Journal of Anthropological Archaeology 42 (2016) 27–36

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Wild, domestic and feral? Investigating the status of suids in the Romanian Gumelniţa (5th mil. cal BC) with biogeochemistry and geometric morphometrics

Marie Balasse [a,*], Allowen Evin [b,c], Carlos Tornero [a], Valentin Radu [d], Denis Fiorillo [a], Dragomir Popovici [d], Radian Andreescu [d], Keith Dobney [b], Thomas Cucchi [a,b], Adrian Bălăşescu [d]

[a] UMR 7209 « Archéozoologie, archéobotanique: sociétés, pratiques, environnements » Sorbonne Universités, CNRS-MNHN, 55 rue Buffon, 75005 Paris, France
[b] Department of Archaeology, University of Aberdeen, St Mary's Building, Elphinston Road, Aberdeen AB24 3FX, United Kingdom
[c] Institut des Sciences de l'Evolution de Montpellier, Université de Montpellier, CNRS, IRD, EPHE, place Eugène Bataillon, 34095 Montpellier Cedex 5, France
[d] National History Museum of Romania, Calea Victoriei, 12, sector 3, 030026 Bucharest, Romania

ARTICLE INFO

Article history:
Received 18 December 2015
Revision received 19 February 2016
Available online 10 March 2016

Keywords:
Sus scrofa
Late chalcolithic
$\delta^{13}C$
$\delta^{15}N$
Bone collagen
Geometric morphometrics
Teeth

ABSTRACT

In south-eastern Romania, a prominent place was given to pigs in the Gumelniţa culture (Late Chalcolithic, second half of 5th millennium BC); as was the highly prized wild boar, one of a variety of species targeted for hunting. The wild boars' ecological niche and the scale of pig husbandry were investigated during a stable isotope study of the Gumelniţa A2 occupations at Borduşani-Popină, Hârşova-tell and Vităneşti-Măgurice. Results from the bone collagen $\delta^{15}N$ and $\delta^{13}C$ analysis suggested that the wild boars did not inhabit dense forests, in any of these locations. The emerging picture is of small-scale pig husbandry involving household management: pigs being fed leftovers and/or by-products of human activities. At Vităneşti, previous work involving geometric morphometrics on suid molars evidenced, besides the two expected groups of small domestic pigs and large specimens with wild molar shape (i.e. wild boar), the presence of specimens with large size and domestic shape molars, whose relationship with the human community was unclear. Results from the combined geometric morphometric and stable isotope analyses, suggested that the large specimens with domestic molar shape lived in close proximity to the wild ecosystem. They were probably not part of the domestic stock, but belonged to a feral population and were acquired through hunting.

1. Introduction

The 5th millennium BC in South-East Europe represents a phase of increasing social complexity (Lichardus et al., 1985; Guilaine, 2007; Chapman et al., 2006). In south-eastern Romania, this period witnesses the appearance of numerous tell sites (Marinescu-Bîlcu, 2001). Changes in the subsistence economy of this period have also been observed, particularly in the meat component of the diet (Bréhard and Bălăşescu, 2012). The earliest evidence for animal husbandry in Southern Romania dates from the beginning of the 6th millennium cal BC (Dumitrescu et al., 1983), and over one and a half millennia – through early Neolithic to early Chalcolithic times (i.e. Starčevo-Criş, Dudeşti, Vădastra, Boian and Hamangia cultures), pig (*Sus scrofa* f. *domestica*) was sparsely represented in faunal assemblages (Bălăşescu et al., 2005b; Bălăşescu, 2014). A significant change occurred with the Gumelniţa culture (Late Chalcolithic 4600–3900 cal BC), where pig consumption appears to increase in importance – ranking second to cattle or caprines, or more exceptionally first, in terms of the number (15–25%) of mammal remains (Bălăşescu et al., 2005a). Wild game procurement through hunting continued as a component of the subsistence economy – acquiring increasing importance at some settlements from Southern Romania compared to previous periods (Bréhard and Bălăşescu, 2012). Within the varied hunted species that were exploited, wild boar, red deer and aurochsen remain the main hunted taxa recovered from sites (Bălăşescu et al., 2005a, 2005b).

