Herding, Settlement, and Chronology in the Balkan Neolithic

DAVID ORTON

McDonald Institute for Archaeological Research, University of Cambridge, UK

The Neolithic in the central Balkans saw dramatic changes in settlement forms, architecture, and material culture, with substantial, often long-lived settlements that can reasonably be called villages emerging in the later part of the period. This paper examines the role of herding practices in the development of these large, more-or-less settled communities. Radiocarbon results (including twenty-seven new AMS dates from Gomolava, Opovo, and Petnica) are used to place the available zooarchaeological data into a chronological framework, allowing comparison of inter- and intra-site changes across the region. The data point to the development of large-scale cattle herding in the later Neolithic, the implications of which for mobility and community cohesion are discussed. This trend is seen clearly over time at certain sites but, like the settlement evidence, is neither universal nor synchronous across the region, emphasizing that change occurred, and should be understood, on the level of individual communities.

Keywords: Vinča culture, settlement histories, Balkan Neolithic, zooarchaeology, sedentism, mobility, cattle herding

INTRODUCTION

This article examines connections between human–animal relations and the development of large, more-or-less settled communities in the central Balkan Neolithic. Remarkable changes are seen over the 1500 years following the introduction of domesticates to this region (c. 6200–6000 cal BC). Small, typically transient sites characteristic of the Early Neolithic are replaced by increasingly large and frequently long-lived settlements that can reasonably be labelled villages; clusters of pits and ‘pit-dwellings’ give way to rows of substantial rectilinear houses; and portable material culture becomes increasingly elaborate and abundant. These changes have been argued to represent decreasing residential mobility, increasing population density and community size, and the resulting emergence of a tension between communities and their constituent co-residential units ('households'). This tension may eventually have led to the population dispersal seen in the subsequent Copper Age, but it did not prevent the emergence of large, stable villages in the later Neolithic. What, then, underpinned the formation and maintenance of these communities?

This paper explores the potential contribution of herds and herding practices, seeking to draw out links between changing use of animals and more widely discussed developments in settlement form and pattern. Faunal data spanning the Neolithic across the central Balkan region are collected and analysed, together with new and previously published radiocarbon dates, to address two aims:

1. To establish the chronology of studied Neolithic faunal assemblages in the
region and to identify any overall trends that might be related – as cause, effect, or both – to developments in settlement patterns, mobility, and social organization.

2. To assess trends in multi-phase faunal assemblages against this backdrop. Does animal use develop in consistent ways over the course of individual settlement histories? If so, do intra-site trends stand out from overall regional changes?

**BACKGROUND**

The ‘central Balkans’ are here defined loosely by the maximum extent of the later Neolithic Vinča and Butmir cultures. As such the region includes western Romania, the far south of Hungary, and the eastern part of the former Yugoslavia (Serbia proper, Vojvodina, Kosovo, northern Macedonia, and central/western Bosnia). At the north of this region is the southern Great Hungarian Plain, including parts of the Sava, Tisza, and Tamiš river systems (Figure 1a). To the south are the upland plateaux of the Kosovo Plain and Ovčé Pole, and the floodplains and terraces of the upper Vardar, the latter eventually draining into the Aegean. Linking these areas is the Morava, flowing from its watershed with the Vardar – close to the contemporary Serbian-Macedonian border – to the Danube. The Western Morava, Ibar, Kolubara, Drina, and Bosna rivers provide access to the Balkan interior, while in the northeast the Mureș links Transylvania to the Great Hungarian Plain. Finally, the Danube drains most of the region, bisecting the plain before cutting through the southern tail of the Carpathians via the well-known Iron Gates gorges.

Early Neolithic sites are known from northern Macedonia by the end of the seventh millennium BC, despite a paucity of radiocarbon dates, and from the southern Great Hungarian Plain by around 6000 cal BC (Whittle et al., 2002, 2005). By the early sixth millennium sites belonging to the Starčevo/Körös/Criș (SKC) cultural group

![Figure 1.](image-url)
are found along the floodplains and lower terraces of the major rivers and on the Kosovo and southernmost Great Hungarian Plains. These are typically short-lived sites consisting of clusters of pits, some of which may represent dwellings, although some above-ground post-hole structures are known, for example from Divostin Ic (Bogdanović, 1988). In the south, the Anzabegovo-Vršnik culture of the upper Vardar and Ovčé Pole is broadly similar to the SKC in terms of portable material culture, but is characterized by small yet often long-lived sites with rectilinear architecture.

The later Neolithic – from around 5500 cal BC – is represented by the Vinča phenomenon across most of the study region (see Chapman, 1981; Markotić, 1984). Settlements typically consist of larger rectilinear wattle-and-daub buildings interpreted as houses and a few smaller structures whose function is unknown. The initial phase of many sites is characterized by a paucity of apparent dwellings and an abundance of large pits (Tripković, 2003: 450, 2007: 19–34), in some ways resembling the typical SKC site. Houses vary in size both between and within sites, and some very large examples (up to 100 m²) are known. Evidence for centralization of authority is limited, although enclosures at some sites – including massive ditches at Parţa and Uivar (Drășovean, 2007; Schier, 2008) – do imply communal mobilization of labour.

Later Neolithic sites vary considerably in size and longevity, but some appear to have had occupations running into centuries and could have supported hundreds of residents at their greatest extents. These include classic tells such as Gomolava, Parţa, Uivar, and the type-site at Vinča-Belo Brdo, as well as more extensive sites including Selevac and Ploćnik. The largest settlements emerge in the middle to the late part of the period, although smaller sites are known throughout. Claims of a subsequent population dispersal (Chapman, 1990; Tringham, 1992; Brukner, 2003) are undermined by very large final Vinča settlements at Stubline (Crnobrnja et al., 2009), Mali Borak (Arsić et al., 2011), and Divostin (McPherron & Srejović, 1988) not to mention continued occupation of the type site. A reduction in site size into the post-Vinča Copper Age is much clearer but currently extremely poorly dated.

Given its generally small, short-term sites, there is a degree of consensus that the earliest Neolithic of the central Balkans involved considerable movement on the part of human groups (Whittle, 1996: 69; Bailey, 2000: 57; Tringham, 2000: 40–41; Greenfield and Jongsm, 2008). The existence of larger, longer-term settlements in subsequent periods indicates permanence of a sort, although interpretations of long-term Balkan sites vary from ‘fully sedentary’ villages with considerable mobility around them for various tasks (Tringham, 2000: 51; Halstead, 2005) to foci for periodic congregations of people engaged in very specific activities (Bailey, 1999: 97). In the central Balkan case the range of activities represented at each site, and in some cases the sheer rate of deposition, support the former interpretation.

