A MILLENNIUM OF MIGRATIONS: PROTO-HISTORIC MOBILE PASTORALISM IN HUNGARY

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During the A.D. 1st millennium, numerous waves of mobile pastoral communities of Eurasian origins reached the area of modern-day Hungary in the Carpathian Basin. This paper reviews animal exploitation as reconstructed from animal remains found at the settlements of Sarmatian, Avar/Slavic, and Early ("Conquering") Hungarian populations. According to the historical record, most of these communities turned to sedentism. Archaeological assemblages also manifest evidence of animal keeping, such as sheep and/or goat herding, as well as pig, cattle, and horse. Such functional similarities, however, should not be mistaken for *de facto* cultural continuity among the zooarchaeological data discussed here within the contexts of environment and cultural history. Following a critical assessment of assemblages available for study, analysis of species frequencies shed light on ancient lifeways of pastoral communities in transition. Spatial limitations (both geographical and political), as well as a climate, more temperate than in the Eurasian Steppe Belt, altered animal-keeping practices and encouraged sedentism.

Key words: Central European Migration, environmental determinism, nomadism, pastoral animal keeping

Zoarchaeological data central to this paper originate from settlements spanning much of the A.D. 1st millennium in the Carpathian Basin. At least three major groups of mobile pastoralists (Sarmatians, Avars, and Hungarians) of eastern origins occupied this territory during that time. Following their arrival in the Carpathian Basin, these groups, wedged between major empires in the West and waves of migration from the East, responded with new means of subsistence, of which sedentarization (Barth 1961) was central. Although predatory raids into neighboring territories, best documented in the case of early Hungarians, offered an ephemeral alternative, they had no long-term impact on the forms of animal exploitation that are discussed here.

It has been hypothesized that patterns of meat consumption, sensitive indicators of cultural identity (Bartosiewicz 1997a), characterize mobile pastoralism, at least in a stochastic sense. Therefore, the taxonomic composition of animal remains from archaeological sites mirror the complex interplay between geographical (i.e., environmental) conditions and known historical changes. This hypothesis was tested using descriptive environmental evidence as well as the intersite analysis of available osteological materials. Given practical limitations, however, an in-depth description of animal types ("breeds") was beyond the scope of this study.

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Data used in this study represent the lowest common denominator of the three different research paradigms listed below:

1. Geographic: The Great Hungarian Plain. This region of the far western frontier of the Eurasian steppe zone overlaps with the most northwestern distribution of classic prehistoric lowland *tell* settlements (multilayer settlement mounds in a plains environment),

2. Historiographic: The Great Migration Period. Maurading Hungarian horsemen and other early pastoralists of eastern origins have held ideological importance since the Árpád Dynasty, A.D. 1000.

3. Methodological: Zooarchaeological coarse analyses. Animal bones collected since World War II from A.D. 1st millennium sites in the Carpathian Basin.

In Hungary, poor wood preservation limits the use of dendrochronology and radiocarbon measurements for recent periods are imprecise. Consequently, archaeological theory in Hungary has emphasized "typochronology," interpretations of culture change and ethnic relations based on pottery styles. The point made by Ammerman et al. (1978: 123), that "sampling is a ghost which has come to haunt the corridors of archaeology," is thus relevant to most older assemblages discussed here.

Baron de la Brède et de Montesquieu (Charles Louis de Secondat, 1689-1755), in his book *De l'Esprit des Lois* (1973 [1748]), first raised the concept of geographical determinism, an idea fine tuned by 250 years of subsequent research. The Great Migration may be perceived of as the product of disharmony between the

agricultural and pastoral economies, although, since the term "Great Migration Period" left ownership of the means of production undefined, it did not fit the mechanical version of Marxist social theory adopted in post-war Hungarian archaeology (Erdélyi 1970: 92). Therefore, geographical distinctions like the Great Hungarian Plain between Europe and Asia, whether defined by the Ural Mountains or the ancient Thanais (Don) River, are arbitrary since in historic terms Eurasia forms a contiguous land mass (Vásáry 1993:13, map 3). While such underlying factors as climate change and mass population movements in the Eurasian Steppe Belt have been emphasized, in this phenomenon the effects of nature and culture seem hopelessly intertwined.

Conventionally, the Great Migration Period has been limited to the post-Roman/pre-medieval period (A.D. 5th-9th centuries) in the Carpathian Basin. In fact, the history of the entire A.D. 1st millennium was influenced by mobile pastoralists of Eurasian origins. Here the Great Migration Period is a blanket term for the first millennium. Earlier Scythian influence (6th-5th centuries B.C.), relevant in principle, was not evaluated owing to the absence of major animal bone assemblages from settlement contexts.

The term *nomad* was first used by Herodotus to describe Scythians, who were "not cultivators, but pastoralists" (Tökei 1983: 11). This paper discusses nomads as mobile pastoralists exploiting extensive areas without permanent habitation. In spite of their respective cultural continuity, most pastoral peoples discussed in this paper had undergone centuries of cultural development before they "spilled" over the Carpathian Mountains. Occupying the Carpathian Basin, however, seems to have introduced an element of irreversibility in the mobility of all these free ranging peoples.

After the pacification or extinction of "true" nomads in the Carpathian Basin, sources from the Middle Ages onwards have romanticized the military and political component that gave mobile pastoralists their strength (Lindner 1982: 691). Until the nineteenth century, Werbőczy's 1517 laws provided the hegemonic historical paradigm in Hungary: glorious descendants of Huns, who had won back Attila's ancient homeland (i.e., the Carpathian Basin), gave rise to the Hungarian aristocracy. Descendants of cowards during this campaign, as well as subservient local peoples, became serfs (Fodor 1997: 30). By the late nineteenth century, the *topos* of "Hunnic ancestry" had lost social content, and, with the emergence of public education, this medieval myth became an indelible part of historical consciousness. After the 1990 political opening of Eastern Europe, semi-official Hungarian ideology resuscitated this chauvinistic myth, a regrettable rebound from communist dogma.

MATERIALS AND METHODS

Problems with the material available for study include:

1. Selective representation (cemeteries vs. settlements) at various types of sites,
2. Differential preservation (i.e., taphonomic loss) at poorly defined, single-layer pastoral settlements,
3. Partial recovery without fine recovery at many such sites in Hungary.

Without an understanding of these problems, the information synthesized in this review cannot be fully appreciated. Inferences concerning animal exploitation can be made only after a step-by-step assessment of results from related disciplines. This study is based on animal remains in 82 settlement assemblages (see Appendix tables) used to review both general trends and specific features.

Research History

By the mid-nineteenth century, human river modifications as well as road and railway construction had exposed numerous archaeological sites in Hungary (Kósa 1985), and by the late 1860s there were archaeological societies established nationwide (Fodor 1997: 30). Archaeology, almost inseparable from studies of Hungarian ethnogenesis, focused on spectacular Great Migration Period grave goods, weapons, and jewelry to the neglect of pottery finds (e.g., Párducz 1931). Of the animal remains, horse skulls attracted attention, as these high-status animals were often found in Avar and Early Hungarian burials (Besskó 1906; Kubinyi 1859). As late as 1967, the report of an Avar settlement (Bóna 1971), the first found in Hungary, created a nationwide sensation as has a more recently published "classical" Migration Period, Hunnic Age animal bone assemblage from the A.D. 5th century (Vörös 1999).

Primary historical accounts by sedentary chroniclers usually present a negative attitude about nomads, whose prosperity depended on mobility and even opportunistic raiding (Lindner 1982: 689). Coeval Byzantine, Arabic, and Persian, as well as Western authors, described the conquering Hungarians of the A.D. 10th century as one of many fierce steppe nomads, referred to variably as Scythians, Turks, or Onugrians. Thomas of Spalato's 13th-century *Historia Pontificum Salonitanorum atque Spalatensium,* which documented Mongol invasions of Hungary, clearly illustrates how a typical Western source would combine three characteristic perceptions—invaders, aliens, and instruments of divine chastisement—into an interlocking negative narrative (Sweeney 1982: 170).

Hungarian zooarchaeology also focused on the late Migration Period. The first monograph treated the

osteology of camel and horse in the historical context of "Hungarian emigration from the East" (Kubinyi 1859). After a century of sometimes romantic, historizing research into ancient domesticates, in the 1950s two important trends emerged in Hungarian science: data-oriented zooarchaeological studies from all types of sites, including settlements, became standard practice (Bökönyi 1974), and academic cooperation with the Soviet Union took some Hungarian scholars to their "ancestral land" in the Eurasian Steppe Belt (Matolcsi 1969, 1982).

Linguistics has helped scholars better understand ancient Hungarian pastoralism. Following the separation from other Finno-Ugric peoples in Asia and prior to integration within Christianity in the Carpathian Basin, Hungarians were exposed to intensive Turkic influence in the Eurasian Steppe (Németh 1930: 298). Consequently, the Hungarian language assimilated hundreds of Bulgar/Turkic loanwords such as *disznó* (pig), *serte* (bristle), *ártány* (castrated pig), and *tyúk* (hen). These are telling examples, since mobile pastoralists do not typically keep either pigs or poultry (Fodor 1997: 40). Such terms suggest that this interaction was not limited to adopting steppe-type pastoral nomadism. Mészöly (1929: 210), on the other hand, pointed out that such terms as *ló* (horse), *másodfü ló* (yearling), *harmadfü ló* (2-year-old), *nyereg* (saddle), *fék* (bridle), and *ostor* (whip) originate from the earlier, Ugric linguistic layer. Ancient Hungarians thus may have been familiar with horse-keeping prior to Turkic contacts in the steppe. Unfortunately, no linguistic research of comparable detail could be carried out on the earlier pastoral groups that vanished along with their languages.

Archaeological Background

Recent intensive studies in settlement history and environmental archaeology have concentrated on a 35 km^2 microregion in the southern portion of the Great Hungarian Plain (Bökönyi 1992; Jankovich et al. 1989), close to the geographic center of the entire Carpathian Basin. The 220 sites (6.3 sites/km^2) in this region often represented several periods (Fig. 1).

Prehistoric (mostly neolithic) occupation in this area is beyond the scope of our study, although Early Iron Age Scythian (6-5th century B.C.) animal bones from a few settlements have been collected, but are not yet available for study. Celts from the west occupied the Great Hungarian Plain during the 3rd century B.C. (Szabó 1971: 79).

Animal exploitation by the groups summarized in Fig. 1 is directly relevant to this study as is the hypothesis that these ratios are also reflected in the 82 animal bone assemblages (collected countrywide) analyzed using a Chi-square test (Table 1). The resulting Chi-square value of 1.465 (df = 2, $p \leq 0.001$) shows no chronological discrepancies between the representation of Migration Period contexts within the 35 km^2 microregion and the set of zoological assemblages available for study. Background variables include homogenizing effects in the lengths of occupation and settlement intensity, evident in the cultural history of the groups that follow.

At the time of colonization, survival among hostile local elements, the search for water and pasture, and a common interest in predation probably maintained a special cohesion among newcomers (Lindner 1982: 699). This cohesion may have dwindled with increasing sedentism and partial merging into local populations.

Sarmatians of Iranian origins first settled in the Great Hungarian Plain around the middle of the A.D. 1st century. During the entire Roman Period (A.D. 1st to 4th centuries in Pannonia), Sarmatians occupied the area east of the Danube River, also inhabited by Germanic tribes of eastern origins. The best investigated central core of the Great Hungarian Plain corresponds to the heartland of Sarmatian territories, wedged for centuries between the Roman Empire, the border of which was the west bank of the Danube, and new, violent waves of migration from the east. The existence of a threat on a frontier forces inhabitants of border zones to decide who they are and what they want, as well as how they propose to obtain it (Lindner 1982: 699). Relations between the Romans and groups east of the Danubian *limes* (Roman frontiers) culminated during the A.D. 170s in the

Table 1. Test of homogeneity of chronological distributions within the microregion area and the zoological assemblages available for study.

Period	Sarmatian (A.D. 1-4th c)	Avar (A.D. 6-9th c)	Early Hungarian (A.D. 10-13th c)	Total
All contexts in microregion	109	62	73	244
Theoretical frequency	109.2	58.3	76.3	
All assemblages with faunal data	37	16	29	82
Theoretical frequency	36.7	19.6	25.7	
Total	146	78	102	326

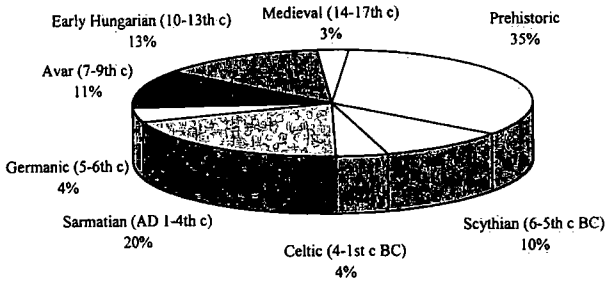

Figure 1. The chronological distribution of 545 contexts at 220 sites in the 35 km^2 sample area in the Great Hungarian Plain.

Marcomannic Wars, after which the Romans organized the province of Sarmatia (Barkóczi 1980: 98). In the early 5th century, the Great Hungarian Plain fell under Hunnic rule and several Late Sarmatian/Hunnic Period settlements were destroyed during fierce attacks. In part due to four centuries of Sarmatian occupation, these settlements are the best represented (n = 37) among the zooarchaeological materials.

The Avars of Central Asia reached the Carpathian Basin in A.D. 568, ending the short-lived rule by competing Germanic tribes. Unlike 5th-6th century Germanic sites, sites from the 7th-9th century Avar Period are better represented by faunal materials. The Avar Khanate united the Carpathian Basin and, under more than two centuries of Avar rule, numerous ethnic groups (including Slavs) coexisted. Excavation of the few settlements since discovered display a heterogeneous picture in terms of both structure and find materials. Avar (n = 11) and, especially, Slavic (n = 5) settlement assemblages are underrepresented in faunal material. The Avar Khanate, weakened by infighting, collapsed under 8th- and 9th-century military pressure from the Frankish Empire to the west.

Conquering Hungarians, following a long migration from the east, were forced out of present-day Ukraine by the Patzinaks in A.D. 895, reaching the Carpathian Basin the same year. Early Hungarian settlements from the first phase, called the Conquest Period (best known for its high-status equestrian burials), are poorly represented zooarchaeologically. Crowning of the first Christian king, St. István, in A.D. 1000 was followed by 300 years of rule by the Árpád Dynasty. This period is represented by 29 assemblages.

