila 1998
Tell Knedig	P42	0	4	8	14	37	13	4	**80**	EBA	Vila 2005
Tell Chuera c5	P43	4	17	49	70	118	75	42	**375**	EBA	Vila, unpublished
Tell Chuera c6	P44	4	3	11	20	28	22	13	**101**	EBA	Vila, unpublished
Tell Chuera c7	P45	4	3	13	47	55	22	13	**157**	EBA	Vila, unpublished
Tell Chuera c8	P46	5	8	13	52	85	49	33	**245**	EBA	Vila, unpublished
Kharab Sajjar	P47	3	3	13	6	20	5	12	**62**	EBA	Vila, unpublished
Tell Shiukh Fawqani	P48	0	0	0	7	17	10	11	**45**	EBA	Vila 1998
Mari	P49	1	10	18	22	32	12	22	**117**	EBA	Vila, unpublished
French sites	**Nb**	**A**	**B**	**C**	**D**	**EF**	**G**	**HI**	**NISP**	**Period**	**Reference**
Combe Obscure c6	F1	2	5	10	4	4	3	7	**35**	Early Neo.	Helmer 1991a
Baume d'Oulen c6	F2	6	6	9,5	7,5	5,75	2,25	1	**38**	Early Neo.	Helmer *et al.* 2005
Grotte Lombard	F3	1	3	3	4	9	7	1	**28**	Early Neo.	Helmer 1991b
Baume d'Oulen c5	F4	1	2	3	1	3	0	1	**11**	Early Neo.	Helmer *et al.* 2005
Eglise supérieure c7/8	F5	0	3	12	6	6	10	2	**39**	Middle Neo.	Helmer *et al.* 2005
Trou Arnaud	F6	6	2	2	2	5	5	0	**22**	Middle Neo.	Helmer *et al.* 2005
Eglise supérieure c6/3	F7	9	10	34	15	36	41	17	**162**	Middle Neo.	Helmer *et al.* 2005
Combe Obscure c5	F8	12	6	7	8	2	3	1	**39**	Middle Neo.	Helmer 1991a
Baume d'Oulen c3/4	F9	3	2	2	2	6	5	5	**25**	Middle Neo.	Helmer *et al.* 2005
Grotte Murée c7b/10	F10	1	6	14	8	11	18	25	**83**	Middle Neo.	Helmer *et al.* 2005
Eglise	F11	0	7	13	36	42	36	18	**152**	Middle Neo.	Helmer *et al.* 2005
Combe Obscure c2/3	F12	3	7	5	8	10	6	7	**46**	Late Neo.	Helmer 1991a
Baume Saint-Michel	F13	0	2	1	2	8	10	6	**29**	Late Neo.	Hameau *et al.* 1994
Grotte Murée c7/6	F14	1	3	3	3	5	13	8	**36**	Late Neo.	Helmer *et al.* 2005
Villa Giribaldi	F15	0	0	12	10	10	12	12	**56**	Middle Neo.	Helmer, unpublished
Caucade	F16	0	0	3	2	5	1	4	**15**	Middle Neo.	Helmer, unpublished
La Raverre	F17	0	0	4	4	1	1	2	**12**	Middle Neo.	Helmer, unpublished
La Roberte	F18	0	2	9	5	11	7	5	**39**	Middle Neo.	Pahin 1987
La Fare	F19	1	2	8	36	39	8	3	**97**	Late Neo.	Blaise *et al.*, in press
Claparouse	F20	1	4	13	5	8	5	9	**45**	Late Neo.	Helmer *et al.* 2005
La Lauzière	F21	0	2	6	5	13	9	8	**43**	Late Neo.	Helmer *et al.* 2005
La Citadelle	F22	2	6	20	16	29	30	40	**143**	Late Neo.	Helmer *et al.* 2005
Les Calades	F23	1	1	10	13	6	3	2	**36**	Late Neo.	Blaise & Helmer, unp.
Col Saint-Anne	F24	0	2	11	12	17	1	0	**43**	Late Neo.	Loirat 1997
La Balance rue Ferruce	F25	0	3	11	11	4	4	3	**36**	Late Neo.	Helmer *et al.* 2005
Les Moulins	F26	0	11,8	52	36,5	34,5	44,9	47,3	**227**	Middle Neo.	Blaise *et al.*, in press
Barret de Lioure c6	F27	0	2	9	4	8	5	1	**29**	Early Neo.	Helmer *et al.* 2005
Saint-Mitre	F28	0	1	6	2	2	3	0	**14**	Early Neo.	Helmer *et al.* 2005
Fraischamps 3	F29	0	3	5	6	5	2	0	**21**	Early Neo.	Helmer *et al.* 2005

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Cultures et élevages par monts et par vaux : quelle lecture archéologique ?