**MODELS OF CHANGE**

Discussion on the formation of settled ‘village’ communities in the region – especially in the Anglophone literature – has relied heavily on extrapolation from broadly parallel trends observed at a number of well-studied sites, including Selevac, Gomolava, Parţa, Banjica, and Vinča itself. These include increases in site size and presumed population, with successive building horizons featuring closer-
packed and more substantial (permanent?) houses, richer house inventories, and rising frequency of house burning.

While this is certainly a common pattern, it is by no means universal. Some small sites appear to have persisted for long periods without dramatic changes in architecture or settlement form, while apparently single-phase sites occur in a range of sizes. Even where the ‘classic’ pattern of increasing size and apparent permanence applies, it does not seem to have been synchronous between sites; changes occurred on a settlement/community level and must be explained on this level rather than in terms of overarching regional processes. Shifting the locus of change from region to site/community focuses attention on the factors which promoted the formation and maintenance of large communities in the later Neolithic.

The mechanisms linking mobility patterns to settlement/population growth remain to be demonstrated. Did decreased residential mobility permit individual groups to grow into large communities in situ, as it were? Or did the large sites of the later Neolithic develop from increasingly permanent agglomerations of smaller, previously mobile units? Ruth Tringham (Tringham et al., 1985; Tringham & Krstić, 1990a) has argued that the Vinča period saw the emergence within communities of increasingly autonomous and competitive households, creating tensions that were ultimately resolved by a process of fissioning into smaller groups (Tringham, 1992: 141; see also Bankoff & Greenfield, 1984: 15–19). The increasing quantity and diversity of apparent household possessions during the Vinča period might reflect this competition (Chapman, 1992; see also Kaiser & Voytek, 1983) or conversely practices of exchange and hospitality serving to reinforce community ties (Whittle, 1996: 105). If one accepts Chapman’s (2000: 47–48) proposition that the south-east European Neolithic was characterized by gift exchange involving inalienable objects then both may be true; such exchange is certainly competitive, but since the competition revolves around the social relations materialized by objects rather than the objects themselves it also has a cohesive potential. The apparent intensification of production and exchange during the Vinča period might therefore represent both a result of intracommunal competition and a means of maintaining cohesion among larger communities.

This would have applied to animals and their products as much as lithics or pottery, and particularly to domesticates (Russell, 1993: 12–13). Communal consumption is necessitated by the size of many species exploited in the Neolithic (Halstead, 2007) and has the potential to be simultaneously competitive and cohesive, as does gift exchange involving live animals (see Russell, 1998). On a more practical level, changing settlement sizes and mobility patterns are likely to have entailed alterations to the scale and organization of herding. Documenting the changing social and subsistence roles played by animals is thus doubly important for understanding the formation of settled communities in the later Neolithic.

If common changes in animal exploitation can be observed over the course of occupation at individual sites which exemplify the developments outlined above, and particularly if these stand out from background regional trends, this would constitute good evidence for links between animal use and the formation of larger communities. In particular, one might expect to see increased representation of those species with the greatest role in exchange and communal consumption, and changing kill-off patterns as the logistics and ultimate goals of raising livestock shifted.
MATERIALS AND METHODS

This article contributes to this discussion by collating the available zooarchaeological data and presenting them in a chronological framework to assess trends in animal use both between and within Neolithic sites. Three new suites of AMS radiocarbon dates are presented and analysed alongside existing radiocarbon evidence.

The sample

A surprising number of faunal assemblages from the central Balkan region (as defined above) have been published over the last half-century (Table 1, Figure 1b), including studies in seven languages by more than 20 analysts from a variety of countries and zooarchaeological traditions. The excavations from which they derive are likewise extremely diverse in terms of scale, bone preservation, excavation methodology, recovery techniques, and documentation standards. There are two possible approaches to this situation. The first – adopted by Greenfield (2008a) in a recent review of early Neolithic data – is to select only those assemblages which meet a strict set of criteria concerning taphonomy, recovery, and publication, resulting in an analysis that is methodologically sound but based on a small and potentially unrepresentative subset of the data. The alternative is the ‘lowest common denominator’ approach, relaxing the criteria for inclusion but restricting the variables to be considered – and thus the depth of comparison – while taking care to consider potential biases.

The latter approach is taken here, in view of the large number of relevant but brief publications and the limited set of in-depth studies. Analysis is limited to taxonomic frequencies and – for a subset of sites – age-at-death data. All relevant assemblages are included in the main dataset provided that (a) number of identified specimens (NISP) is reported for all identified mammalian taxa, and (b) the total sample size is at least 200.

The bulk of represented sites are located on the Hungarian plain, including the Vojvodina and Romanian Banat, in the Sava and Morava valleys of northern Serbia proper, and in the Đerdap/Iron Gates region. Outlying groups are found in the Bosna valley (central Bosnia), the Mureș valley (Transylvania), and the upper Vardar basin (northern Macedonia). The paucity of data from southern Serbia and Kosovo is due to research bias rather than an absence of settlement; in contrast, the gap between the Bosna and Šumadija (central Serbia) may reflect genuinely limited Neolithic activity.

Taxonomic frequencies

NISP is used as the measure of abundance throughout, since it is the most commonly reported measure, and because the manifold problems of minimum number estimates (see, e.g., Lyman, 2008: 45–57) are amplified when comparing data between analysts. Where assemblages from the same site have been published by multiple authors – as at Gomolava, Petnica, and Opovo – the larger sample is used; frequencies are not pooled. Only at Sânandrei are frequency data from different authors used, in this case for purposes of inter-phase comparison.

Only mammals are included, with the ‘other’ category including wild carnivores, hare, beaver, and wild ass. Sheep and goats are combined since many published reports do not distinguish between them systematically. Where relative proportions

1. An exception is made for Selevac due to its importance as a major multi-layered settlement around which much of the debate on change over time has centred. Since Legge (1990) does not provide frequencies for dog or for small game, the site is excluded from the inter-site comparisons. However, it is included for the purposes of tracking intra-site changes, since the contribution of the excluded taxa is assumed to have been marginal.
Table 1. Studied faunal assemblages from the earlier (top) and later (bottom) neolithic of the central balkans. Assemblages included in the main dataset are shown in bold face. Italics are used where there is ambiguity concerning numbers of wild versus domestic pigs and cattle. ‘Age data’ refers to standardized results following Payne (1973).