Mongol (Tartar) military incursions in 1241-1242 were too short and violent to have a lasting cultural influence. Rather, settlers repopulating Hungary, mostly from German-speaking territories, exerted western cultural influences, including consumption of pork rather than mutton (Bartosiewicz 1995: 49).

NATURAL ENVIRONMENT

To be able to make archaeological inferences relevant to pastoral animal keeping, one must assess how well research is doing or can expect to do along parallel lines of evidence (Ammerman et al. 1978: 130). In classical nomadic economies, the species composition of herds depends on the environment, i.e., the herders' perception of the best means of exploiting that environment (Johnson 1969: 13), but traditional species preferences may sometimes be maintained even in less than ideal conditions (Bartosiewicz and Choyke 1985: 183). This delicate balance between natural and cultural imperatives cannot be understood without familiarity with ecological conditions.

Present-day Hungary is 93,036 km^2, comparable in size to the state of Indiana in the U.S. Its location between latitudes 46° and 48° north, would place it in the same latitude as the North American wheat belt, just south of the Canadian border. However, this relatively low area, located in the center of the Carpathian Basin, has a fundamental difference that also sets Hungary apart from areas of similar latitude in the East European Steppe. Hungary is surrounded by mountains that temper the extremes of a harsh, continental climate. Moreover, its location between 16° and 22° east longitude means that the continental climate is balanced by warm air from the Mediterranean and the mild and humid Atlantic influences. Present day mean temperatures vary from -1°C in January to 21°C in July. Annual precipitation ranges from 500 to 800 mm (maxima May/June and September). In the central area of the country over 2050 hours of sunshine are measured annually. Historically, a small climatic optimum was observed between ca. A.D. 800 and 1200. Although humidity increased around A.D. 1000, it was gradual, only becoming pronounced in the 13th century (Rácz 1993), a period beyond the scope of this study. Elements of natural vegetation from the Fonyód-Bélatelep site in western Hungary also indicate an increasingly mild climate during the late 7th to 9th centuries (Gyulai et al. 1992).

Hungary may be divided into four topographic sections:

1. The Danube River, crossing the country north to south, separates the western, hilly 39% of the territory (100-600 m asl) called Transdanubia.
2. In the northern, low-lying section of Transdanubia, the Danube and its tributaries form the Small Hungarian Plain. The eastern reaches of this section border on the hillier Danube Bend and Buda regions.
3. The Northern Mountains (700-1000 m asl) run north of the Great Hungarian Plain, incorporating the 16% of the northeastern section within this schematic subdivision.

4. The remaining two-thirds of the country, stretching east of the Danube, is divided by the Tisza River and is best known as the Great Hungarian Plain. It occupies ca. 45% of the country's total territory. This large section, of pivotal importance, may be divided into regions termed the Central Tisza Valley (4A), the Northeastern Plain (4B), and Southern Plain (4C) (Vörös 2000: 73-76).

These major sections display a diagonal, chessboard-like arrangement (Fig. 2) in which the continental character of climate increases somewhat in a northwest to southeast direction (Bartosiewicz 1989).

Despite having a more favorable climate than that of the Eurasian Steppe zone, all mobile pastoralist communities under discussion faced severe declines within the Carpathian Basin in the amount of pasture for their horses (Lindner 1981: 11). Topographic barriers, as well as the aforementioned political borders, forced them to develop new ways to survive. Predation or sedentism or both were evident alternatives for mobile pastoralists.

Topography and hydrology have always determined settlement patterns in the Carpathian Basin, since over three-quarters of the country's present surface lie below 200 m asl (Görög 1954: 35). It is in Area 4, the Great Hungarian Plain, comprising 45% of the country's area, where archaeological research has been concentrated for the last 150 years. This major region is formed in part by the Tisza Valley and the Danube-Tisza Interfluve as both rivers turn toward the south. The Danube, often a barrier throughout history, served as the northeastern border of the Roman province of Pannonia.

Until the river regulation works of the 19th century, approximately one-quarter of Hungary's present-day territory was either permanently or seasonally under water. Marshland covered hundreds of square kilometers, especially in the southeast. Human impact began with deforestation in the rivers' catchment areas, which resulted in increased flood levels. Settlement in the Great and Small Hungarian Plains was possible in elevated areas and on the periphery of wetland areas, while the swamps and wet meadows offered continuous sources of food for both humans and livestock.

During the Holocene, this territory turned increasingly fertile. From the viewpoint of settlement history, however, it is important to note that supplies of flowing water declined, e.g., in the microregion area sampled in the Southern Plain, so that water often could be obtained only from wells, groundwater that surfaced in depressions, or by collecting rainwater (Blazovich 1985: 23, 48-49).

Soils on which rich pastures grew often developed from the layers of fertile mud left by episodic inundation in the plain. In the best studied 35 km^2 microregion

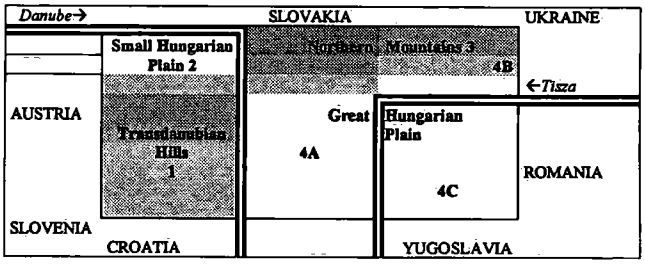

Figure 2. Schematic map showing the gross topographic sections of Hungary.

(altitudes 90 ±15 m asl), infusion loess (riverine sand and windblown silt) define the present-day surface on which meadow chernozem and lime-coated chernozem formed. Elevated surfaces, less exposed to river activity, are covered with salinated soils. On the highest elevations, grassland soil formations occur.

It has been hypothesized that steppe peoples first conquered regions in the Carpathian Basin that most resembled their former habitats. Visually appraising the distribution of Hungarian Conquest Period burials, Bálint (1980) noted that, while graves with indicators of higher social status (jewelry, weapons, and horse remains) occurred mostly in sandy regions, common people were more frequently buried in loam/loess areas. In fact, the very first equestrian burial from the Period of the Hungarian Conquest, found in 1834 by herdsmen, was on a sandy plateau at Benepuszta near the city of Kecskemét, Central Hungary (Fodor 1997: 30). Bálint concluded that Hungarian leaders maintained their mobile pastoral way of life, including burials, in sandy plains, an environment theoretically most similar to their ancestral land in the transitional zone between the Steppe and Forest-Steppe belts in Eurasia. Common people, meanwhile, were interred in loamy/loess floodplains where both animal-keeping and land cultivation were easier. This hypothesis (never before formulated in numerical terms) was tested by reading data points from the map in the original study (Bálint 1980: 43, Fig. 1) and subjecting the data to a non-parametric test of correlation (Table 2).

Table 2. Two-way presentation of the relationship between social status and burial area (39 elite and 129 common burial grounds lay in a variety of non-classified soil types, often in river valleys).

	Burial sites		
Soil type	equestrian (elite)	common people	Total
sand	126	70	196
loam/loess	156	159	315
Total	182	229	411

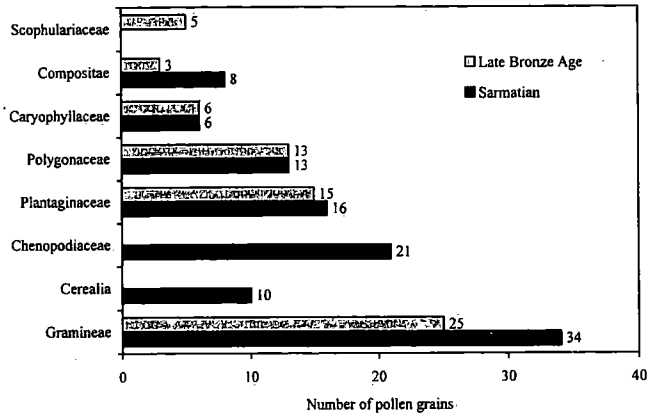

Figure 3. Comparison between palynological samples from Gyoma 133.

While the Chi-square = 13.268 value obtained from these data is indeed indicative of a statistically significant relationship between soil type and mortuary behavior ($p \leq 0.001$), the resulting Phi = 0.180 coefficient of correlation between these two variables is very low. In light of this weak relationship, it seems more likely that life in general was concentrated in the more fertile, extensive areas of loam and loess, which also offered excellent grazing opportunities for mobile pastoralists. Therefore, the following additional possibilities should be considered when fine-tuning the basic interpretation:

1. Mounted warriors must have been very mobile "by trade." They would have fought, died, and been buried in less functionally defined habitats than common agriculturalists.

2. Mortuary rituals for individuals of high social status are usually characterized by greater labor expenditure. It is thus possible that, at least in marginal soil zones, preference was given to sandy areas where deeper, drier graves could be dug.

3. Finally, a subtle chronological difference (intangible if using typological analysis) may lie behind the spatially more dispersed distribution of (the earlier?) burials of the "conquerors" and those of the more sedentary elements of the population.

Phytogeographic similarities between the South Russian Steppe flora and patches of vegetation in the Carpathian Basin have attracted attention for decades (Soó 1940: 1-4; Tuzson 1913). Unfortunately, due to a chronological gap between the archaeological research focus in the two areas, recent valuable data on the Holocene vegetation in southern Russia and the Ukraine (Kremenetskii 1997a,b; Paskevich 1997) by definition predate the Migration Period in the Carpathian Basin.

While the survival of postglacial grassland vegetation in the Great Hungarian Plain, typical of a steppe climate, is widely claimed by geographers (Marosi and Szilárd 1969: 317-319), it is still being debated whether the formation of a forest-steppe environment was prevented by anthropogenic factors during the Neolithic and the Bronze Age. For one thing, marshland forests were gradually destroyed. By the time the first military survey maps were made (1788), endless grassy plains had become characteristic, and the gradual expansion of human settlement can also be appraised. The development of Holocene grassland vegetation thus may have been a secondary phenomenon.

Preliminary palynological data from the site of Gyoma 133 within the 35 km^2 sample area (Medzihradszky 1996: 447-448) are summarized in Fig. 3. Even these small numbers support the difference expected between the Late Bronze Age and Sarmatian Period sample where, in the latter, there is a sudden, massive increase in plants in the goosefoot family (Chenopodiaceae) and cultivated cereals (Gramineae) in the Sarmatian sample, which is also richer in pollen from wild grasses (also Gramineae).

A diachronic increase during the A.D. 1st millennium in pollen counts from Gramineae (including cultivated cereals) and weeds associated with disturbed ground has also been observed at numerous locations in Hungary, including the site of Bátorliget in the northeastern corner of the Great Hungarian Plain (Willis 1997: 196, Fig. 3). High ratios of cereals and plowland weeds in Hungarian Conquest Period pollen samples from Transdanubia correlated with settlement density. The intensification of sedentism was also indicated by the presence of ruderalia (Chenopodietea associations, i.e., weeds resistant to trampling) and birch (*Betula pendula*), indicators of progressive deforestation and the emergence of secondary steppe habitats (Zólyomi 1980).

Plowland cultivation in this steppe-like environment is of interest as an alternative to pasturing. Understanding the diachronic expansion of agricultural lands is important, because it may have both complemented and competed with the mobile pastoral tradition of migrating peoples. Millet (*Panicum miliaceum*), barley (*Hordeum vulgare*) and, to some extent, einkorn wheat (*Triticum monococcum*) were the main crops grown by Sarmatians at the site of Endrőd 170 (Bartosiewicz and Gyulai 1994). Because of its fast growth and short reproductive cycle (Wasylikowa et al. 1991), millet is a cereal typical of highly mobile pastoral communities. It can be cultivated on land where the risk of waterlogging is low during the growing season. Huns as well as Avars grew millet and barley (Gyulai 1997: 117). Wheat, on

the other hand, is a cereal requiring a long growing season (September to July; Shiel 1997: 185), a period that also coincides with flooding and waterlogging in the Carpathian Basin (Figler et al. 1997: 224, Fig. 7). Cereal finds from the Great Hungarian Plain are indicative of increasing sedentism by the 12th to 13th centuries. Common bread wheat (*Triticum aestivum*) and rye (*Secale cereale*) became widespread, while millet seems to have remained in cultivation as a secondary crop (Gyulai 1997: 125). It seems likely that wheat cultivation spread as the catchment areas of rural settlements increased beyond the extensive floodplain habitats, best exploited as seasonal pastures.

Animal Remains

As mentioned before, taphonomic observations have been limited to a few recent excavations. Although 150 years of archaeological study in Hungary have seen a gradual shift from the antiquarian's attitude toward an increasingly scientific approach, this process is still far from complete. In particular, sampling and methods of recovery are still regarded by many as novelties or extraneous intellectual activities. Several Migration Period cultures are best known from burials, which tend to be better preserved, than from non-distinct, often shallow settlement features. Fundamental differences between animal remains from these two types of cultural deposits are summarized in Table 3.

In this study, priority was given to the analysis of less known settlement materials, directly related to everyday life during the periods discussed. Household refuse, often at small rural settlements, offers evidence for mundane meat consumption practices, something never documented in coeval written sources. Mobile lifeways seldom resulted in the spectacular accumulation of well-preserved, thick deposits, and bones lying on the surface were exposed to multi-faceted taphonomic loss (weathering, trampling, redeposition, and the like).

Bones in the food refuse of pastoral peoples show varying degrees of butchering that may be interpreted as pot-sizing. Understandably, barbecuing a complete ox or sheep would result in more intact bones than the preparation of stew in a kettle with a diameter of 20 to 30 cm (Bartosiewicz 1997b: 139). Even today, bones are often smashed to release marrow into the gravy of a traditional sheep stew in Hungary. Sometimes more robust cattle and horse bones also show distinct signs of hacking. In general, however, Migration Period butchering displays poor patterning, probably not having been carried out by specialist butchers, as in Roman or medieval towns (Bartosiewicz 1988a). It is nearly impossible to associate animal remains with individuals or households, so signs of social stratification are also difficult to detect at such settlements.

It is important to note that the chronological/regional representation of the settlement assemblages available for study was not homogeneous. When the regional subdivision is applied, the asymmetric pattern shown in Fig. 4 emerges.