Agriculture and herding on mountain slopes: the view of archaeologists

édité par Marie-Pierre Ruas et Jean-Denis Vigne

Qu'ils soient situés à haute ou basse altitude, les versants induisent une structuration particulière des ressources naturelles, dans l'espace (étagement) et dans le temps (saisonnalité). Les stratégies d'exploitation préindustrielles de ces gradients d'altitude offrent un éventail particulièrement riche de situations illustrant le jeu complexe entre société, pratiques et environnement. L'articulation entre productions végétales et animales est au cœur des stratégies mises en œuvre. La table-ronde de Penne (Tarn, 6-8 mai 2004), à l'origine de ce numéro 40(1) de la revue *Anthropozoologica*, s'interrogeait sur les apports réels ou potentiels de l'archéologie à cette thématique.

Les neuf articles d'ethnologie, d'archéozoologie, d'archéobotanique ou de géoarchéologie de ce volume, apportent une contribution fertile et originale à des questions archéologiques en plein essor : feux agro-sylvo-pastoraux, rôle des jardins potagers de montagne, pastoralisme du Néolithique ou de l'Âge du Bronze, terrasses de culture, fourrages d'arbre et cultures fourragères ; sans oublier, bien sûr, les questions méthodologiques. En guise de contribution au nécessaire accroissement des référentiels actuels utilisables par l'archéologie, s'y ajoutent deux notes techniques, deux films et trois diaporamas (sur CD) restituant et valorisant les pratiques et les savoir-faire des jardiniers de montagne, des éleveurs de la région du Tarn et des nomades Bakhtiari.

Whether high or low in altitude, mountain slopes and hillsides entail a particular structuring of the natural resources, both spatially (terracing) and temporally (seasonality). The strategies of pre-industrial exploitation of these slopes provide a wide range of situations which illustrate the complex interactions between society, human activity and environment. The articulation between plant production and animal production is at the heart of the strategies used. The round table conference at Penne (Tarn, France, 6-8 May 2004), upon which this volume 40(1) of the journal *Anthropozoologica* is based, was concerned with the actual and potential contributions of archaeology to these themes.

The nine articles concerning ethnology, archaeozoology, archaeobotany and geoarchaeology in this volume are a fertile and original contribution to current archaeological questions: agro-sylvo-pastoral fires, the role of vegetable gardens in the mountains, pastoralism in the Neolithic and the Bronze Age, crop terraces, fodder from trees and fodder cultivation; and of course methodological questions are also addressed. As contributions to the necessary increase of current information usable in archaeology are two technical notes, two films and three diaporamas (on CD), which reconstitute and enhance understanding of the practices and knowledge of mountain gardeners, of herders in the Tarn region of southern France and of the Bakhtiari nomads of Iran.

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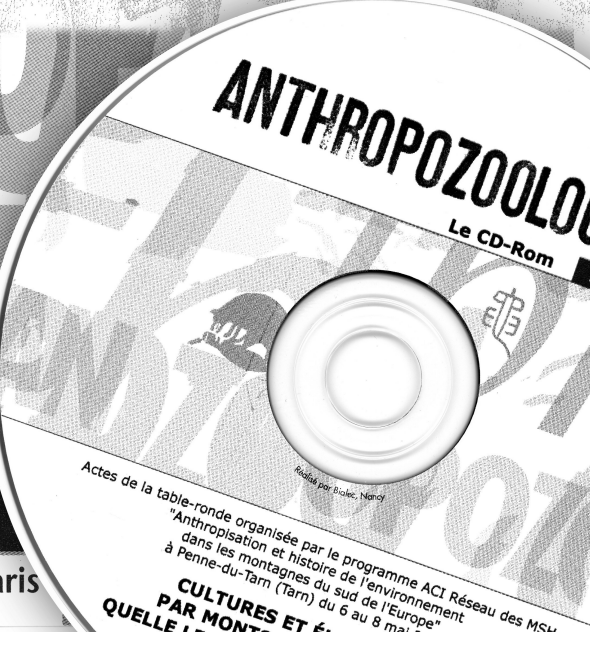

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