<p>| No. | Site                        | Reference                        | Sieving | NISP | Cattle | Pig | Caprines | Dog | Red deer | Roe deer | Aurochs | W. pig | Other | % Wild | Age data | 14C dating |
|-----|-----------------------------|----------------------------------|---------|------|--------|-----|----------|-----|----------|----------|---------|--------|-------|--------|---------|-----------|-----------|
| 1   | Anzabegovo I–III            | Bökönyi (1976)                   | 100%    | 3201 | 9.5    | 9.0 | 77.4     | 1.3 | 0.4      | 0.4      | 0.8     | 0.4    | 0.8   | 2.78   | X        |           |
| 2   | Blagotin                    | Arnold and Greenfield (2006)     | ~50%    | 3201 | 9.5    | 9.0 | 77.4     | 1.3 | 0.4      | 0.4      | 0.8     | 0.4    | 0.8   | 2.78   | X        |           |
| 3   | Bukovačka Česma             | Greenfield (1993)                | 0%      | 241  | 29.0   | 8.7 | 5.4      | 0.0 | 32.4     | 7.9      | 1.7     | 11.2   | 3.7   | 56.85  | X        |           |
| 4   | Deszk-Olajkút               | Vörös (1980)                     | ?       | 224  | 0.2    | 53.5 | 32.4     | 23.9| 0.2      | 23.9     |         |        |       |        |         |           |
| 5   | Divostin I                  | Bökönyi (1988)                   | Very little | 2356 | 38.0   | 4.4 | 43.1     | 0.8 | 4.8      | 3.7      | 2.7     | 1.7    | 13.8  | 14.93  | X        | X         |
| 6   | Donja Branjevina            | Blažič (1992, 2005)              | ?       | 1073 | 22.2   | 2.0 | 10.7     | 0.3 | 28.3     | 22.4     | 5.5     | 7.5    | 1.1   | 64.79  | X        |           |
| 7   | Dudeștii Veche              | El Susi (2001)                   | ?       | 254  | 17.0   | 5.7 | 29.3     | 1.4 | 17.7     | 14.7     | 3.2     | 7.4    | 3.5   | 46.6   | X        |           |
| 8   | Foeni-Gaz                   | El Susi (2001)                   | ?       | 502  | 34.5   | 5.2 | 40.4     | 0.2 | 7.4      | 4.2      | 5.0     | 2.8    | 0.4   | 19.7   | X        |           |
| 9   | Foeni-Sălaș                 | Greenfield and Jongsma (2008)    | ~85%    | 2356 | 38.0   | 4.4 | 43.1     | 0.8 | 4.8      | 3.7      | 2.7     | 1.7    | 0.8   | 13.8   | X        | X         |
| 10  | Golokut                     | Blažič (1985)                    | ?       | 1173 | 22.2   | 2.0 | 10.7     | 0.3 | 28.3     | 22.4     | 5.5     | 7.5    | 1.1   | 64.79  | X        |           |
| 11  | Gornea-Locurile Lungi       | El Susi (1996a)                  | ?       | 134  | 44.0   | 12.7| 28.4     | 0.0 | 9.0      | 0.7      | 2.2     | 3.0    | 0.0   | 14.93  | X        |           |
| 12  | Gylălarét-Szilágyi major    | Bökönyi (1974a)                  | ?       | 323  | 20.1   | 3.1 | 42.1     | 0.9 | 3.4      | 4.0      | 4.0     | 11.5   | 10.8  | 33.75  | X        |           |
| 13  | Hajdučka Vodenica           | Greenfield (2008b)               | 0%      | 41   | 7.3    | 19.5| 0.0      | 7.3 | 56.1     | 0.0      | 2.4     | 4.9    | 2.4   | 65.85  | X        |           |
| 14  | Lepenski Vir III            | Bökönyi (1969)                   | ?       | 1954 | 19.2   | 1.3 | 65.4     | 0.7 | 1.4      | 2.0      | 1.8     | 1.8    | 5.3   | 12.32  | X        |           |
| 15  | Ludoš-Budžak               | Bökönyi (1974a)                  | ?       | 2455 | 11.6   | 0.3 | 76.0     | 0.3 | 1.1      | 1.1      | 1.3     | 0.3    | 7.9   | 11.71  | X        |           |
| 16  | Madžari                    | Moskalewska and Sanev (1989)     | ?       | 2848 | 38.8   | 9.9 | 45.4     | 0.6 | 1.4      | 0.1      | 1.6     | 0.6    | 1.4   | 5.232  | X        |           |
| 17  | Miercurea Sibiuului-Petriş  | El Susi (2008)                   | ?       | 1243 | 55.5   | 1.3 | 28.9     | 0.1 | 5.2      | 2.3      | 6.0     | 0.6   | 0.1   | 14.2   | X        |           |
| 18  | Mihajlovac-Knješiće         | Bökönyi (1992)                   | ?       | 2559 | 33.3   | 0.2 | 56.3     | 0.0 | 4.3      | 0.8      | 3.2     | 0.8   | 1.0   | 10.16  | X        |           |
| 19  | Moldova Veche-Rât           | El Susi (1996a)                  | ?       | 424  | 40.3   | 3.1 | 11.8     | 0.9 | 24.1     | 1.2      | 1.4     | 16.3  | 0.9   | 43.87  | X        |           |
| 20  | Na Breg                    | Ivkovska (2009)                  | ?       | 1407 | 14.6   | 5.7 | 76.8     | 0.6 | 0.1      | 1.1      | 0.6     | 0.1   | 0.6   | 2.4    | X        |           |
| 21  | Nosa-Biserna Obala         | Bökönyi (1984)                   | ?       | 911  | 10.4   | 2.0 | 12.6     | 0.1 | 10.4     | 12.6     | 14.3    | 8.2   | 29.3  | 74.9   | X        |           |</p>
<table>
<thead>
<tr>
<th></th>
<th>Site/Location</th>
<th>Author(s)</th>
<th>Year</th>
<th>Site Type</th>
<th>Sample Size</th>
<th>Depth (mm)</th>
<th>Width (mm)</th>
<th>Planarity</th>
<th>Settlement Type</th>
<th>Chronology</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Nosa-Gyöngypart</td>
<td>Bökönyi (1974a)</td>
<td>?</td>
<td>56</td>
<td>16.1</td>
<td>0.0</td>
<td>23.2</td>
<td>0.0</td>
<td>7.1</td>
<td>10.7</td>
</tr>
<tr>
<td>23</td>
<td>Obre I A-B</td>
<td>Bökönyi (1974b)</td>
<td>?</td>
<td>2763</td>
<td>48.4</td>
<td>1.3</td>
<td>32.0</td>
<td>0.2</td>
<td>6.0</td>
<td>1.6</td>
</tr>
<tr>
<td>24</td>
<td>Padina</td>
<td>Clason (1980)</td>
<td>?</td>
<td>644</td>
<td>5.4</td>
<td>0.9</td>
<td>1.2</td>
<td>27.8</td>
<td>40.8</td>
<td>5.7</td>
</tr>
<tr>
<td>25</td>
<td>Parţa tell 2, Lv. I</td>
<td>El Susi (2005)</td>
<td>?</td>
<td>?</td>
<td>24.5</td>
<td>8.0</td>
<td>20.0</td>
<td>1.6</td>
<td>45.9</td>
<td>45.9</td>
</tr>
<tr>
<td>26</td>
<td>Peştera Cauce Lv. I</td>
<td>El Susi (2005)</td>
<td>100%</td>
<td>631</td>
<td>3.5</td>
<td>11.9</td>
<td>75.0</td>
<td>0.0</td>
<td>3.8</td>
<td>2.1</td>
</tr>
<tr>
<td>27</td>
<td>Pojejena-Nucet</td>
<td>El Susi (1996a)</td>
<td>?</td>
<td>302</td>
<td>43.4</td>
<td>0.9</td>
<td>7.1</td>
<td>0.0</td>
<td>28.1</td>
<td>1.9</td>
</tr>
<tr>
<td>28</td>
<td>Rőszke-Lődvár</td>
<td>Bökönyi (1974a)</td>
<td>?</td>
<td>1407</td>
<td>10.9</td>
<td>1.0</td>
<td>44.8</td>
<td>2.4</td>
<td>21.8</td>
<td>3.8</td>
</tr>
<tr>
<td>29</td>
<td>Rug Bair</td>
<td>Schwartz (1976)</td>
<td>100%</td>
<td>693</td>
<td>14.0</td>
<td>14.9</td>
<td>68.3</td>
<td>1.0</td>
<td>0.0</td>
<td>0.4</td>
</tr>
<tr>
<td>30</td>
<td>Sajan-Domboš</td>
<td>Vörös (1980)</td>
<td>?</td>
<td>199</td>
<td>35.2</td>
<td>2.0</td>
<td>17.6</td>
<td>1.0</td>
<td>16.6</td>
<td>6.5</td>
</tr>
<tr>
<td>31</td>
<td>Schela Cladovei</td>
<td>Bartosiewicz, et al. (2001)</td>
<td>Some, wet</td>
<td>1203</td>
<td>33.3</td>
<td>5.5</td>
<td>27.2</td>
<td>2.4</td>
<td>19.1</td>
<td>3.4</td>
</tr>
<tr>
<td>32</td>
<td>Șeușa-La Cărarea Morii</td>
<td>El Susi (2000)</td>
<td>?</td>
<td>433</td>
<td>32.6</td>
<td>6.9</td>
<td>55.7</td>
<td>0.2</td>
<td>1.4</td>
<td>3.0</td>
</tr>
<tr>
<td>33</td>
<td>Starčevo</td>
<td>Clason (1980)</td>
<td>0%</td>
<td>1448</td>
<td>49.5</td>
<td>3.5</td>
<td>20.2</td>
<td>0.5</td>
<td>9.7</td>
<td>0.7</td>
</tr>
<tr>
<td>1</td>
<td>Anzabegovo IV</td>
<td>Bökönyi (1976)</td>
<td>100%</td>
<td>3007</td>
<td>16.5</td>
<td>11.7</td>
<td>68.7</td>
<td>1.2</td>
<td>0.7</td>
<td>0.0</td>
</tr>
<tr>
<td>34</td>
<td>Vršac-At</td>
<td>Russell (1993)</td>
<td>?</td>
<td>447</td>
<td>44.3</td>
<td>5.4</td>