For the aforementioned, purely historical, reasons, the western (Transdanubia) and northern/central (Danube Bend/Buda) parts of the country are largely represented by later sites of the Avar and Early Hungarian periods. The presence of the Roman Empire in these regions prevented the infiltration of eastern pastoralists before the A.D. 5th century. The chronological distribution of mobile pastoralist settlements under discussion here is more even in the eastern two-thirds of the country, since new arrivals first populated the Great Hungarian Plain (Central Tisza Valley and Southern Plains), also referred to as the Barbaricum in Roman times. Important sites from the time of the Hungarian Conquest are located in northeastern Hungary.

Quantitative estimates in zooarchaeology are often biased by the degree of bone fragmentation. Since bone weights and much-debated numbers of individuals have not systematically been published in the literature, most conclusions are based on the number of identifiable bone specimens (NISP) as the most consistently available parameter used in the characterization of the zooarchaeological assemblages under discussion here. Should sufficiently great numbers of bone become available, NISP values in and of themselves will mirror the relative importance of various

Table 3. Taphonomic/interpretive differences between Migraton Period animal bone deposits in Hungary.

	Settlements	Burials
Context	poorly defined provenances	discrete units
Form of skeletal representation	dispersed	articulated
Degree of fragmentation	high	moderate
Chances of recovery	variable	relatively good
Relevance to diet	usually direct	biased by rituals
Relevance to social status	low	high

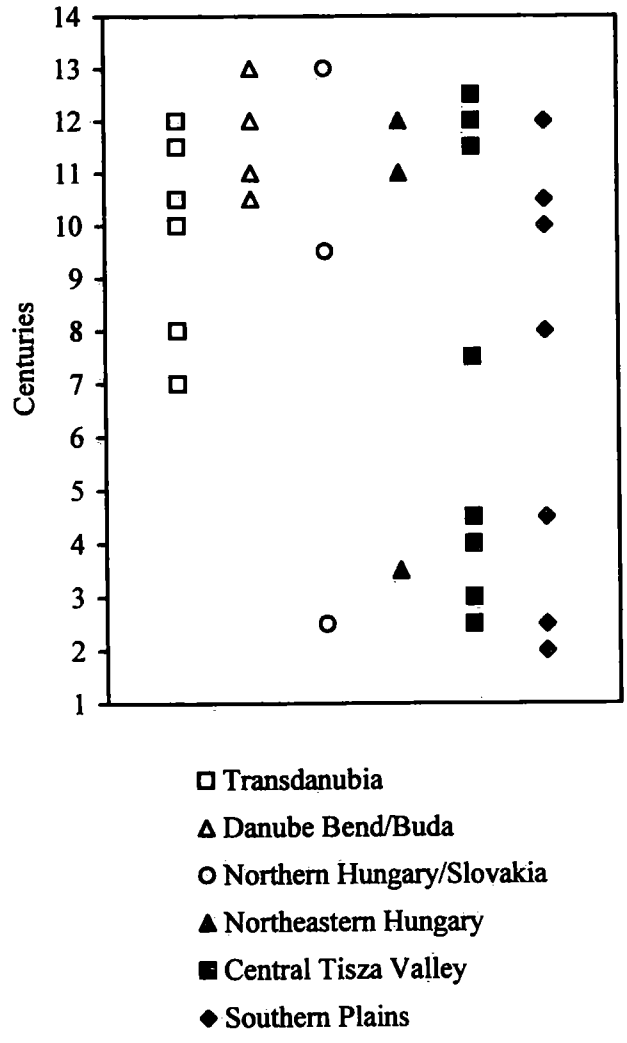

Figure 4. The chronological and regional distribution of dated assemblages.

animal species, especially in the case of domesticates used for their meat.

Because the number of animal species identified, that is, the taxonomic richness, to a great extent is dependent on assemblage size, animal bone assemblages of different sizes are sometimes difficult to compare (Grayson 1984: 137). Infrequently recovered species have a greater statistical probability of occurring in large assemblages. Increasing assemblage size is followed by the discovery of new taxa in a degressive manner. When decimal logarithms of these two variables are plotted against each other, the largely linear trend may be expressed by the regression equations in Table 4.

No relationship could be established for the small pooled samples from Avar and Slavic sites. Slopes of the two better represented periods display a marked degressive increase in species diversity. This is in sharp contrast with the trends observed at urban settlements in both Roman Period Pannonia (b = 0.257, Bartosiewicz 1990-1991: 109) and medieval (11-16th century) towns (b = 0.335, Bartosiewicz 1995: 21), where even small assemblages contained a rich variety of species. In the rural settlements discussed in this study, meat consumption seems to have been characterized by a rather monotonous exploitation of domestic animals. The trends described by these linear regression equations are shown in Fig. 5. Most of the settlement materials available for study fall between NISP values of 100 and 1000, and contain remains from fewer than ten taxa, mostly domesticates.

Even in recent research, the near absence of fish bones in early medieval assemblages has been described as a "striking" (but unexplained) phenomenon, in strong contrast with the abundance of fish mentioned in the written record (Vörös 2000: 105). Unfortunately, poorly preserved bones of most fish and small birds tend to be overlooked at excavations where finds are collected only by hand (Bartosiewicz 1988b). Such finds were recorded so rarely that here their analysis was not even attempted.

We can characterize basic types of animal husbandry by relationships among small ruminants in the Caprinae subfamily, osteologically similar sheep (*Ovis aries*) and goat (*Capra hircus*), and pig (*Sus domesticus*). In marginal environments, small ruminants are often seen as being more advantageous than omnivorous pigs, being more mobile and less dependent on water supplies and high-calorie fodder. Fig. 6 shows the frequency distribution of assemblages by the proportions between the remains (NISP) of small ruminants and pig.

The distribution of sites in Fig. 6 is far from normal because at many sites the ratio between caprine (sheep and/or goat) and pig NISPs is close to equal. None of the Slavic settlements, however, have yielded more bones from caprines than from pigs. Even Avar Period assemblages only seldom fall above the index value of 2, and more extreme cases occur among both Early Hungarian and, especially, Sarmatian Period settlements.

Table 4. Linear regressions between the decimal logarithms of NISP (x) and the number of taxa (y) (some data points stand for several samples).

Period	Correlation r	Intercept a	Slope b	p-level of slope
Sarmatian	0.762	0.344	0.199	0.000
Avar/Slavic	0.133	0.739	0.050	0.714
Early Hungarian	0.712	0.304	0.217	0.000

Advanced Sarmatian sheep husbandry is also illustrated by the presence of robust horn cores from rams (Fig. 7) indicative of a larger, improved phenotype. It is also important to note that the number of identifiable sheep bones is usually 3 to 5 times more than those of goat at most settlements in Hungary (Bartosiewicz 1999a). Aside from apparent similarities, important functional differences include, for sheep, easier herding and wool production and, for goats, greater milk yields and near omnivory. Sheep as grazers have more narrowly defined food preferences; goats are browsers, even bordering on scavengers (Hoch 1979: 633).

In the late 19th century, in the absence of archaeological materials, the possibility of pig-keeping by ancient Hungarians was fiercely debated, chiefly on the basis of linguistic evidence. According to a then current uniformitarian interpretation, pigs represented a sedentary way of life (attributed to conquering Hungarians in their ancient homeland), "culturally superior" to nomadism. On the other hand, neither sedentism nor pig herding fit the carefully cultivated 19th-century romantic image of heroic mounted warriors (Bartosiewicz and Gyöngyössy 2000). Pigs, social animals whose ancestor, wild boar (*Sus scrofa*), was available throughout Eurasia, are present at practically all sites in the Carpathian Basin, including the settlements of mobile pastoralists. Although these animals represented an unimproved form (Fig. 8), they often complemented the role of caprines as a source of meat. Lacking explicit dietary prohibitions, this prolific animal could rapidly gain importance, even if pork was not a classical part of traditional nomadic diets.

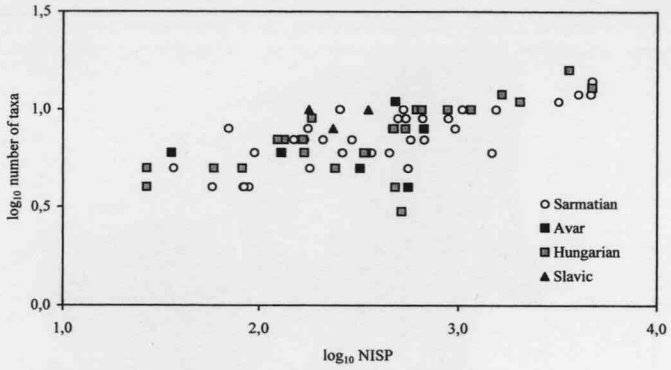

Figure 5. Relationship between assemblage size (x) and taxonomic richness (y).

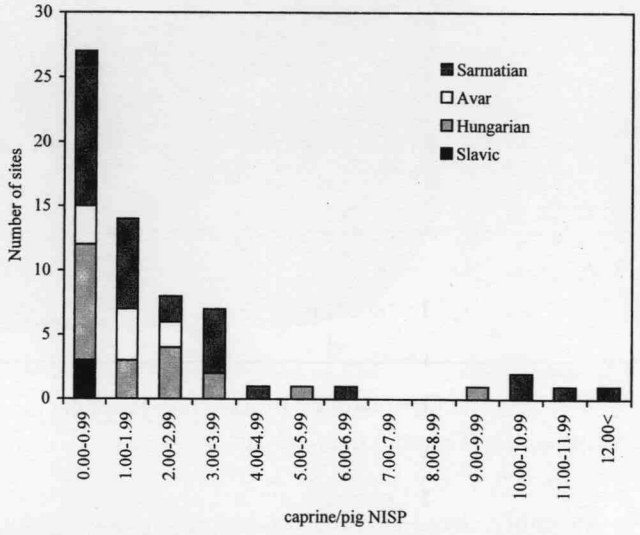

Figure 6. The distribution of settlement assemblages by caprine/pig ratios.

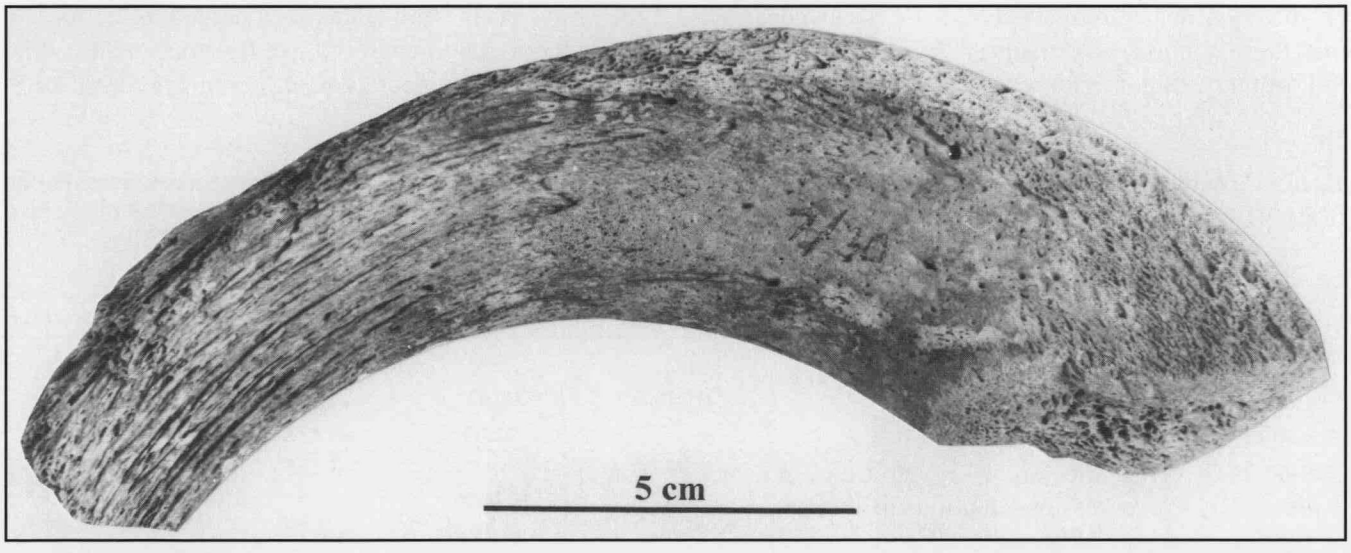

Figure 7. Robust right horn core of a ram (Gyoma 133/2, 2nd c) illustrating the improved phenotypes characteristic of early Sarmatian sheep keeping. The horn was hacked off at its base.

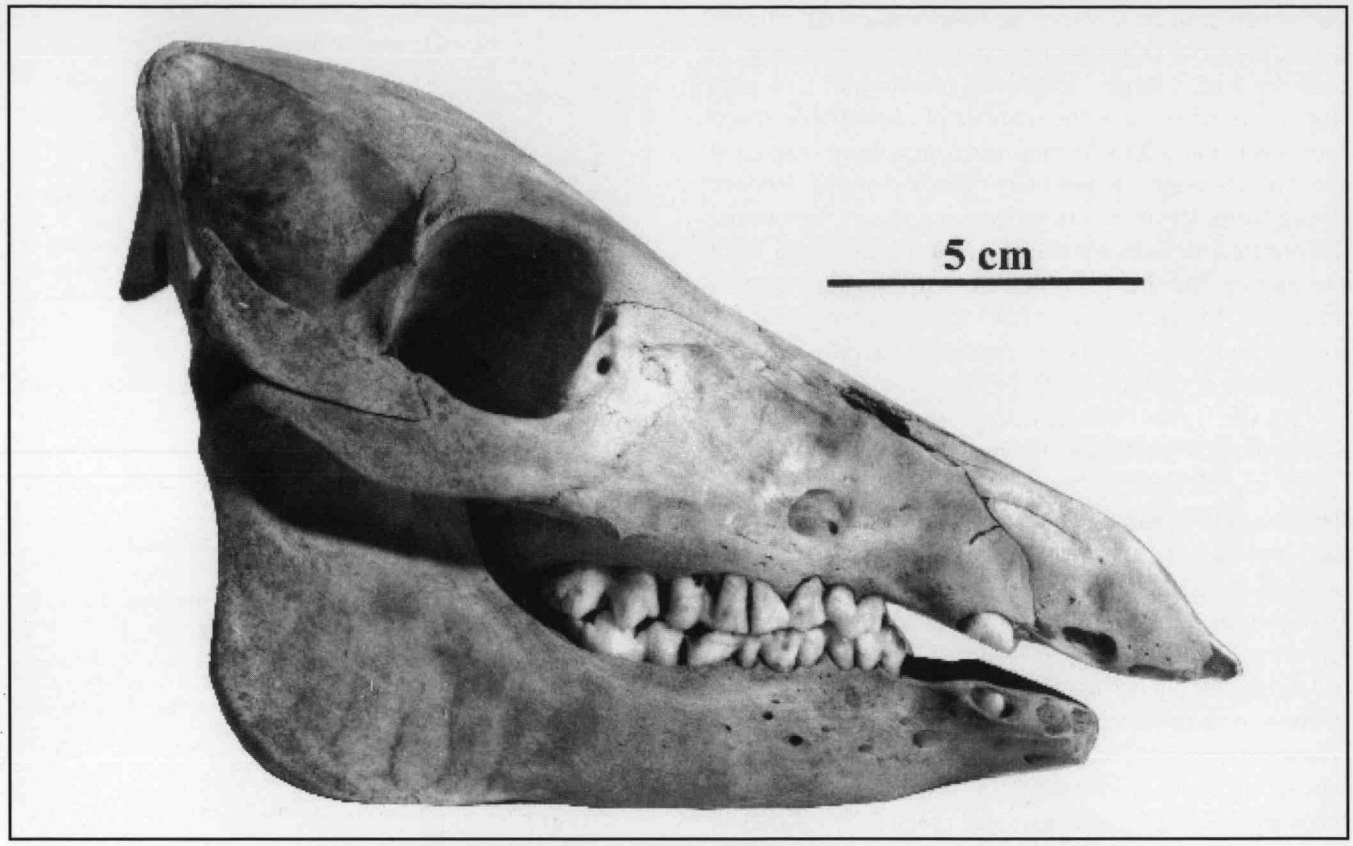

Figure 8. The complete skull of a young pig shows the increasing importance of at least unimproved forms of this species at Sarmatian sites (Gyoma 133/3, 2nd-3rd c).