In this context, defining the ecological niche of wild boar and the scale of pig husbandry at Gumelniţa tell settlements should help with understanding the investment of human society in the management of these related resources. Suids display an

* Corresponding author.
E-mail addresses: balasse@mnhn.fr (M. Balasse), allowen.evin@univ-montp2.fr (A. Evin), carlos.tornero@mnhn.fr (C. Tornero), raduvalentin@hotmail.com (V. Radu), denis.fiorillo@mnhn.fr (D. Fiorillo), mirel_d_n_p@yahoo.com (D. Popovici), radian_romus@yahoo.com (R. Andreescu), keith.dobney@abdn.ac.uk (K. Dobney), cucchi@mnhn.fr (T. Cucchi), abalasescu2005@yahoo.fr (A. Bălăşescu).

http://dx.doi.org/10.1016/j.jaa.2016.02.002
0278-4165/

opportunistic feeding behaviour within a broad ecological niche, rendering them particularly adaptable to a variety of ecological settings and husbandry systems. The scale of husbandry may vary widely – from household keeping of few individuals to specialized extensive management of large herds – the latter adapted to a wide variety of landscapes (from open areas to woodlands, including seasonal foraging in cultivated fields), involving both highlands and lowlands, and following either sedentary or transhumant pathways (Albarella et al., 2007, 2011; Halstead and Isaakidou, 2011; Hadjikoumis, 2012). As omnivores, pigs can fully exploit different niches within the anthropic ecosystem. Those herded extensively would be expected to have a diet similar to that of their wild counterparts – consisting mostly of plant resources with seasonally variable animal components. In contrast, pigs kept in closer proximity to human settlements (and/or confined and raised for fattening at a household level) would potentially incorporate in their diet human consumption refuse including by-products of animal exploitation and plant cultivation.

These different dietary components can be detected through analysis of stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope ratios in archaeological bones. When placed within the local ecosystem (i.e. by comparison with values measured against wild and domestic fauna found in association with them), $\delta^{15}N$ values measured in pig remains should indicate a positive shift in trophic level induced by the consumption of animal proteins, while $\delta^{13}C$ values may be useful, in some instances, to reveal the dietary contribution of C_4 crops when the surrounding wild environment is dominated by C_3 plants (Pechenkina et al., 2005; Ervynck et al., 2007; Hamilton et al., 2009; Madgwick et al., 2012; Frémondeau et al., 2013; Chen et al., 2014, 2015). In contrast, lower values of both carbon and nitrogen isotope ratios would be expected for animals under an extensive herding regime, with a diet more focused on wild plants, whereas higher $\delta^{13}C$ and $\delta^{15}N$ values would suggest a closer proximity to (or management by) humans, with a diet higher in protein.

Bone collagen carbon and nitrogen isotope analyses were undertaken on the Gumelniţa vertebrate assemblages from Hârşova-tell and Borduşani-Popină, in the Danube River basin, south-eastern Romania. They revealed a high trophic level for domestic pigs, suggesting a significant contribution of animal protein to their diet, which may be partly acquired from the abundant aquatic resources and nesting birds within the surrounding marshland environment. However, a significantly higher trophic level in pigs compared to wild boar, suggested that the former strongly relied on human waste in their diet. Consequently, the scale of husbandry at these sites was thought to more closely resemble household level management than specialised extensive herding (Balasse et al., in press).