<td>3.1</td>
<td>22.8</td>
<td>1.6</td>
<td>12.5</td>
</tr>
<tr>
<td>35</td>
<td>Bardhosh</td>
<td>Pipe (n.d.)</td>
<td>?</td>
<td>14</td>
<td>Extremely small sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Belovode</td>
<td>Jovanović, et al. (2003)</td>
<td>?</td>
<td>1046</td>
<td>42.0</td>
<td>25.9</td>
<td>25.0</td>
<td>5.9</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>37</td>
<td>Boljevi</td>
<td>Lazić (1988)</td>
<td>?</td>
<td>437</td>
<td>92.2</td>
<td>2.5</td>
<td>3.2</td>
<td>0.0</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>38</td>
<td>Crkvine-Mali Borak</td>
<td>Blažić and Radmanović (2011)</td>
<td>?</td>
<td>1871</td>
<td>86.9</td>
<td>3.2</td>
<td>2.3</td>
<td>0.0</td>
<td>6.0</td>
<td>0.1</td>
</tr>
<tr>
<td>5</td>
<td>Divostin II</td>
<td>Bökönyi (1988)</td>
<td>Very little</td>
<td>10,785</td>
<td>62.7</td>
<td>10.1</td>
<td>11.4</td>
<td>0.9</td>
<td>3.9</td>
<td>0.4</td>
</tr>
<tr>
<td>39</td>
<td>Drenovac</td>
<td>Russell (1993)</td>
<td>0%</td>
<td>123</td>
<td>30.1</td>
<td>10.6</td>
<td>27.6</td>
<td>?</td>
<td>18.7</td>
<td>4.9</td>
</tr>
<tr>
<td>40</td>
<td>Foeni-Cimiturul Ortodox</td>
<td>El Susi (2003)</td>
<td>?</td>
<td>16,591</td>
<td>43.3</td>
<td>14.0</td>
<td>17.3</td>
<td>1.4</td>
<td>14.6</td>
<td>1.7</td>
</tr>
<tr>
<td>41</td>
<td>Gomolava I</td>
<td>Clason (1979)</td>
<td>0%</td>
<td>2659</td>
<td>37.0</td>
<td>17.9</td>
<td>8.0</td>
<td>1.5</td>
<td>17.6</td>
<td>4.8</td>
</tr>
<tr>
<td>42</td>
<td>Orton</td>
<td>Orton (2008)</td>
<td>Probably 0%</td>
<td>3240</td>
<td>47.7</td>
<td>6.0</td>
<td>1.8</td>
<td>1.8</td>
<td>24.6</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Continued
<p>| No. | Site                                      | Reference | Sieving | NISP | Cattle | Pig | Caprines | Dog | Red deer | Roe deer | Aurochs | W. pig | Other | % Wild | Age data | 14C dating |
|-----|------------------------------------------|-----------|---------|------|--------|-----|----------|-----|----------|----------|---------|--------|-------|--------|--------|----------|-----------|
| 42  | Gornea-Căunătia de Sus                   | El Susi (1996a) | ?       | 1632 | 47.5   | 6.1 | 16.5     | 0.4 | 16.4     | 2.3      | 3.9    | 6.1    | 0.9   | 29.5   | X       |
| 43  | Korošovo                                 | Babović (1986); S. Blažić (pers. comm.) | ?       | 6540 | 45.9   | 6.2 | 8.8      | 1.5 | 30.4     | 1.1      | 0.3    | 4.8    | 1.2   | 37.7   | X       |
| 44  | Liubcova-Ornita                         | El Susi (1996a, 2003) | ?       | 2775 | 34.2   | 8.3 | 9.8      | 0.5 | 29.5     | 2.9      | 2.7    | 16.0   | 1.3   | 52.4   | X       |
| 23  | Obre I C                                 | Bőkönyi (1974b) | ?       | 375  | 44.5   | 3.7 | 31.5     | 0.3 | 9.9      | 1.9      | 0.3    | 3.2    | 4.8   | 20.0   | X       |
| 45  | Obre II                                  | Bőkönyi (1974b) | ?       | 28,937 | 65.2 | 13.1 | 7.4      | 1.1 | 5.6      | 1.1      | 3.1    | 2.5    | 0.9   | 13.2   | X       |
| 46  | Okolište                                | Benecke (2009) | ?       | 563  | 80.1   | 8.3 | 9.6      | 0.2 | 0.4      | 0.4      | 0.0    | 0.9    | 0.2   | 1.8    | X       |
| 47  | Opovo²                                   | Russell (1993) | &lt;50%    | 13,084 | 22.6 | 3.3  | 3.8      | 37.9 | 10.9     | 1.2      | 18.1   | 2.2    | 65–70 | X       |
| 48  | Orăștic                                  | El Susi (1996b) | ?       | 1106 | 56.1   | 3.2 | 2.0      | 0.2 | 34.7     | 0.2      | 1.2    | 2.4    | 0.2   | 38.6   | X       |
| 49  | Paraćin-Motel Slatina                   | Cvetković (2004) | ?       | 201  | 39.3   | 24.4 | 21.9     | 0.0 | 3.5      | 2.5      | 1.5    | 5.5    | 1.5   | 14.43  | X       |
| 50  | Parta 1                                  | El Susi (1995) | ?       | 4367 | 27.0   | 11.8 | 8.7      | 0.2 | 25.0     | 6.0      | 3.8    | 17.2   | 0.3   | 52.3   | X       |
| 25  | Parta tell 2                             | El Susi (2003) | ?       | 2854 | 43.1   | 10.1 | 15.8     | 0.0 | 18.9     | 3.7      | 1.1    | 5.4    | 2.0   | 31.1   | X       |
| 26  | Peștera Cauce Lv. II                    | El Susi (2005) | 100%    | 554  | 4.7    | 19.9 | 63.5     | 0.5 | 3.4      | 4.3      | 0.4    | 2.5    | 0.7   | 11.4   | X       |
| 51  | Petnica 1–3                              | Greenfield (1986) | 20%    | 570  | 30.0   | 19.6 | 3.0      | 0.4 | 30.4     | 7.5      | 0.9    | 5.4    | 2.8   | 47.0   | X       |
|     |                                          | Orton (2008) | &gt;50%    | 3657 | 30.9   | 6.6  | 6.1      | 0.7 | 32.6     | 7.4      | 0.4    | 12.6   | 2.7   | 55.7   | X       |
| 52  | Rast                                     | Nicolăescu-Plopșor (1980) | ?       | 384  | Only cranial fragments recorded                                    | 8.8   |
| 29  | Rug Bair                                 | Schwartz (1976) | 100%?   | 693  | Vinča material not separated from Early Neolithic layers              |       |
| 53  | Sânandrei                                | Jongsma and Greenfield (1996) | 0%     | 301  | 44.5   | 9.3  | 10.3     | 0.7 | 14.3     | 7.3      | 0.3    | 13.0   | 0.3   | 35.2   | X       |
|     |                                          | El Susi (2003) | ?       | 3437 | 55.7   | 7.3  | 6.7      | 0.0 | 17.7     | 4.2      | 4.0    | 3.0    | 1.3   | 30.3   | X       |
| 54  | Selevac                                  | Legge (1990) | 100%    | 7442 | 38.0   | 26.5 | 20.7     | 11.1 | 3.8      |          |       |       |       |        | X       |
| 55  | Stragari                                 | Arnold and Greenfield (2006) | 0%     | ?    | Age data only                                                      |       |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Stubline-Crkvine</td>
<td>M. Porčić (pers. comm.)</td>
<td>0%</td>
<td>61</td>
<td>50.8</td>
<td>8.2</td>
<td>3.3</td>
<td>3.3</td>
<td>13.1</td>
<td>1.6</td>
<td>4.9</td>
<td>6.6</td>
<td>0.0</td>
</tr>
<tr>
<td>57</td>
<td>Turdaş Lvl. 2 (upper)</td>
<td>El Susi (2005)</td>
<td>?</td>
<td>?</td>
<td>71.7</td>
<td>4.4</td>
<td>7.0</td>
<td>0.7</td>
<td>10.1</td>
<td>0.8</td>
<td>4.6</td>
<td>0.7</td>
<td>0.0</td>
</tr>
<tr>
<td>58</td>
<td>Vinča</td>
<td>Dimitrijević (2006)</td>
<td>100%, dry</td>
<td>2624</td>
<td>22.4</td>
<td>18.3</td>
<td>12.0</td>
<td>5.5</td>
<td>21.5</td>
<td>5.9</td>
<td>0.6</td>
<td>9.5</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bökönyi (1990)</td>
<td>0%</td>
<td>?</td>
<td>No useful figures provided</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arnold and Greenfield (2006)</td>
<td>0%</td>
<td>?</td>
<td>Age data only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Žarkovo</td>
<td>Schwartz (1992)</td>
<td>?</td>
<td>249</td>
<td>41.8</td>
<td>18.1</td>
<td>3.2</td>
<td>0.8</td>
<td>30.1</td>
<td>4.4</td>
<td>0.4</td>
<td>0.0</td>
<td>1.2</td>
</tr>
</tbody>
</table>
of sheep and goats are stated the latter are typically rare, so the ‘caprine’ category is assumed overwhelmingly to represent sheep. Apart from the wild and domestic forms of cattle and pigs, some analysts list specimens of indeterminate domestication status. These are assigned to the wild or domestic categories pro rata here, using the frequencies of positively identified specimens.2