In reality, sheep-keeping can be a key to developing a centralized livestock management system. As opposed to pigs, these animals also provide a surplus of secondary products (milk, wool) and they are more easily controlled (with very little labor investment) in flocks much larger than those of pigs (Akkermans 1990: 245-249) because, indisputably, pigs are not easily herded. Considering, however, the agility of unimproved forms of pigs, one cannot not rule out the possibility that some pastoral peoples occasionally moved pig stock over relatively long distances. In 19th century Hungary, pigs stolen beyond the Drava river were sometimes herded as far as 130 km to the southern coast of Lake Balaton. In Šumadija, Central Serbia, monocultural pig herding involved long-

Table 5. Spearman rank correlations between culture (Sarmatian/Hungarian), region (plain/hill), and the percent contribution (NISP%) of main domesticates. Significant correlations are shown in bold.

	Coefficients of correlation for 60 sites (roman type)					
Correlation	Region	Culture	Cattle	Caprine	Pig	Horse
Region	1	0.141	0.040	0.102	0.130	**-0.429**
Culture	*0.284*	1	-0.251	-0.163	0.237	0.038
Cattle	*0.764*	*0.054*	1	**-0.381**	**-0.278**	**-0.427**
Caprine	*0.438*	*0.213*	***0.003***	1	**-0.255**	-0.235
Pig	*0.323*	*0.068*	***0.032***	***0.049***	1	0.004
Horse	***0.001***	*0.774*	***0.001***	*0.070*	*0.974*	1
	Significance	levels of probability (p-values) in italic type				

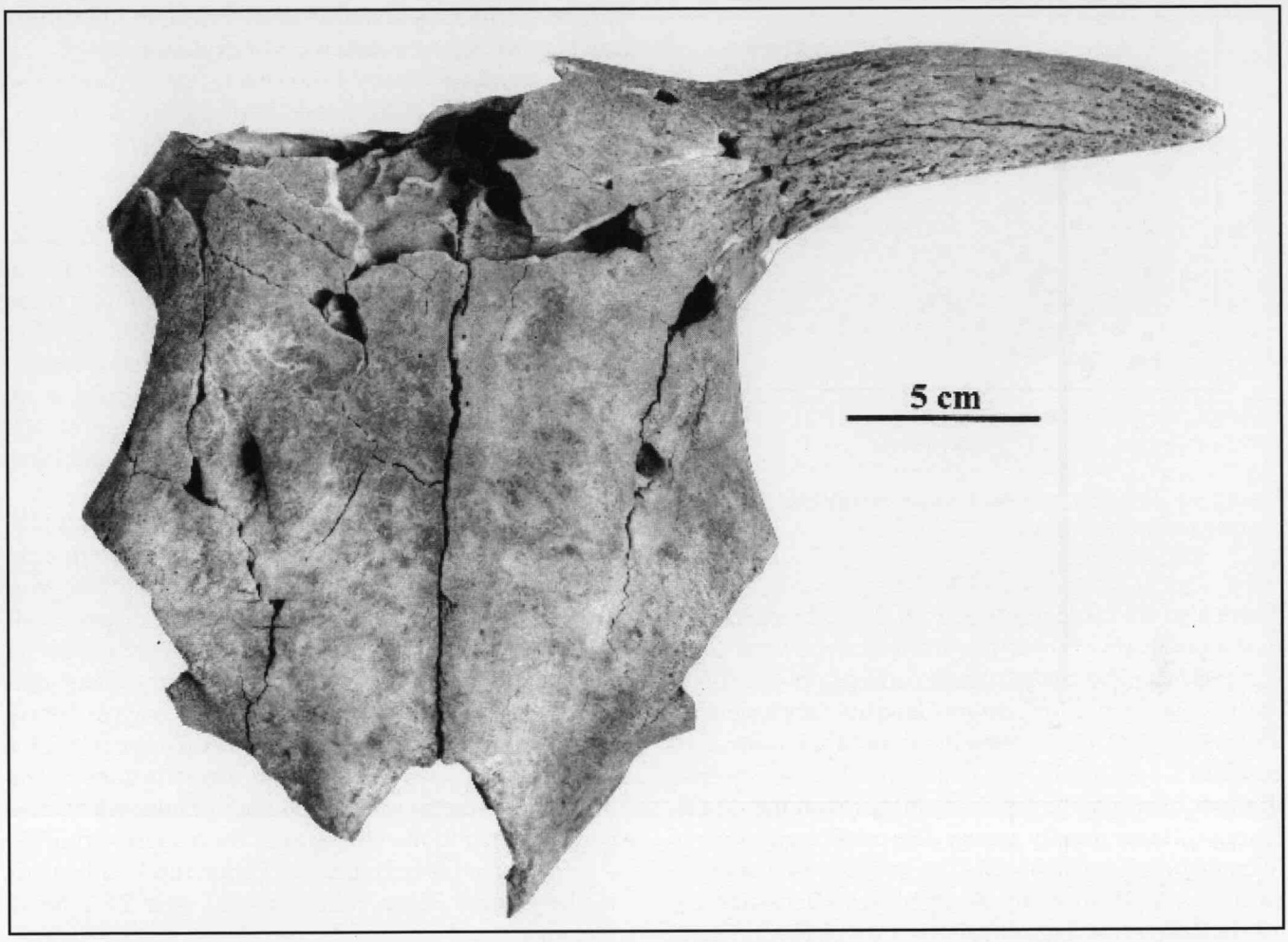

Figure 9. Frontal fragment of an Early Hungarian cow displaying horn conformation typical of the period (Endrõd 170, 10th-11th c). The tip of the horn shows *post mortem* polish of unknown origin.

distance movements in the 19th to early 20th centuries (Halpern 1999). In Mexico, pigs are driven to market over similar distances across rugged, hilly terrain (Diener and Robkin 1978).

Relationships between domesticates of major importance may be expressed in percentages at each site, a useful heuristic device (Bartosiewicz 1993a: 127, figs. 1-3). Potential discrepancies between the distributions of the numerator and denominator, however, may distort parametric calculations when percentages are used (Atchley et al. 1976). Possible relationships between descriptive NISP percentages, therefore, were studied by calculating Spearman's rank correlations on the basis of the two largest chronological subassemblages from the Sarmatian (n = 35; code: 0) and Early Hungarian Periods (n = 24; code: 1). The gross topographic distribution of these sites was also expressed by dichotomic variables (plains: 0, hills: 1).

Correlations between regional position, cultural affiliation, and the relative frequencies of major domesticates in settlement assemblages are summarized in Table 5. As is shown by figures in this table, neither Sarmatian nor Early Hungarian sites are characterized by a particular dominance of bones from any of the studied species. Of the significant coefficients of correlation, the highest value indicates that horse bones occurred more commonly in the food refuse from plains habitats. These two trends need further analysis.

High frequencies of cattle (*Bos taurus*) bone fragments tend to dominate assemblages at the expense of all other domesticates, especially horses (*Equus caballus*) and caprines. One might speculate whether meat production from cattle and horses, unipara animals of comparable sizes, directly complemented each other. In the Hungarian Conquest Period, the contribution of horsemeat did not simply increase at the expense of beef.

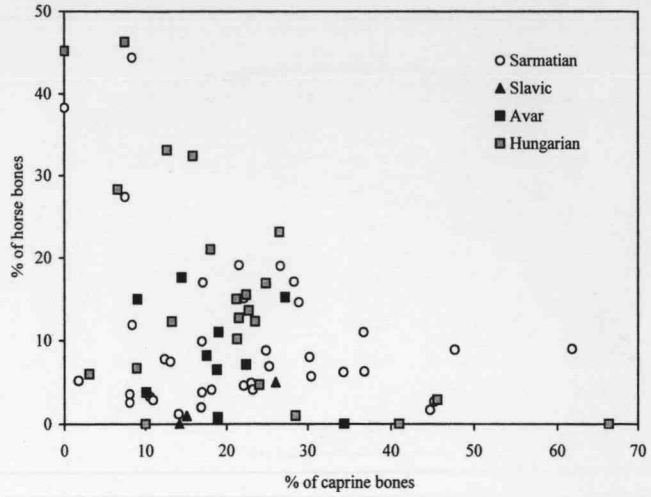

Figure 10. The distribution of major (NISP>100) sites by caprine and horse remains.

There also are cattle remains from small, brachyceros-type animals (Fig. 9) very far from the renowned Grey Hungarian longhorn breed whose earliest horn-core finds are known from 17th-century deposits (Bartosiewicz 1996a: 17; 1997c). A comparison between cattle and caprines is less useful, however, since the meat output of the former may be ten times higher than that of the latter, while the usually greater degree of fragmentation of cattle bones tends to lead to an overrepresentation of cattle by NISP in many assemblages (Bartosiewicz 1991). Differential fragmentation is a less distorting factor when caprines and pigs are compared. The negative correlation established between these two domesticates

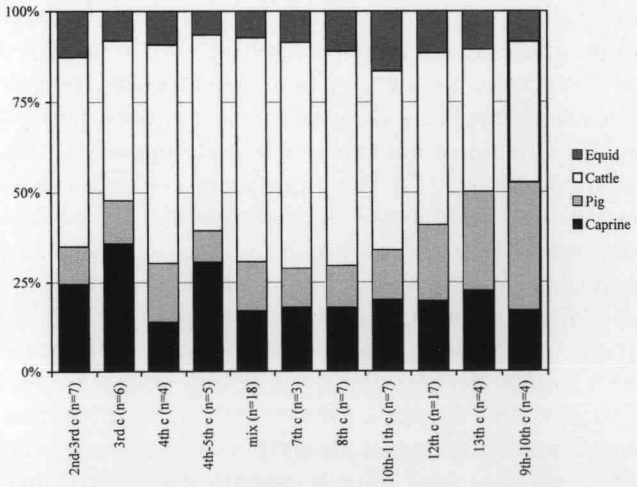

Figure 11. Diachronic changes in the percentual contribution of domestic ungulates.

clearly illustrates the aforementioned functional dichotomy between their ways of exploitation.

It was hypothesized, however, that beyond these general features of Migration Period pastoral cultures, differences had existed at least between the two best represented periods (Sarmatian and Early Hungarian). Disregarding the overall dominance of cattle, percentages of the most typical "nomadic" animals, caprines and horses, are plotted against each other in Fig. 10. Sampling simulations have shown that, when only a few square meters are excavated, reliable estimates for caprines are rare and the thus-obtained percentages are not substantiated (Ammerman et al. 1978: 130). Therefore, an arbitrary minimum of 100 identifiable bones was established; faunal assemblages below this were excluded from this analysis.

The resulting plot (Fig. 10) shows that even this low, artificial limit is of help in visually detecting patterning in the configuration of major sites. While the few Avar Period (and single Slavic) settlements are dispersed all over the graph, percentages of caprines are greater in Sarmatian assemblages, and a few Early Hungarian settlements stand out with very high percentages of horse bone. Three Sarmatian Period sites with more than 15% horse bone in the food refuse were located in the 35 km^2 microregion in the Southern Plain, which also corresponded to the core area of Sarmatian territories. At least three Early Hungarian Period rural settlements in the Central Tisza valley yielded over 25% horse remains.

These characteristic tendencies were translated into chronological trends by plotting the percentage of contributions of all domestic ungulates (NISP values pooled by centuries) against a time scale (Fig. 11). Owing to the eminent role of pigs in 9th- and 10th-century Slavic animal-keeping, this data set was placed at the very end of the chronological sequence to contrast typical sedentism with assemblages of mobile pastoral character.

In addition to the lesser manifestation of the trend shown in Fig. 10 (in which horse and caprine bones were singled out for study), Fig. 11 illustrates the stable contribution of beef to the diet, in spite of the varied patterns in the early representation of mutton at sites in the Great Hungarian Plain and the apparently important dietary contribution of horse in the early phases of Sarmatian occupation (2nd-3rd centuries) and during the time of the Hungarian Conquest (10th-11th centuries). Moreover, there is a consistent increase in pork consumption over time.