In addition to the challenge of disentangling dietary differences between wild and domestic pigs (both being potentially omnivorous and opportunistic), a debate has recently emerged over the use of the size criteria alone to distinguish the two forms from their zooarchaeological remains. A decrease in body size is one of the most significant (and traditionally accepted) changes associated with the process of domestication (e.g. Boessneck and von den Driesch, 1978; Meadow, 1989; Vigne et al., 2005) and in most previous studies, a size criterion (applied especially to teeth), was used to distinguish the small (domestic) pigs from their (large) wild counterparts (e.g. Albarella et al., 2006; Rowley-Conwy et al., 2012). However, recent studies involving geometric morphometric analyses of teeth have challenged the traditional size criteria used to distinguish domestic pig from wild boar, demonstrating that shape is more powerful in addressing this issue (Cucchi et al., 2011; Evin et al., 2013, 2015a). Geometric morphometric analyses allowed to contrast the archaeological specimens with small and 'domestic' shape molars to the Mesolithic (pre-domestic) specimens with large and 'wild' shape teeth (see more details in Evin et al., 2015a). Moreover, when applied to Romanian Neolithic and Chalcolithic assemblages, a third group of suids was revealed – i.e. specimens with large size and 'domestic' shape molars – present from the early Neolithic (Evin et al., 2015a).

When combined with ancient DNA sequences from the same specimens, it appears that the majority of small domestic pigs possessed a mitochondrial signature (Y1 haplotype, 17 among 18 specimens) linked with the introduction of pigs from Anatolia during the Neolithic (Ottoni et al., 2013). Based on analyses of teeth, the earliest evidence of these small domestic pigs dates from the Middle Neolithic (Vădastra culture) at the site of Măgura–Buduiasca, though the presence of small pigs had been previously identified during the Early Neolithic from postcranial measurements (Bălăşescu, 2014). So far, the earliest specimen with large and domestic shape molars that was genotyped carried the European haplotype E1-C, suggesting either admixture between the introduced domestic pigs and local wild boar, or domestication of the local (European) wild boar. Modern hybrids possess molar shapes strictly intermediate between the two ancestral forms (for the M2) or closer to wild boar (for the M3) while their size is, on average, smaller than wild boar (Evin et al., 2014, 2015b). However, multiple crosses between hybrids and back-crosses with the wild and domestic forms may result in phenotypes where the signature of domestication on size and shape are dissociated. Similarly, so far, little is known about the relative tempo of morphological changes in molar size and shape at the beginning of the domestication process. Local domestication may therefore result in specimens with relatively large molar size and a domestic shape signature. In Romania, the specimens with large and domestic shape molars were found to be on average smaller than those with a wild shape (Evin et al., 2015a), which could as well be in agreement with the size decrease observed during domestication. Furthermore, the presence of large specimens with both a wild and domestic tooth shape, and carrying the Near-Eastern Y1 haplotype during the Gumelniţa promotes the admixture hypothesis, at least for this time period (Evin et al., 2015a).

Outstanding questions remain about the status of these suids with large and domestic tooth shape – specifically in terms of their relationship to humans – i.e. were they part of the domestic stock or were they hunted (wild or feral) game?

From the two Gumelniţa assemblages analysed to date, pigs and wild boar – separated merely by humerus size – showed significantly different stable isotope values (Balasse et al., in press). This distinction suggests that dietary characterisation of the suids with large domestic shape molars may provide clues regarding their role in the anthropic ecosystem and could help confirm their status, if both morphometric and isotopic markers are collected from the same specimens.

In order to resolve the questions surrounding the status of the Gumelniţa suids, we first established baseline ecological diversity from a wide spectrum of other animals – at three contemporaneous sites in south-eastern Romania – by measuring their nitrogen and carbon isotope ratios. These included herbivore, omnivore and carnivore taxa from both terrestrial and aquatic food webs. We then contrasted stable isotope compositions obtained from suids (i.e. 'wild' and 'domestic' pigs) from the site of Vităneşti-Magurice with traditional and advanced (geometric morphometric) biometrical approaches, providing a direct dietary characterisation of the three morphological groups (i.e. small domestic, large wild boar, and specimens with large and domestic molar shape). These analyses offered a potential new insight into the manner and form of wild and domestic suid exploitation (specialised extensive herding or household management) by the Chalcolithic farming communities of southern Romania.