**Age and sex data**

Age-at-death estimates and sex ratios are among the most useful data for assessing the ways in which people managed and used domestic animals. Any changes that affect either the aims or the practicalities of herding – and hence influence slaughter decisions – may be visible through shifts in mortality profiles. Equifinality is a major problem, however (Halstead, 1998), and it is now widely recognized that ideal ‘signature’ mortality profiles for different exploitation strategies – meat, milk, wool, etc. – ignore the sheer range of factors involved in slaughter decisions, from herd security and availability of fodder (Redding, 1981) to prestige and the importance of animals in exchange or communal consumption (Russell, 1998). An increase in social incentives to maintain herds of cattle, for example, might result in higher representation of mature animals, but this would not necessarily be distinguishable from changes designed to improve herd security or from a slight shift in priority between meat and milk production.

Sex data can help to tease out likely explanations for changes in mortality. The handful of central Balkan Neolithic assemblages with systematically reported sex ratios do not allow for anything more than anecdotal comparison, however; even where ratios and sample sizes are given it is not always clear which elements and criteria were used.

Relatively few central Balkan Neolithic sites have published age data, and fewer still have standardized mortality profiles suitable for inter-site comparison. The most useful data come from sites studied by Greenfield (2005), who uses Payne’s (1973) system of age classes to compare Neolithic and post-Neolithic herding strategies. The Neolithic portion of this dataset is re-analysed below for cattle and caprines – supplemented by data from Opovo (Russell, 1993) and the author’s own results from Gomolava (Orton, 2008) – to detect any changes over the course of the Neolithic period.