The statistical significance of percentages is difficult to appraise. A Chi-square test was used to evaluate chronological heterogeneity within the data

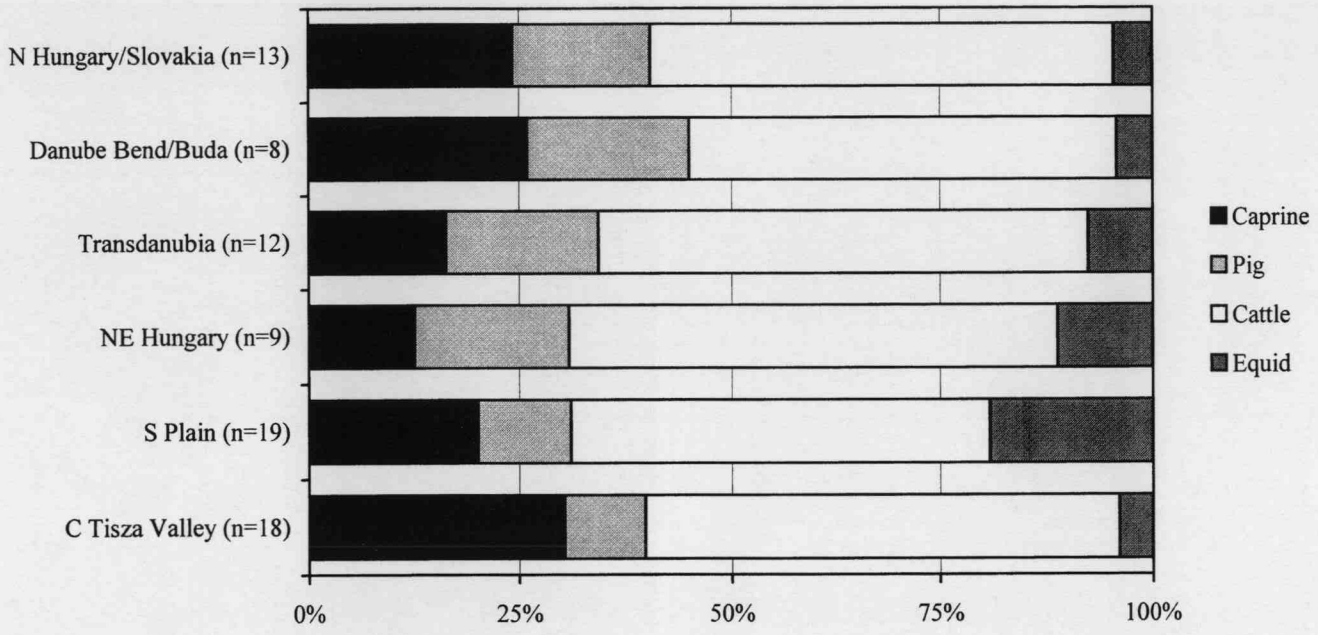

Figure 12. Regional differences in the percentual contribution of domestic ungulates.

set presented in this graph. Pooled NISP values for cattle, caprines, pigs, and equids (including horse remains and the odd bones from asses, mules, or hinnies) showed no statistically significant heterogeneity in this sample. The Chi-square = 4.909 value obtained (df = 30) is smaller than the threshold for the $p \leq 0.05$ level of probability. In spite of the visible trend, therefore, the differences between centuries shown in Fig. 11 may be random.

One factor "diluting" the diachronic trend, expected on an historical basis, may be the fact that the sites under discussion here were located in a great variety of habitats (cf. Fig. 4.). Thus, in spite of the evident differences between the food refuse of various cultures, it must be hypothesized that dietary preferences could be realized only through the properties of the natural environment these communities occupied. The percentual distribution of domestic ungulate NISP values is shown by region in Fig. 12.

Although sites of all periods were pooled in Fig. 12 on a purely geographical basis, fundamental trends emerge. It is also noteworthy that these trends survived into the period of the Árpád Dynasty of the Hungarian Middle Ages (Vörös 2000: 80, Fig. 2). However, the regional heterogeneity observed in the distribution of domestic ungulate remains is likewise non-significant (Chi-square = 3.536, df = 15, $p \leq 0.001$), even if high percentages of caprines in the Danube Bend and the Central Tisza Valley match the medieval trend outlined by Vörös (2000: 80). Remarkably high contributions of horse bone occur in the Great Hungarian Plain, except for the sites of the Central Tisza Valley. Although all these individual differences are valid, the great total variability inherent in the material overwhelms the clear-cut statistically significant differences when overall comparisons are attempted.

Natural environment and cultural tradition evidently interact inseparably, influencing animal husbandry and determining the bone assemblage of a given site at any historical period. While the presence of caprines or pigs may, to some extent, be explained by habitat preferences (open grassland and forests, respectively), the selective presence of horse remains among the food refuse is more characteristic of the settlement's inhabitants than of the natural environment. Pastoral communities were more likely to first occupy the plains, and it was at this early phase of their arrivals that horseflesh seems to have played more of a role in their diets.

Domestic chicken (*Gallus domesticus*) is difficult to compare to other domesticates in quantitative terms because of its small size (less meat output and poorer chances of bone recovery). At Sarmatian Period sites, chicken remains occur only in large assemblages (17.1% of settlements, NISP >500). Over half (57.1%) the Avar/Slavic settlement materials contained bones of chicken, apparently regardless of assemblage size. By the Early Hungarian Period, this bird is present in 62.5% of the samples. Cat (*Felis catus*), not a food animal, shows a

Figure 13. Single (Sarmatian Period, left) and multiple (Avar Period, right) dog burials at the settlement of Gyoma 133/2 and 133/5. In addition to three dog skeletons, the multiple burial also included a sheep's head and the remains of a cat.

somewhat less clearly increasing trend. These two domesticates, chicken and cat, are considered indicators of increasing sedentism.

Remains of domestic ass (*Equus asinus*) and, in one case, mule occur only sporadically in Migration Period assemblages due in part to special carcass disposal patterns for working animals (Bartosiewicz 1993b). During the Sarmatian Period, their presence, like that of cats, may be attributed to Roman cultural influence. The few Early Hungarian specimens were found in northern areas, near Árpád Period administrative centers (Bartosiewicz 1994: 208). According to Vörös (2000: 98), the relative robustness of these bones may relate to the political and cultural influence of Italian and French missionaries on the emerging Hungarian state.

Camels (Camelidae) were the beasts of burden of choice for mobile pastoralists arriving from the East. In fact, Kubinyi (1859) mistakenly attributed a Pleistocene camel find to the conquering Hungarians. Measurements of a ca. A.D. 2nd to 3rd century distal tibia fragment from a dromedary (*Camelus dromedarius*) found at the Sarmatian settlement of Kompolt-Kistér (Hungary) east of the Danubian *limes* of Pannonia province (Bartosiewicz 1999b: 327-328, Fig. 62) fall exactly on the regression line obtained between the distal measurements of dromedary tibiae (Bartosiewicz and Dirjec 2001: Fig. 7). In more robust Bactrian camels (*Camelus bactrianus*) of Central Asian origin, the distal depth of tibia would have been consistently 4 mm greater than in dromedaries ($p \leq 0.001$). Kompolt is located along a major trading route (Bartosiewicz 1999b: 327-328) that crosses the Barbaricum between the towns of Aquincum and Porolissum (this latter having been located beyond the northern *limes* of Dacia province). Although it would be tempting to link this camel find with eastern migrations, the tibia fragment seems to mark yet another point reached by "Roman" dromedaries of Afro/Arabian origin.

Consistent evidence for the consumption of dog (*Canis familiaris*) meat, widely practiced in modern-day Asia, is unknown from Migration Period sites in the Carpathian Basin, although dogs were sacrificed and buried, apparently for ritual purposes, in all the periods under discussion here (Fig. 13; Bartosiewicz 1996b: 373; Juhász 1981; Vörös 1991). Sarmatian dogs, studied in

greater detail, were of medium to large size, fit for herding and guarding animals. They did not show the variability indicative of conscious breeding, as did dogs in some cities in the Roman Province of Pannonia (Bartosiewicz 2000: 186; Bökönyi 1974), but were more robust than non-distinct "pariah" dogs, omnipresent scavengers throughout most periods in Hungarian history (Bartosiewicz 1995: 60).

The "Nomadic Bestiary" is poorly represented in Migration Period settlements in Hungary, only a pale shadow of the image known from the rich decorative art of mobile pastoral cultures in Eurasia (e.g,. Brentjes 1982), best represented by the "Griffin and Meander" style of Avars in the Carpathian Basin. The scant occurrence of wild animal bones among food remains shows that inhabitants of the studied settlements produced most of the meat they consumed. Among food refuse, when roughly less than one-quarter of NISP originates from game, one should not place emphasis on subsistence hunting (Bartosiewicz 1990: 288). Sporadic remains of wild mammals were found only at a fraction of the sites listed in the Appendix and summarized in Table 6.

According to these figures, even at the 57.5% of sites where wild animal bones were found at all, their mean contribution is only 4.0%. A special bias may set this even lower. Although Bökönyi (1974: 38) wrote that Avars, who worked red deer (*Cervus elaphus*) antlers extensively, "had to hunt to ensure this quantity of antlers," the archaeological importance of shed-antler gathering has only been recognized recently (Choyke 1987; MacGregor 1985). In many publications, authors do not distinguish between antler fragments listed (correctly) under "wild animal" remains and those gathered from attached antlers. Rather, antlers are exclusively interpreted (incorrectly) as evidence for hunting. This would be acceptable only in the case of antlers found still attached to the pedicle of the skull of the stag.

There is no reason to doubt, however, that warriors and noblemen occasionally went hunting as a pastime or as a form of military exercise, as is often mentioned in written sources. Nevertheless, aside from cervids (possibly represented mostly by antler), the remains of large game are very rare in the plains during the Sarmatian Period. In the case of Avar Period, Slavic, and Early Hungarian assemblages, the bones of aurochs (*Bos primigenius*), bison (*Bison bonasus*), wild pig (*Sus scrofa*) and brown bear (*Ursus arctos*) occurred in assemblages from or near major administrative centers, such as the royal town of Esztergom and the bailiff's seat in Szabolcs (Vörös 1989, 1990) located near the foothills of mountainous northern regions where bison was served at major feasts as late as the 17th century (Zolnay 1971: 199). These sites, however, do not fit the general profile of rural, pastoral settlements characteristic of the Carpathian Basin.

Hare (*Lepus europaeus*) and wild fowl (including gathered eggs) must have been easily available even for common people. Hare was mostly hunted in the plains where it must have been abundant in the grassland environment. In one case, at the 11th-13th-century Transdanubian settlement of Sióagárd-Tsz major, the high

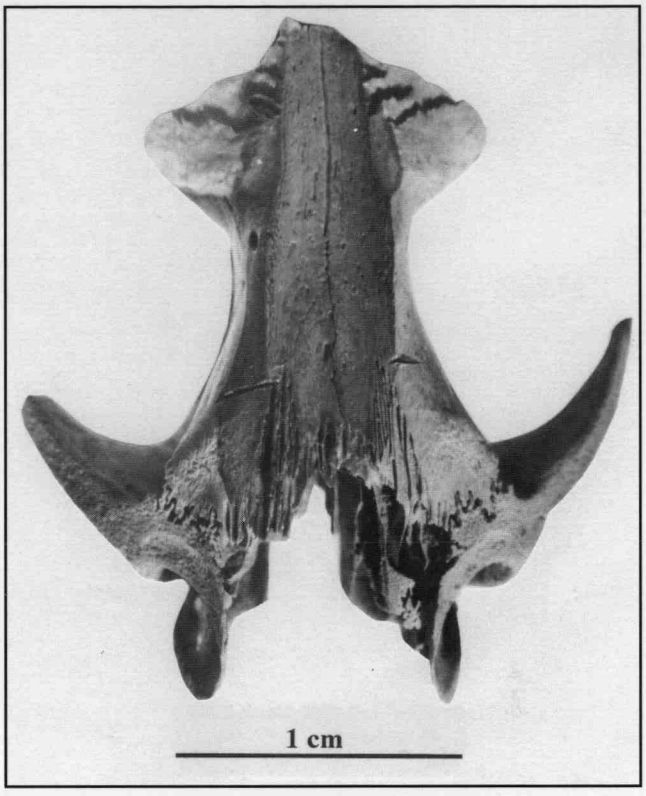

Figure 14. One of two hamster neurocranium fragments (Sióagárd-Tsz major, 11th-13th c) showing fine cutmarks across the frontal bone indicative of skinning.

Table 6. The contribution of wild animal bones to Migration Period assemblages in the Carpathian Basin.

		Sites with wild mammalian remains		
Period	No. sites	n	mean NISP	mean % wild
Sarmatian	35	24	1110	5.1
Avar/Slavic	14	3	360	0.9
Early Hungarian	24	15	1130	2.9
Total	73	42	1064	4.0

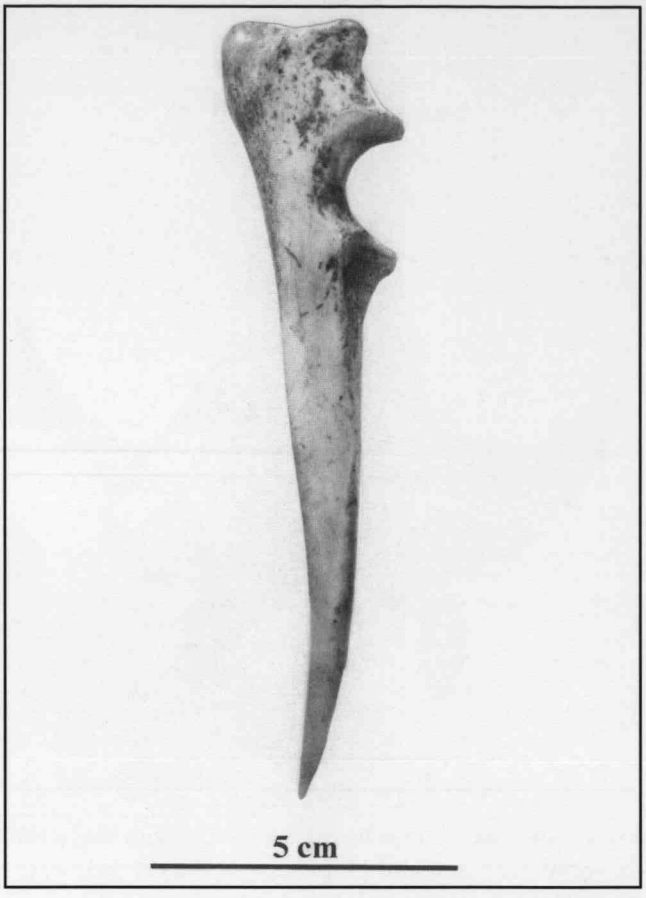

Figure 15. Dog ulna perforator from the Avar Period (Szekszárd-Bogyiszlói út, 7th c).

percentage of "wild" animals is caused by an unusual deposit of hamster (*Cricetus cricetus*) bones. Small rodent bones cannot be systematically recovered without sieving, and even when encountered are routinely considered the remains of intrusive, burrowing animals. At this site, however, skinning marks could be detected on some skulls (Fig. 14). Skinning, unquestionable evidence for the anthropogenic origins of such hamster bones, was first reported from Hungary at the Sarmatian settlement of Kompolt-Kistér (Bartosiewicz 1999b: 328, Pl. XIII).

Bone tool manufacturing, a craft that had relied on food refuse as a source of raw material during Prehistory for the preparation of mundane tools, had lost most of its significance by the Migration Period. Even pastoralists had access to metal (usually iron) equipment, and evidence of iron smelting is available from Sarmatian sites in the Great Hungarian Plain (Vaday 1996). In spite of the importance of caprines in the diet, small ruminant metapodium points, commonly occurring at prehistoric sites all over Europe (Bartosiewicz and Choyke 1997) and in the Mediterranean Basin, are practically unknown from the Migration Period of Hungary. Dog ulna perforators (which take advantage of the bone's natural shape) from the Avar Period sites of 7th-century Szekszárd-Bogyiszlói út (Fig. 15) and Örménykút 54, however, are similar to a less common type of prehistoric artifact.

Among the few, expediently made, bone tools, simple bone skates (and runners) represent a new characteristic type in Sarmatian and Early Hungarian assemblages from the Great Hungarian Plain (Choyke 1996). These implements were made predominantly from the third metacarpus of horse (Fig. 16), an animal apparently kept, therefore slaughtered, in relatively great numbers. Considering the extensive water surfaces and continental winter, skating even may have been a rather important form of winter transport in the plains of the Eurasian Steppe Belt. None of these skates show any sign of fastening (e.g., strap holes), but they could be kept under the foot by pressure. Heavy, evidently hafted, bone points commonly co-occur with skates (Fig. 17). Although there is no direct evidence available to link these two artifact types, one may speculate whether such crude points strengthened the ends of poles used by skaters to propel themselves on the ice (Choyke 1999: 152; MacGregor 1985:175, Fig. 93/a-c).

In comparison with such unsophisticated-looking bone tools, specialized types of Migration Period antler artifacts, such as combs, as well as reinforcement plates and grips from reflex bows, may be considered luxury items. These are distributed over broad regions, probably even beyond the catchment area of localized antler gathering and manufacture (Choyke 1995).

Domesticates as Sources of Animal Protein

Refuse bone from settlements provide primary evidence of meat consumption. Inaccurate dating and quantification make estimations of absolute meat weights (especially based on the zooarchaeological literature) an indoor sport of dubious scholarly merit. Ethnohistorical data also offer only a very loose interpretive framework for the appraisal of quantities. In the recent past, for example, Yürük pastoral communities in Anatolia consumed meat only 3 to 4 times annually (Vékony 1997: 75). At the other extreme, early medieval western ambassadors or missionaries invariably describe battle-size hunts and copious feasts held by sovereigns or chieftains in "nomadic empires" in Asia (Tomka 1997: 88). This is one point, however, at which osteological evidence from the Carpathian Basin is in dramatic contrast with written sources. Could the typically scanty refuse bone assemblages from Migration Period settlements also be a reflection of moderate meat consumption? The answer varies by taxa.

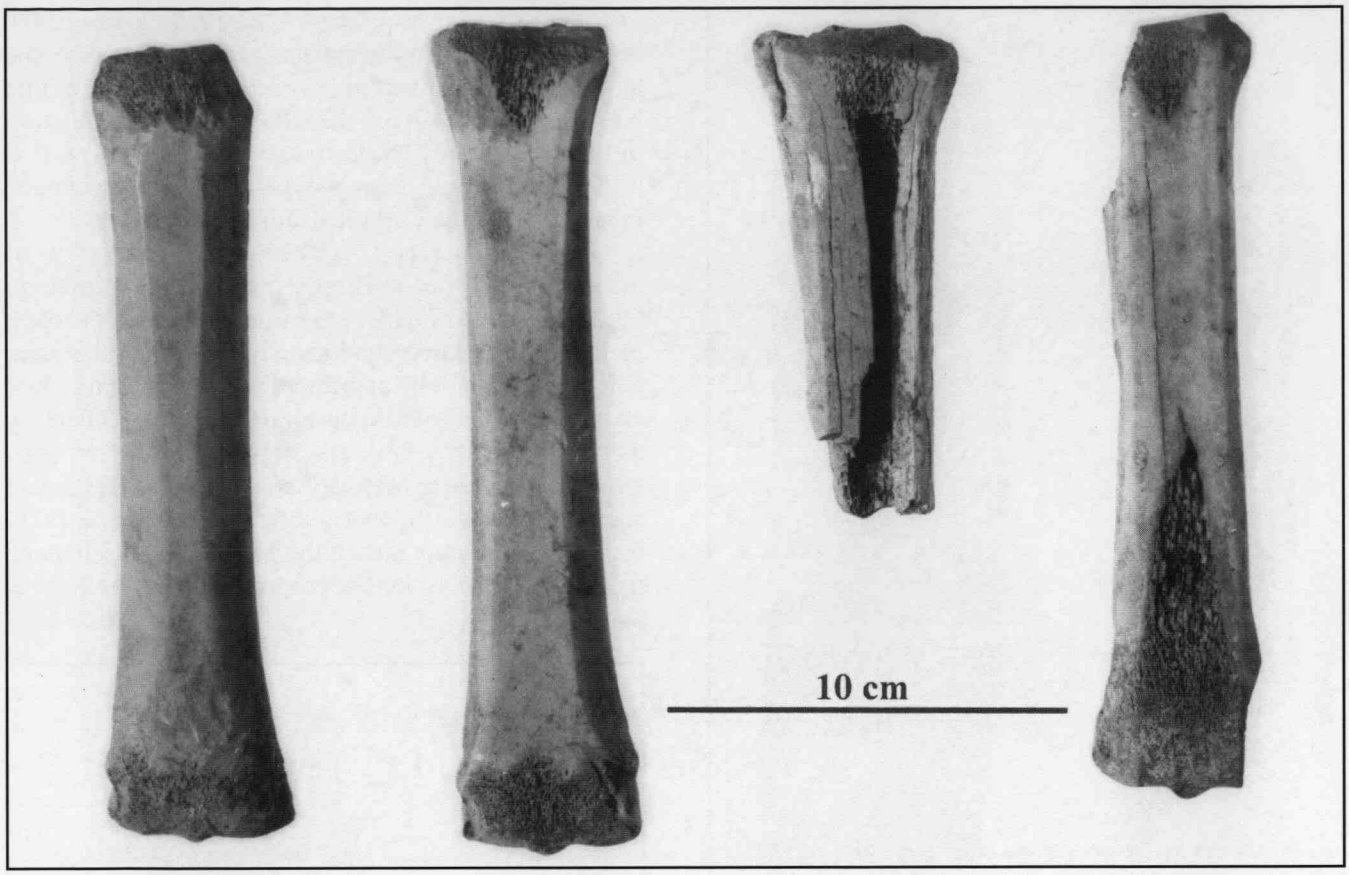

Figure 16. Horse metacarpus skates from the Sarmatian Period (Endrõd 170, 4th-5th c). Use wear on the bones' dorsal/anterior surface (once in contact with ice) increases from left to right.

Caprines are kept not so much for meat, but for secondary products and to be used as a trading currency by present-day pastoralists in the Near East (Akkermans 1990). Such ethnographic observations suggest that, depending on the economic situation and cultural traditions, even the culling of prolific small stock may have been subject to serious consideration. Nevertheless, characteristically high percentages of sheep bones were identified at many sites in the communities studied.

Horses were slaughtered by most steppe peoples only on special occasions or for ritual purposes (Tomka 1997: 89). According to the medieval chronicle *Gesta Hungarorum,* conquering Hungarians celebrating a major military victory killed an *equo pinguissimo* (very fatty horse) on the spot (Anonymous 1977: Cap. 16). High ratios of horse bones in Sarmatian and Early Hungarian deposits may reflect more common horse-meat consumption as well. A heavily hacked *acetabulum pelvis* from the early Sarmatian settlement at Gyoma 133 (Fig. 18) represents the meat-rich hindquarters (Bartosiewicz 1997b; Kretzoi 1968; Uerpmann 1973), also considered extremely choice in numerous historical sources concerning such Asiatic pastoralists as the Kirghiz (Vékony 1997: 82-83).

In 732, Pope Gregory III banned horseflesh in the Christian world. As is usual with food taboos, its consumption was denounced on hygienic grounds, based on a 715 decree by the missionary Winfried Bonifatius (Becker 1994: 31), although the ruling may have been aimed at protecting stocks for military use, thereby helping to keep Islamic expansion at bay. The Christian avoidance of horsemeat is often tackled indirectly, on the basis of horse bones recovered from food refuse at pre-Christian sites (e.g., Jahnkuhn 1967; Lauwerier 1999; Levine 1998; Matolcsi 1982: 252). Negative evidence (possibly resulting from economic rather than ideological considerations), as well as the degree to which the taboo may have been enforced during the Middle Ages, varies and is still open to discussion.

More than two centuries later, the issue of hippophagy symbolized pagan pastoral tradition in the nascent Hungarian Kingdom. Evidence of hacking on the skull

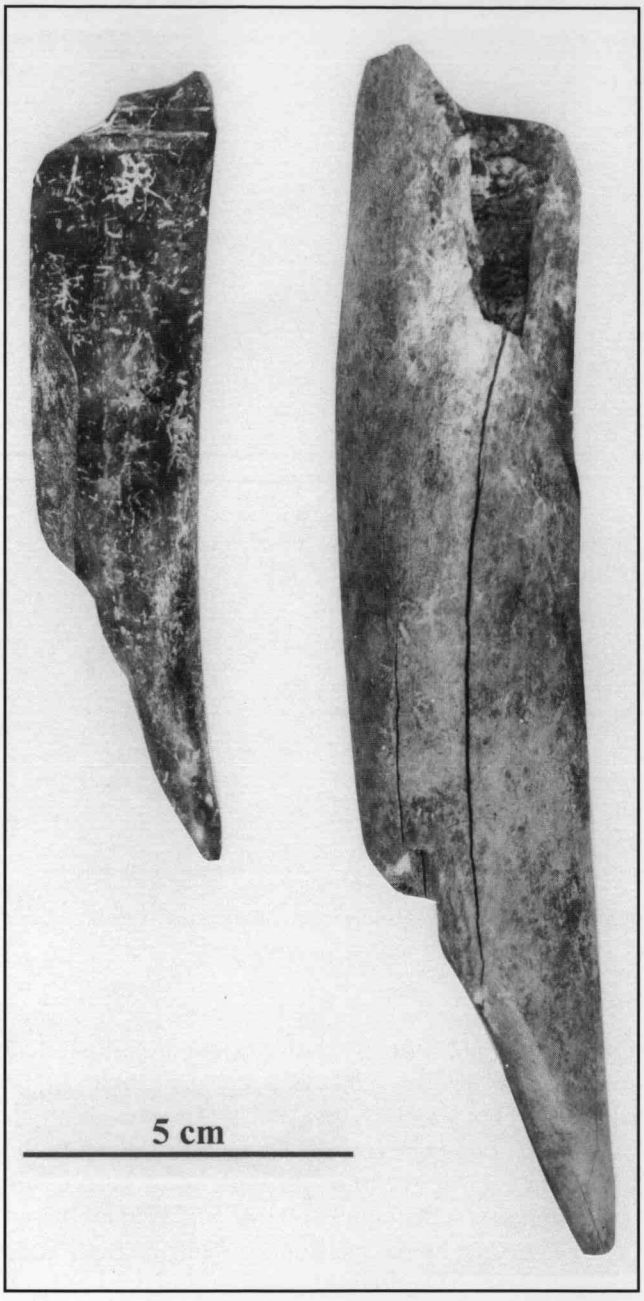

Figure 17. Found in association with skates, crude points, based on the spiral fracture of cattle long bones (Endrõd 170, Sarmatian), may have been used as the tips of sticks to propel the skater. Alternatively, they may be interpreted as tips of digging sticks.

of a decapitated horse found at the 11th- to 13th-century settlement of Tiszalök-Rázom (Bökönyi 1974), may be related to this non-culinary aspect of horse slaughtering (Fig. 19). Zooarchaeological evidence suggests that this custom survived for centuries, e.g., among the last major groups of Eastern pastoralists (Cumans and Iasians) who continued to infiltrate the Carpathian Basin between the 11th and 13th centuries (Takács 1988-1989). Vörös (2000: 96) raised the possibility that horseflesh had not become a food taboo and it was only *ritual* horse sacrifices that had been banned. Given the widespread condemnation of hippophagy in European documents, however, it is difficult to imagine that it would have been encouraged in any form by the Catholic Church in Hungary.

Cattle remains occur most commonly at archaeological sites in Hungary, and also dominate (in terms of NISP, ca. 50%) at most settlements discussed in this study. Beef was undoubtedly an important staple, although it cannot be appraised in terms of being more characteristic of mobile pastoralism than of sedentary animal husbandry. Pork and horse meat may, in part, have substituted for beef at Slavic and Early Hungarian sites. It is noteworthy that among the nomadic Kazakh, cattle (adopted only during the 18th century) remained the livestock of sedentary commoners (Shnirelman et

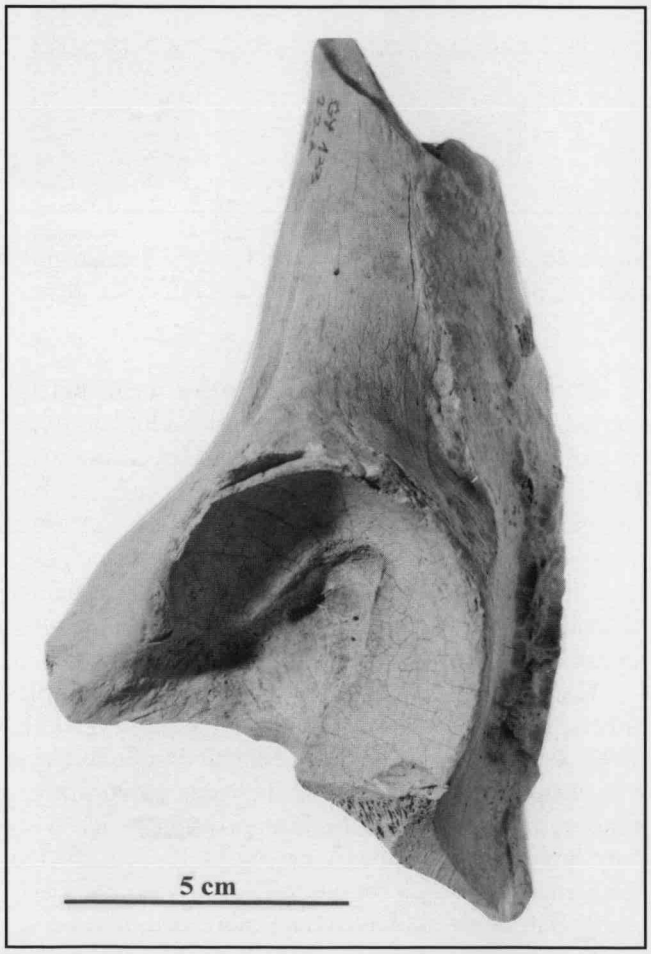

Figure 18. Hip joint (*acetabulum pelvis*) from a Sarmatian horse (Gyoma 133/4) with heavy hacking marks, supporting hypotheses concerning the dietary importance of this meat-rich body region.