**Recovery bias**

Inter-site comparison on the scale attempted here inevitably introduces potential for biases due to a range of factors, from bone preservation conditions to identification protocols, but the most worrying is recovery methodology. The relationship between sieving and taxonomic frequencies has been demonstrated at Petnica (Orton, 2008: 210–11) and Opovo (Russell, 1993: 90–94), although Clason and Prummel (1977) play down its importance at Gomolava. Small species will inevitably be underrepresented in hand-collected assemblages, but unless frequency of sieving is correlated either with geographical location or with time period – which does not appear to be

---

2. Relative proportions of wild and domestic pigs at Opovo are given as Diagnostic Zone (DZ) counts, following Watson’s (1979) more robust quantification system in which only unique specimens of (primarily) articular ends are counted. NISP data are only available for all pigs combined. The DZ ratios for each phase are used here to estimate the NISP for each form. For Selevac, relative proportions of wild and domestic forms are stated for the entire site rather than individual phases, and it has therefore been necessary to assume a constant ratio. Any changes between phases in the wild:domestic ratios for pigs or cattle would have to have been extreme (and opposite to overall regional trends) to be responsible for the patterns observed here. Smaller shifts no doubt occurred but are unlikely significantly to have affected the observed trends.
the case here – differences in recovery regime are far more likely to blur the data and obscure genuine trends than to create false patterns or introduce systematic bias. The analysis of trends over time at individual sites also provides a control for recovery methodology.

Figure 2 shows the contribution of ‘small’ species (primarily caprines, roe deer and dog) to central Balkan Neolithic assemblages, sorted by recovery strategy. In the majority of cases the recovery regime is not stated, but it is probably safe to assume that this usually means little or no sieving was undertaken. Sieving does appear to be a major factor, with small mammals particularly common at Anzabegovo, Cauce cave, and Foeni-Sălaș, though notably less so at Petnica and Vinča. Among the ‘unknown’ group, the highest values are predominantly from early Neolithic sites on the Hungarian Plain. While some of these might indeed have been unusually thoroughly sieved, there is no reason to think that this is true in general, especially since the Plain is divided between three countries and three archaeological traditions. Rather, there seems to be a genuinely higher frequency of caprines at these sites.

**Chronology**

Assemblages are compared on three scales. Firstly, sites are grouped into earlier Neolithic and later Neolithic on typological grounds, as in Table 1. The former group includes the SKC and Anzabegovo-Vršnik cultural groups, whereas the latter covers the Vinča, Vinča-Turdaș, Kakanj, Butmir, Banat, and Foeni groups. Where successive phases at a site straddle this division – as at Obre I – their fauna are treated as separate

![Figure 2. Contribution of ‘small’ species (caprines, roe deer, dog) to faunal assemblages with varying frequencies of sieving.](image-url)
assemblages. The next scale includes four chrono-typological groups, corresponding approximately to Starčevo-Criş IA-IIA (‘EN1’), Starčevo-Criş IIB-IV (‘EN2’), Vinča A-B (‘LN1’), and Vinča C-D (‘LN2’) as defined by Lazarovici (1984) and Milojčić (1949). Again, assemblages are divided by phase where necessary.

Finally, aspects of the zooarchaeological data are plotted on an absolute chronological scale to facilitate comparison of trends within and between sites. Approximate date ranges for many sites with published faunal data (and for individual phases where appropriate) are estimated using published radiocarbon results, while twenty-seven new AMS dates were obtained on animal bone from the three sites with the most detailed zooarchaeological studies: Gomolava, Petnica, and Opovo. Boundaries and simple stratigraphic modelling are employed where appropriate using OxCal 4.1.7 (Bronk Ramsey, 2009; atmospheric data: Reimer et al., 2009) to improve the precision of estimated age ranges. Samples with standard deviations of 150 years or more are excluded from analysis, as are extreme outliers.

**NEW DATING RESULTS**

Details of the new AMS dates from Gomolava, Petnica, and Opovo are given in Table 2, and their contexts represented schematically in Figure 3.

**Gomolava**

Gomolava is a large tell site on the river Sava, around 60 km west of modern Belgrade. Three Neolithic phases were distinguished by the excavators: Ia, Iab, and Ib, typologically dated to Vinca B2-D (Brukner, 1980, 1988); see Borić (2009: 221–27) for a good summary of research. Gomolava Ia is characterized by large pits, with a single post-hole structure assigned to the phase. Gomolava Iab features large buildings recognized from post-holes, while Ib has smaller but quite densely packed houses, most of which were destroyed by fire. Gomolava Ib also includes the only known late Vinča cemetery, thought to represent the latest phase of activity at the site. Animal remains were studied by Clason (1980) and more recently the present author (Orton, 2008), the latter concentrating on 1980s excavations in block VII.

Fourteen early charcoal dates from the site (Waterbolk, 1988) concentrated heavily on phase Ib buildings, with a single result from a phase Ia pit. These were recently supplemented by five dates on bone (Borić, 2009), but again focusing on phase Ib and the cemetery, leaving the start of occupation poorly dated. Eight new AMS dates (Table 2, G.3–G.11) were obtained from pits assigned to Gomolava Ia, plus one from a phase Iab pit fill (G.2). An additional sample (G.1) from the remains of house 4/80 (Ib) appears to be intrusive.

Figure 4 shows all the AMS dates from the site, modelled according to the overall phasing. Charcoal dates were removed from the main model since a presumed old-wood effect for some phase Ib samples had an excessive impact on the earlier phases. The new dates place Gomolava Ia in the second century of the fifth millennium BC, with occupation continuing until around 4650 cal BC.