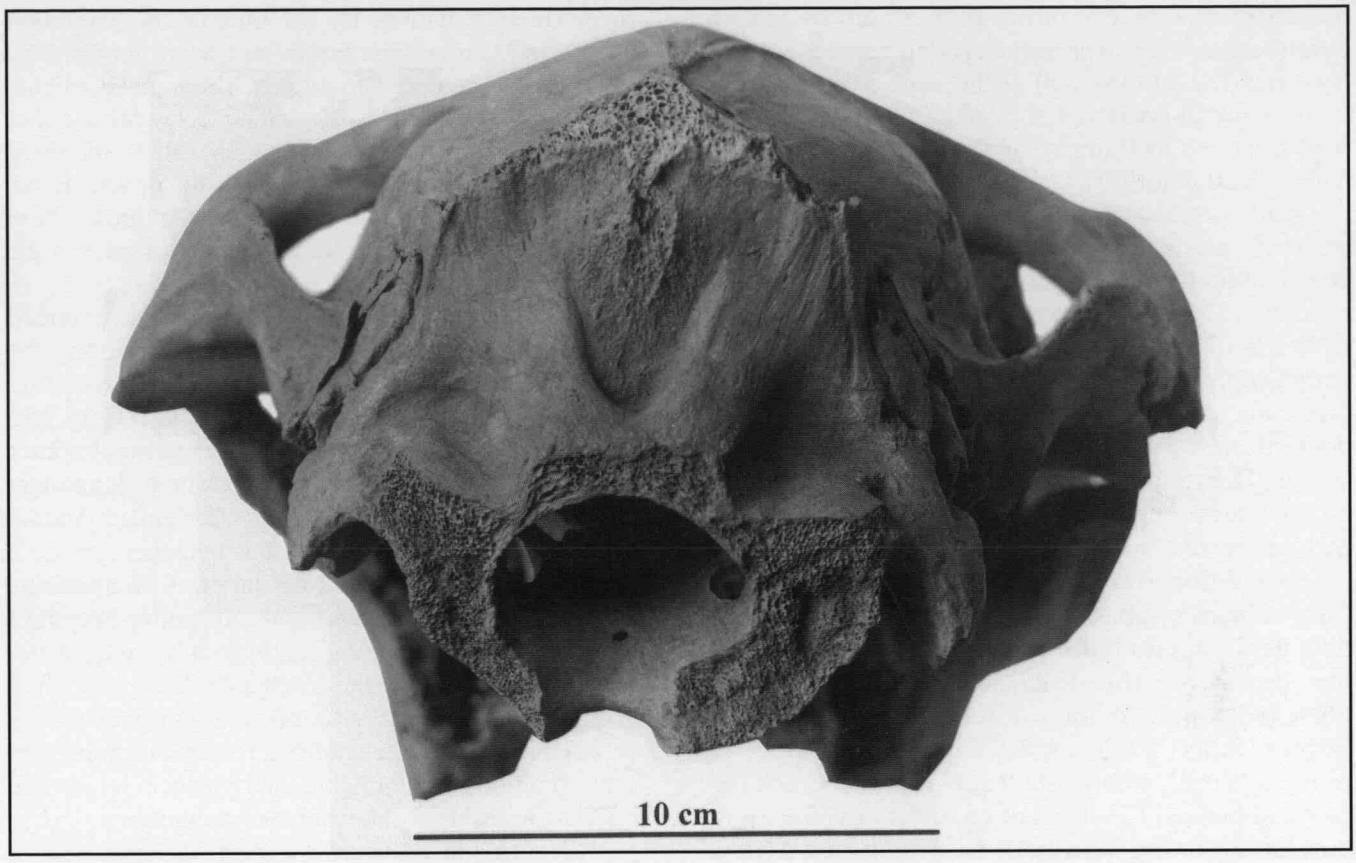

Figure 19. Horse skull with hack marks (Tiszalök - Rázom, 11th-13th c) indicative of decapitation in the occipital area (secondary damage on the *crista saggitalis* was inflicted after recovery).

al. 1995: 135). Although this ethnographic parallel should by no means be projected back to the Migration Period in Hungary, one should probably reconsider the widely hypothesized high value of these animals in light of environmental restrictions or when the high mobility of livestock is a priority.

Pigs, single-purpose meat animals, are the most prolific and atypical of all domestic ungulates, to which they are distantly related. Many ethnographic parallels to Old World mobile pastoralism, however, are available from the Islamic regions of Southwest Asia and North Africa, both with a long tradition of pork avoidance. This historical cultural fact reinforces the valid impression that a mobile way of life in dry steppe regions is indeed less than ideal for pig keeping. Pigs, however, evidently thrived in the temperate, humid environment of the Carpathian Basin. In the apparent absence of an explicit pork prohibition, its exploitation may have spread rapidly among newly settled pastoral peoples, even if the reach and perhaps hectic pace of their previous migrations had not favored pig herding.

Domestic chicken represents a meat resource that can be even more dynamically regenerated than pig. While goat and pig are kept only rarely in modern day Kalmykia, practically all villagers rear poultry (Shishlina 1997: 107). The diachronically increasing contribution of chicken bones to Migration Period bone assemblages in Hungary thus indeed may indicate a tendency toward sedentism.

Presuming that animals were slaughtered infrequently, the "shelf-life" of meat must have been expanded by preservation. The 4th-century Roman officer Amianus Marcellinus (A.D. 330-390) wrote, "The Huns . . . eat meat from all sorts of animals, which they place on their horse's back under their thighs, thereby making the meat tender and warm." It thus seems possible that horsemen traveled with rations of meat. Since this quote is also frequently cited in connection with ancient Hungarians, some of us prefer a more "civilized" alternative (Takács 1997: 105), treating saddlesores with raw meat, as was a custom among 18th-century Kalmyk and Uzbek pastoralists.

Supplies of preserved meat, on the other hand, also may have been kept near or under the saddle, as was

documented at the end of the 14th century by Johann Schiltberger, a German traveler who visited Kirghiz horsemen (Szántó 1986: 6). In the same century, a form of oven- or sun-dried beef, similar to a low-fat pemmican was described in Hungary by the chronicler Giovanni Villani (Miskulin 1905: 72).

Dairy products must have been a renewable source of animal protein for pastoral groups in the Carpathian Basin, although direct archaeological evidence is not available. Most mobile pastoralists regularly milk dams in their herds, including mares. This not only provides a daily supply of animal protein but, due to the different (and thus complementary) lactation cycles of various domesticates, could expand milk supplies for a longer season (Dahl and Hjort 1976). Today, a variety of milk products are the chief staple to Kazakh pastoralists from early spring until late fall (Shnirelman et al. 1995: 143).

In addition to *koumiss*, the best known processed form of mare's milk, the evidence for millet in macrobotanical samples indirectly supports the possibility that Sarmatians ate a meal made of millet mixed with horse milk or blood drained from the veins of the leg (Plinio [Pliny] 1983: 18, 100). Topsell (1607: 331) refers to Virgil, who wrote that Goths also drank the blood of horses. This form of secondary exploitation, best known today from cattle herders in East Africa, was also practiced by Mongolians, who tapped into their camels in similar ways in times of need. The fleeing of Ong Khan is sardonically described by Genghis Khan: "You . . . fed yourself by bleeding your camels" (Ligeti 1962: no. 177).

CONCLUSIONS

Pastoralism in its extreme nomadic form is a highly specialized way of life whose stability depends on mobility among different natural habitats. Pastoral groups that reached the area of present-day Hungary thus faced the following challenges:

1. Territorial limitations. Although plains in the Carpathian Basin represent the westernmost section of the Eurasian parkland steppe, their size is not suitable for long-distance pastoralism, as defined by the amplitude of yearly displacements (Johnson 1969: 12). To many eastern populations, the Carpathian Basis thus represented a dead end in terms of trying to maintain their cycles of annual migrations.

2. Rainfall. Higher precipitation in this region prevented long-distance seasonal herding along the rivers surrounded by broad floodplains. Transhumance-type seasonal grazing of large stock on islands in the Danube floodplain, known from ethnographic sources (Timaffy 1980: 45), would not have suited flocks of sheep.

3. Overpopulation. By the time of the Migration Period, the Carpathian Basin had been changed by centuries of sedentary agriculture. Although no reliable demographic estimates are available concerning either "indigeneous" inhabitants or new arrivals in the three periods studied, immigrations evidently multiplied the risk of intergroup conflict within this limited region. These typically would break out between the two sides of the mobile/sedentary divide.

While eastern groups once may have practiced regular long-distance pastoralism, they arrived in the Carpathian Basin with badly disrupted economic lifeways. Under these pressures, once they had conquered the Carpathian Basin, their pastoral winter occupations of lands gradually became more permanent habitations and the rate of sedentism accelerated. Animal remains from settlements show this tendency.

1. Mobility of livestock became less of a priority, with increased pork consumption and poultry-keeping.

2. Floodplain grazing, indicated by increasing exploitation of pigs and the dominant role of cattle, may be regarded as adaptation to the new environment.

3. Horse bones found among food refuse represent cultural traditions, eating habits, and resources for warfare in Sarmatian and Early Hungarian communities.

4. Hunting as a "warrior's sport," with no role in subsistence, must have been of negligible significance in the procurement of meat in the increasingly agricultural landscape.

In the absence of high-resolution absolute dating, it is difficult to ascertain the rate at which changes in pastoral animal husbandry took place in the Carpathian Basin. According to a modern ethnographic parallel, 19th-century Russian settlers in the Caucasus adopted local transhumance techniques, dictated by topography and climate, in less than two generations. However, they did not give up sedentary cattle breeding, different from indigenous nomadic and semi-nomadic sheep-keeping traditions (Yamskov 1988: 6-7). While this situation is largely the inverse of what has been studied in this paper (sedentary settlers moving into a mountain region where mobile pastoralists operate), it clearly shows the conservative nature of animal husbandry. Similarly, evidence of conservative food habits may appear disproportionately when settlement refuse, direct evidence of meat consumption, is studied in archaeology.

Depending on geopolitical conditions, the general trends discussed in this paper were manifested to varying degrees in animal remains of the three major phases during a millennium of migrations in the Carpathian Basin.

1. Sarmatians, caught in the shadow of the Roman

Empire, often had to shift short-term alliances. This may have strengthened ethnocultural identity, thus encouraging maintenance of eastern pastoral tradition in the core area of the Great Hungarian Plain. Small relative frequencies of bones from pig and poultry illustrate this conservative tendency. On the other hand, the traditional military use of horses enhanced the "predatory threat" posed by this pastoral population (Lees and Bates 1974: 191). Written references to such events as Germanic Quadi learning Sarmatian equestrian military tactics (Alföldi 1942: 179) or the 8,000-man Sarmatian cavalry demanded by the Roman Empire after they had been defeated in A.D. 175 (Barkóczi 1980: 96) indirectly correlate with the high ratio of horse remains in food refuse.

2. Avars, having first established an ethnically heterogeneous empire here that also included the ruins of Roman Pannonia on the right bank of the Danube, eventually united the entire Carpathian Basin. Despite this difference, however, the composition of their food refuse often resembles that of the Sarmatian settlements, slightly tempered by sedentism. Aside from a diachronically increasing contribution of pigs and poultry in grave goods (Bartosiewicz 1986), settlement features such as grain storage pits and semi-subterranean sties (Tomka 1997: 90) seem to reflect the importance of sedentarization. In comparison with the few Slavic settlements, however, the composition of Avar bone assemblages looks definitely more "nomadic."

3. Early Hungarian meat consumption seems the most traditional because of the unusually high average proportion of horse remains, which during the Conquest Period may even rival cattle bones. This phenomenon seems to coincide best with the emphasis on nomadic hippophagy in written sources. Meanwhile pork also contributed more to their diet than was the case for Sarmatians or Avars.

Following the adoption of Christianity after the first Christian king, St. István, was crowned in A.D. 1000, the 300-year period of the Árpád Dynasty was characterized by the consolidation and centralization of political power. Three early royal and monastic centers have yielded evidence of non-subsistence, luxury hunting (Bartosiewicz 1999c: 141), but even at these high status sites, horse bones are rare. Indeed, in Europe by the 11th century the fearsome reputation of marauding Hungarian horsemen had also started fading.