**Petnica**

Petnica is a small site in the Kolubara valley, western Serbia. Covering an estimated 1 ha, it is located on a slope in front of a north-facing cliff, immediately adjacent to one of two cave mouths. Three phases of occupation were identified (Starović, 1993, pers. comm.; see Borić, 2009: figure 41).
Table 2. Details of new radiocarbon results from Gomolava, Opovo, and Petnica.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sample</th>
<th>Site</th>
<th>Phase</th>
<th>Feature</th>
<th>Unit</th>
<th>Specimen</th>
<th>Species</th>
<th>Element</th>
<th>Lab no.</th>
<th>Date BP</th>
<th>s.d.</th>
<th>δ¹³C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>O.5</td>
<td>Opovo</td>
<td>BH3</td>
<td>F30</td>
<td>1588</td>
<td>–</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-21123</td>
<td>5978</td>
<td>35</td>
<td>-21.04</td>
</tr>
<tr>
<td>1b</td>
<td>O.5</td>
<td>Opovo</td>
<td>BH3</td>
<td>F30</td>
<td>1588</td>
<td>–</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-21124</td>
<td>6036</td>
<td>36</td>
<td>-20.92</td>
</tr>
<tr>
<td>2</td>
<td>O.6</td>
<td>Opovo</td>
<td>BH3</td>
<td>F30</td>
<td>1596</td>
<td>–</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-21125</td>
<td>5973</td>
<td>35</td>
<td>-20.68</td>
</tr>
<tr>
<td>3</td>
<td>O.7</td>
<td>Opovo</td>
<td>BH3</td>
<td>F41(W)</td>
<td>1604</td>
<td>27.43</td>
<td><em>Cervus elaphus</em></td>
<td>Metapodial</td>
<td>OxA-21126</td>
<td>5966</td>
<td>36</td>
<td>-20.35</td>
</tr>
<tr>
<td>4</td>
<td>O.8</td>
<td>Opovo</td>
<td>BH2</td>
<td>F41(E)</td>
<td>1663</td>
<td>–</td>
<td><em>Bos/Cervus</em></td>
<td>Tibia</td>
<td>OxA-21127</td>
<td>5921</td>
<td>35</td>
<td>-19.47</td>
</tr>
<tr>
<td>5</td>
<td>O.9</td>
<td>Opovo</td>
<td>BH2</td>
<td>F41(E)</td>
<td>1744</td>
<td>–</td>
<td><em>Capreolus capreolus</em></td>
<td>Metatarsal</td>
<td>OxA-21128</td>
<td>5926</td>
<td>35</td>
<td>-20.51</td>
</tr>
<tr>
<td>6</td>
<td>O.11</td>
<td>Opovo</td>
<td>BH3</td>
<td>F45</td>
<td>1863</td>
<td>–</td>
<td><em>Bos/Cervus</em></td>
<td>Metatarsal</td>
<td>OxA-21129</td>
<td>5963</td>
<td>34</td>
<td>-20.63</td>
</tr>
<tr>
<td>7</td>
<td>O.12</td>
<td>Opovo</td>
<td>BH3</td>
<td>F45</td>
<td>1876</td>
<td>–</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-21130</td>
<td>5972</td>
<td>37</td>
<td>-20.09</td>
</tr>
<tr>
<td>8</td>
<td>O.13</td>
<td>Opovo</td>
<td>BH2</td>
<td>F52</td>
<td>1783</td>
<td>–</td>
<td><em>Bos/Cervus</em></td>
<td>Tibia</td>
<td>OxA-21212</td>
<td>5913</td>
<td>30</td>
<td>-20.70</td>
</tr>
<tr>
<td>9</td>
<td>O.14</td>
<td>Opovo</td>
<td>BH2</td>
<td>F52</td>
<td>1797</td>
<td>–</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-21131</td>
<td>5992</td>
<td>39</td>
<td>-20.79</td>
</tr>
<tr>
<td>10</td>
<td>O.15</td>
<td>Opovo</td>
<td>BH2</td>
<td>F52</td>
<td>1885</td>
<td>–</td>
<td><em>Large mammal</em></td>
<td>Long bone</td>
<td>OxA-21454</td>
<td>5887</td>
<td>36</td>
<td>-20.1</td>
</tr>
<tr>
<td>12</td>
<td>G.2</td>
<td>Gomolava</td>
<td>Ia-b</td>
<td>Pit 1/83</td>
<td>23/84</td>
<td>12</td>
<td><em>Bos taurus</em></td>
<td>Humerus</td>
<td>OxA-21133</td>
<td>5934</td>
<td>40</td>
<td>-20.19</td>
</tr>
<tr>
<td>13</td>
<td>G.3</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 1/83</td>
<td>41/84</td>
<td>17</td>
<td><em>Sus scrofa</em></td>
<td>Femur</td>
<td>OxA-21134</td>
<td>5971</td>
<td>37</td>
<td>-20.80</td>
</tr>
<tr>
<td>14</td>
<td>G.4</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 1/83</td>
<td>43/84</td>
<td>9</td>
<td><em>Cervus elaphus</em></td>
<td>Humerus</td>
<td>OxA-21135</td>
<td>6020</td>
<td>40</td>
<td>-22.25</td>
</tr>
<tr>
<td>15</td>
<td>G.5</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 2/83</td>
<td>20/84</td>
<td>7</td>
<td><em>Bos taurus</em></td>
<td>Metacarpal</td>
<td>OxA-21136</td>
<td>6105</td>
<td>40</td>
<td>-20.98</td>
</tr>
<tr>
<td>16</td>
<td>G.6</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 2/83</td>
<td>30/84</td>
<td>9</td>
<td><em>Bos taurus</em></td>
<td>Humerus</td>
<td>OxA-21137</td>
<td>5985</td>
<td>33</td>
<td>-20.43</td>
</tr>
<tr>
<td>17</td>
<td>G.7</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 2/83</td>
<td>37/84</td>
<td>5</td>
<td><em>Bos taurus</em></td>
<td>Femur</td>
<td>OxA-21138</td>
<td>5946</td>
<td>35</td>
<td>-20.82</td>
</tr>
<tr>
<td>18</td>
<td>G.8</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 12/84</td>
<td>19/84</td>
<td>17</td>
<td><em>Bos taurus</em></td>
<td>Femur</td>
<td>P24877</td>
<td>Not enough collagen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>G.11</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 12/84</td>
<td>19/84</td>
<td>15</td>
<td><em>Bos taurus</em></td>
<td>Humerus</td>
<td>OxA-22339</td>
<td>5944</td>
<td>34</td>
<td>-21.43</td>
</tr>
<tr>
<td>20</td>
<td>G.9</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 12/84</td>
<td>6/85</td>
<td>23</td>
<td><em>Bos taurus</em></td>
<td>Humerus</td>
<td>OxA-21139</td>
<td>5964</td>
<td>35</td>
<td>-20.40</td>
</tr>
<tr>
<td>21</td>
<td>G.10</td>
<td>Gomolava</td>
<td>Ia</td>
<td>Pit 12/84</td>
<td>6/85</td>
<td>88</td>
<td><em>Bos taurus</em></td>
<td>Tibia</td>
<td>OxA-21140</td>
<td>5930</td>
<td>35</td>
<td>-20.82</td>
</tr>
<tr>
<td>22</td>
<td>P.1</td>
<td>Petnica</td>
<td>3</td>
<td>Upper Pit 2</td>
<td>97–1378</td>
<td>3</td>
<td><em>Cervus elaphus</em></td>
<td>Humerus</td>
<td>OxA-23221</td>
<td>6034</td>
<td>38</td>
<td>-22.14</td>
</tr>
<tr>
<td>23</td>
<td>P.3</td>
<td>Petnica</td>
<td>1</td>
<td>House 1 wall collapse</td>
<td>97–1642</td>
<td>1</td>
<td><em>Cervus elaphus</em></td>
<td>Metatarsal</td>
<td>OxA-23222</td>
<td>6002</td>
<td>37</td>
<td>-21.41</td>
</tr>
<tr>
<td>24a</td>
<td>P.4</td>
<td>Petnica</td>
<td>3</td>
<td>Loom</td>
<td>97–1377</td>
<td>1</td>
<td><em>Cervus elaphus</em></td>
<td>Humerus</td>
<td>OxA-23223</td>
<td>6074</td>
<td>37</td>
<td>-21.76</td>
</tr>
<tr>
<td>24b</td>
<td>P.4</td>
<td>Petnica</td>
<td>3</td>
<td>Loom</td>
<td>97–1377</td>
<td>1</td>
<td><em>Cervus elaphus</em></td>
<td>Humerus</td>
<td>OxA-23224</td>
<td>5970</td>
<td>36</td>
<td>-21.54</td>
</tr>
<tr>
<td>25</td>
<td>P.5</td>
<td>Petnica</td>
<td>2</td>
<td>Upper Pit 3</td>
<td>97–1656</td>
<td>1</td>
<td><em>Bos/Cervus</em></td>
<td>Scapula</td>
<td>OxA-23225</td>
<td>5937</td>
<td>36</td>
<td>-20.94</td>
</tr>
<tr>
<td>26</td>
<td>P.6</td>
<td>Petnica</td>
<td>1</td>
<td>House 1 wall collapse</td>
<td>97–1640</td>
<td>1</td>
<td><em>Bos/Cervus</em></td>
<td>Metatarsal</td>
<td>OxA-23226</td>
<td>6047</td>
<td>37</td>
<td>-21.60</td>
</tr>
</tbody>
</table>
Petnica 1 (Vinča B2) included damaged remains of two buildings – houses 1 and 4 – neither of which was extensively excavated. Only one possible building – ‘house 2’ – was found in Petnica 2 (Vinča C), but an outdoor oven with an associated activity area and pit (pit 3) are assigned to the phase, and overlie house 1. The latest phase, Petnica 3 (possibly Vinča D1) features badly preserved remains from a single large structure (house 3), overlying the phase 2 oven/pit/activity area. A small pit (pit 2), also assigned to this phase, may have been cut from the floor of house 3. Animal bones from the 1980s excavations were published by Greenfield (1986), and a larger sample from the 1990s was studied by the present author (Orton, 2008). This sample derives mostly from the later phases, although Petnica 1 is also represented.