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Appendix Table 1. Remains of domestic animals from Sarmatian Period settlements (NISP)

Century	Region		Cattle	Sheep	Goat	Caprine	Pig	Horse	Ass +Mule	Dog	Cat	Chicken	Goose	Domestic total
2	4c	Gyoma 133/2	2150	174	19	770	510	855	0	162	3	28	1	4669
2	3	Szirmabesenyo 1	548	79	7	0	104	27	0	36	0	8	2	811
3	3	Szirmabesenyo 2	113	23	0	0	24	2	0	0	0	0	0	162
2-3	4c	Biharkeresztes	143	0	0	98	57	70	1(+1)	287	0	0	0	657
2-3	4c	Gyoma 133/3	1583	135	16	531	353	464	0	84	4	38	0	3204
2-3	3	Kompolt 14	211	19	0	130	47	27	4	18	0	0	0	452
2-3	3	Kompolt 15	2201	151	6	1046	324	225	1*	49	3	27	3	4032
2-3	4a	Újhartyán M5	262	21	1	117	22	37	0	81	0	1	1	543
2-4	4a	Kunszállás - Alkotmány TSz.	128	56	0	163	71	41	0	100	0	0	0	559
2-4	4a	Kunszentmiklós - Bak-ér	127	17	0	66	35	42	0	3	0	0	0	290
2-4	4a	Szabadszállás - Józan	125	66	0	51	10	7	0	233	0	0	0	492
3	4a	Törökszentmiklós - Surján	59	0	0	7	8	10	0	0	0	0	0	84
3-4	4b	Apagy - Peckés-rét	87	0	0	55	61	15	0	5	0	0	0	223
3-4	4b	Beregsurány - Barátságkert	259	0	0	29	63	13	0	0	0	0	0	364
3-5	4b	Tiszavasvári - Paptelekhát	81	0	0	10	7	37	0	11	0	0	0	146
4	4a	Tiszafüred - Nagykenderföld	153	0	0	41	25	24	0	14	0	0	0	257
4-5	4c	Endrod 170	388	78	6	239	73	97	0	6	1	0	1	888
4-5	4c	Örménykút 52	603	0	0	159	93	0	0	77	0	28	0	960
4-5	4c	Tázlár	724	0	0	660	66	25	2	0	0	0	0	1477
4-5	4a	Tiszaföldvár - Téglagyár	2602	0	0	1151	474	408	4	108	1	0	0	4744
5	4b	Tiszavasvári - Városföld (H)	337	0	0	120	40	25	4	2	0	1	0	529
?	3	Arka	97	0	0	27	30	6	0	44	0	0	0	204
?	4a	Derecske	50	0	0	0	0	31	1	1	0	0	0	83
?	4c	Doboz	88	0	0	19	35	12	0	26	0	0	0	180
?	4c	Endrod 19	35	2	0	12	9	3	0	1	0	0	0	62
?	3	Garadna - Kastélyzug	86	0	0	31	41	7	0	2	0	0	0	167
?	4c	Gyoma 133/5	321	20	3	58	60	99	0	112	1	1	0	674
?	3	Mezokövesd - Csörsz-árok	24	0	0	55	2	8	0	0	0	0	0	89
?	3	Miskolc - Szirma	752	0	0	80	140	26	0	3	0	0	0	1001
?	4a	Nyáregyháza A2	72	4	0	39	11	26	0	1	1	0	0	153
?	4a	Nyáregyháza A3	44	1	0	15	18	16	0	0	1	0	0	94
?	3	Szilvásvárad - Sportpálya	246	0	0	69	157	40	0	31	0	0	0	543
?	4b	Tiszaeszlár - Bashalom: 37	10	0	0	3	7	16	0	1	0	0	0	37
?	4b	Tiszalök - Rázom	53	0	0	1	1	3	0	0	0	0	0	58
?	4b	Tiszavasvári - Városföld	337	0	0	120	40	21	4	2	0	0	0	524
?	2	Vác - Kavicsbánya	306	0	0	211	20	36	0	1	0	0	0	574
?	4b	Zalkod - Jakab-domb	93	0	0	25	28	3	0	0	0	0	0	149

* dromedary

Appendix Table 2. Remains of wild mammals from Sarmatian Period settlements (NISP)

Century	Region		Aurochs	Red deer	Roe deer	Wild pig	Brown hare	Beaver	Hamster	Souslik	Badger	Polecat	Red fox	Brown bear	Wild total
2	4c	Gyoma 133	1	0	1	0	1	0	0	0	1	0	0	0	4
2	3	Szirmabes	1	7	0	2	0	0	0	0	0	0	0	0	10
3	3	Szirmabes	0	0	0	2	0	0	0	0	0	0	0	0	2
2-3	4c	Biharkeres	0	0	0	0	4	0	0	0	1	0	0	0	5
2-3	4c	Gyoma 133	1	0	1	0	0	0	1	1	0	0	0	0	4
2-3	3	Kompolt 15	18	7	0	4	2	0	0	0	0	0	0	31	
2-3	4a	Ujhartyán	0	0	0	0	0	0	2	1	0	0	0	0	3
2-4	4a	Kunszentm	0	1	0	2	0	0	0	0	0	0	0	0	3
2-4	4a	Szabadszá	0	1	0	0	4	0	0	0	0	0	0	0	5
3-4	4b	Apagy - Pe	10	12	1	6	0	0	0	0	0	0	0	3	32
3-4	4b	Beregsurá	0	2	0	1	0	0	0	0	0	0	0	0	3
3-5	4b	Tiszavasv	1	2	0	0	0	0	0	0	0	0	0	0	3
4	4a	Tiszafüred	0	6	0	0	0	0	0	0	0	0	0	0	6
4-5	4c	Endrod 170	0	0	2	1	0	0	0	0	0	0	0	0	3
4-5	4c	Örménykút	0	0	1	0	30	0	7	2	0	0	0	0	40
4-5	4c	Tázlár	0	2	0	0	0	0	0	0	0	0	0	0	2
4-5	4a	Tiszaföldv	22	55	3	16	7	0	0	0	0	1	4	0	108
5	4b	Tiszavasv	0	1	1	1	4	0	0	0	0	0	0	0	7
?	3	Arka	0	2	4	0	0	0	0	0	0	0	0	0	6
?	4c	Endrod 19	0	6	0	0	0	1	1	0	0	0	0	0	8
?	3	Garadna -	0	1	1	0	0	0	0	0	0	0	0	0	2
?	3	Miskolc - S	1	21	3	0	0	20	0	0	1	0	0	0	46
?	4a	Nyáregyhá	0	0	0	0	0	0	0	5	0	0	0	0	5
?	4a	Nyáregyhá	0	1	0	0	0	0	0	0	0	0	0	0	1
?	3	Szilvásvár	0	8	3	1	1	0	0	0	0	0	0	0	13
?	4b	Tiszavasv	0	1	1	1	3	0	0	0	0	0	0	0	6
?	2	Vác - Kavi	0	1	0	0	2	0	0	0	0	0	0	0	3
?	4b	Zalkod - Ja	0	4	2	20	0	1	0	0	0	0	0	0	27

Sources for Sarmatian settlements:Bartosiewicz 1990-1991, 1996b; Bökönyi 1974, 1976, 1981, 1982; Vörös 1993, 1999a, b.

Appendix Table 3. Remains of domestic animals from Avar Period and Slavic settlements (NISP)

Century	Region		Cattle	Sheep	Goat	Caprine	Pig	Horse	Ass	Dog	Cat	Chicken	Goose	Domestic total
7	2	Mosonszolnok M1	199	0	0	61	26	35	0	0	0	1	0	322
7	1	Szekszárd - Bogyiszlói út	296	0	0	75	46	29	0	18	0	1	1	466
7-8	4a	Kunmadaras - Újvárosi temeto	8	0	0	9	11	5	0	2	0	1	0	36
7-9	1	Tatabánya - Alsógalla	73	0	0	21	29	1	0	0	0	4	0	128
8	1	Dunaújváros - Alsófoki patak	358	0	0	159	55	83	2	8	0	5	0	670
8	3	Szirmabesenyo 3	207	29	0	0	37	11	0	0	0	0	0	284
8	4c	Eperjes - Csikóstábla	283	50	17	15	63	39	0	7	0	1	1	476
8	4c	Gyoma 133/5	321	0	0	81	60	99	0	0	0	0	0	561
8	4c	Hunya - Csárdavölgy (%)	60	0	0	22	9	7	0	0	0	0	0	98
9-10	3	Besenov	42	2	0	53	21	3	0	6	26	15	0	168
9-10	3	Nitrianské Hrádok	174	2	0	28	96	22	0	0	1	12	1	336
9-10	3	Stare Mesto (%)	17	0	0	26	52	5	0	0	0	0	0	100
10	1	Zalavár	88	0	0	27	123	38	0	90	0	0	0	366
?	4c	Bokros - Fehérkereszt	26	0	0	3	0	5	0	0	0	0	0	34
?	4b	Gergelyiugornya (%)	61	0	0	14	24	0	0	0	0	0	0	99

Appendix Table 4. Remains of wild animals from Hungarian Conquest/Árpád Period settlements (NISP)

Century	Region		Aurochs	Red deer	Roe deer	Wild pig	Brown hare	Hamster	Brown bear	Wild total
7	1	Szekszárd - Bogyiszlói út	0	0	0	0	0	3	0	3
7-9	1	Tatabánya - Alsógalla	0	0	0	0	0	1	0	1
8	1	Dunaújváros - Alsófoki patak	0	0	0	0	1	0	0	1
8	4c	Eperjes - Csikóstábla	0	1	4	1	1	0	0	7
8	3	Szirmabesenyo 3	0	2	2	0	0	0	0	4
9-10	3	Besenov (%)	0	0	1	2	3	0	0	6
9-10	3	Nitrianské Hrádok	0	0	7	0	2	0	1	10
10	1	Zalavár	0	8	5	12	0	0	0	25

Sources for Avar Period/Slavic settlements: Ambros 1958; Bartosiewicz 1993a; Bökönyi 1974; Vörös 1991b, 1999b.

Appendix Table 5. Remains of domestic animals from Hungarian Conquest/Árpád Period settlements (NISP)

Century	Region		Cattle	Sheep	Goat	Caprine	Pig	Horse	Ass	Dog	Cat	Chicken	Goose	Domestic total
10	4c	Csongrád - Felgyo	1711	0	0	576	181	1187	0	517	63	76	34	4345
10	3	Sály - Lator	341	0	0	76	124	22	2	28	0	1	0	594
10-11	4c	Doboz - Hajdúirtás	142	0	0	71	87	34	0	10	0	2	0	346
10-11	4c	Endrod 170	213	0	0	112	50	76	0	0	0	0	0	451
10-11	2	Esztergom - Szentgyörgy	1747	0	0	886	624	161	8	45	1	18	1	3491
10-11	1	Pápa - Hantai út	299	64	0	0	82	5	0	9	0	9	5	473
10-11	4c	Szarvas - Rózsás	82	0	0	44	117	12	0	73	3	1	24	356
10-12	2	Visegrád - Várkert	374	0	0	234	481	75	0	371	0	31	4	1570
10-12	4a	Szabolcs - Bailiff's Seat	243	45	0	0	69	32	0	148	0	4	0	541
11	2	Vác - Géza tér	85	25	0	188	23	0	2	0	0	8	3	334
11-12	4a	Kunhegyes - Jajhalom	10	0	0	2	2	12	0	1	0	0	0	27
11-12	1	Zalavár	99	0	0	2	5	2	0	1	0	1	0	110
11-13	4c	Csátalja - Vágotthegy	53	0	0	27	28	19	0	4	0	0	0	131
11-13	1	Csatár-TSz istálló	18	0	0	15	31	17	0	0	0	1	0	82
11-13	4c	Csongrád - Felgyo I	57	0	0	21	7	13	0	24	0	0	0	122
11-13	2	Esztergom - Kovácsi	13	0	0	11	2	0	0	0	0	0	0	26
11-13	1	Hahót	20	0	0	12	10	1	0	0	0	1	0	44
11-13	4c	Kardoskút - Hatablak	277	0	0	80	66	209	0	132	93	9	0	866
11-13	2	Óbuda - Piac	1247	0	0	446	288	37	0	4	0	7	2	2031
11-13	1	Sióagárd - TSz major	36	0	0	14	43	13	0	1	13	46	1	167
11-13	3	Szirmabesenyo 4	81	36	0		50	7	0	0	0	5	0	179
11-13	4b	Tiszaeszlár - Bashalom	29	0	0	13	7	9	0	0	0	0	0	58
11-13	4b	Tiszalök - Rázom	361	0	0	60	240	261	0	60	1	32	0	1015
12	4a	Lajosmizse M5	64	3	1	35	10	34	0	6	0	12	1	166
12-13	4a	Sarud - Pócstöltés	60	0	0	0	18	156	0	1	0	0	0	235
13	2	Buda - Vár	77	0	0	24	43	5	0	0	1	0	0	150
13	3	Mende - Leányvár	398	0	0	352	391	12	0	3	0	77	0	1233
13	2	Vác - Széchenyi utca	136	4	1	5	15	7	0	0	0	0	0	168
?	1	Dunaújváros - Öreghegy	71	0	0	10	7	0	0	0	0	0	0	88

Appendix Table 6. Remains of wild animals from Hungarian Conquest/Árpád Period settlements (NISP)

Century	Region		Auroch	Bison	Red deer	Roe deer	Wild pig	Brown hare	Hamster	Marten	Mustelid	Fox	Wolf	Brown bear	Wild total
10	4c	Csongrád - Felgyo	0	0	0	0	0	0	0	0	0	0	0	0	403
10	3	Sály - Lator	0	0	19	2	3	0	0	0	0	0	0	0	24
10-11	2	Esztergom - Szentgyörgymez	0	4	32	6	14	2	1	0	0	0	0	1	24
10-11	1	Pápa - Hantai út	0	0	2	0	0	0	0	0	0	0	0	0	2
10-12	2	Visegrád - Várkert-dülo	0	0	21	5	4	3	0	0	0	1	0	0	2
10-12	4b	Szabolcs - Bailiff's Seat	0	2	2	58	8	0	0	0	0	0	0	0	70
11-12	1	Zalavár	0	0	8	0	0	0	0	0	0	0	0	0	8
11-13	4c	Csátalja - Vágotthegy	0	0	1	1	0	0	0	0	0	0	0	0	2
11-13	4c	Csongrád - Felgyo 1	1	0	0	0	0	1	0	0	0	0	0	0	2
11-13	2	Esztergom - Kovácsi	0	0	0	0	1	0	0	0	0	0	0	0	1
11-13	1	Hahót	0	0	0	0	1	0	0	0	0	0	0	0	1
11-13	4c	Kardoskút - Hatablak	0	0	1	0	3	14	0	0	0	0	0	0	18
11-13	2	Óbuda - Piac	0	0	8	0	5	1	0	1	0	0	0	0	15
11-13	1	Sióagárd - TSz major	0	0	0	0	0	0	17	0	0	0	0	0	17
11-13	3	Szirmabesenyo 4	0	0	1	0	0	0	0	0	0	0	0	0	1
11-13	4b	Tiszaeszlár - Bashalom	0	0	0	0	1	0	0	0	0	0	0	0	1
11-13	4b	Tiszalök - Rázom	0	0	38	8	2	0	0	0	0	0	0	0	48
12-13	4a	Sarud - Pócstöltés	0	0	0	0	7	0	0	0	0	0	0	0	7
13	2	Buda - Vár	0	0	1	0	0	0	0	0	1	0	0	2	
13	3	Mende - Leányvár	0	0	0	1	1	6	0	0	0	0	13	0	21

Sources for Hungarian Conquest/Árpád Period settlements: Bartosiewicz 1993a, 1994, 1995, 1996c; Bökönyi 1974, 1981; Matolcsi 1975, 1982; Vörös 1989, 1990, 1996, 1999a, b.