Five new dates from Petnica (Table 2) supplement a single previous result for the phase 2 activity area (OxA-14754, Borić,
Two (P.3, P.6) were taken from units described as collapsed rubble from house 1 – in the earliest phase – and one (P.5) was taken from pit 3 to provide a second date for Petnica 2. Of two samples from Petnica 3, P.4 is associated with a cluster of loom weights inside house 3, while P.1 is taken from pit 2.

Modelling the dates according to their assigned phases results in a very low agreement index ($A = 35$). Sample P.5 – supposedly from Petnica 2 – is actually

Figure 4. Radiocarbon dates from Gomolava.
the most recent date at the site, raising the possibility that pit 3 is intrusive, either from the level of house 3 or slightly later. Given that there was some disturbance to house 3 this is not implausible. The two dates from the rubble of house 1 are both more recent than the previously published date for Petnica 2, and it seems likely that are not in fact contemporary with the house collapse but rather with phase 2 activity. Given that the majority of studied animal bones assigned to Petnica 1 are from similar contexts, phases 1 and 2 are merged for this study. Despite these problems, the construction of house 3 provides a reasonably reliable boundary between the Petnica 3 and Petnica 1/2 samples. Figure 5 shows the dates modelled on this basis, accepting the hypothesis that pit 3 is intrusive. This suggests occupation in the first two centuries of the fifth millennium BC, although it presumably started somewhat earlier given the lack of samples securely associated with Petnica 1.

**Opovo**

Opovo is another small site, located in the southern Banat around 25 km north of Belgrade, on an old meander of the Tamiš River. Excavation of a 320 m² trench in the 1980s revealed three successive building horizons, all typologically dated to Vinča C (Tringham et al., 1985, 1992). Each of these includes both building remains and pits, with the best-preserved houses in the earliest (BH3) and the latest (BH1). These houses are smaller and simpler than is typical for Vinča sites, and show little sign of change over time. A reasonable sample of animal bones from earlier excavations was published by Greenfield (1986), but more than 13,000 identified bones from all horizons are reported from the 1980s excavations (Russell, 1993).

Ten AMS samples were obtained from four pits belonging to BH3 and BH2 (Table 2). Two samples each are taken from features 30 and 45 in BH3, and

---

**Figure 5.** Radiocarbon dates from Petnica, following tentative stratigraphic revisions.
three samples from feature 52 in BH2. Feature 41 spans both horizons, with the original fill (F41W) assigned to BH3 and a re-cut (F41E) to BH2. One date was taken from the former and two from the latter.

Figure 6 shows the results, grouped according to building horizon. The dates are highly consistent with the stratigraphy: all but one of the BH2 dates are later than all the BH3 dates. The exception, OxA-21131 (O.14), may either be residual or a statistical outlier, since two other dates from F52 are consistent with its placement in BH2. The dates support the suggestion of a brief occupation, with the first two horizons potentially occupied within an 80-year period between around 4860 and 4780 cal BC.

### Other Dated Assemblages

Figure 7 shows estimated date ranges for other sites from which both radiocarbon dates and faunal assemblages are reported by phase. Since most determinations were made on charcoal they should be treated with caution, and extreme outliers have been rejected. The length of estimated ranges is a function both of actual phase length and of uncertainty; improved dating would be likely to reduce apparent occupation durations. Figure 8 shows estimated ranges for single-phase faunal assemblages and for sites with limited phasing information, while individual dates from sites with published fauna are shown in Figure 9.

The tell of Parța 1 has five main Neolithic levels, with increasingly substantial...
and densely packed houses from 7a through 7b and 7c to 6, then a return to fewer and smaller buildings in 5 (Dragojevic, 2007). Zooarchaeological results are given by level, with 7b–7c combined (El Susi, 1995). The published dates are listed by two typological phases, ‘Banat I’ and ‘Banat II’ (Mantu, 2000: 98–99), without context information, but from the excavators’ discussion appear to relate to levels 7c and 6, respectively. Level 5 is typologically dated to Vinča C, as is the occupation of Parta 2, a separate tell a few hundred metres away (Dragojevic, 2007).

Occupation at Selevac is divided into stratigraphic-architectural (S-A) phases I–IV. The two dates from S-A III are

---

**Figure 7.** Dating by phase for Anzabegovo, Obre I and II, Parța 1, and Selevac.
considerably later than those from I–II and several centuries too late for their typological placement in Vinča B/C. Descriptions of both samples reveal some doubts over their phasing (Tringham and Krstić, 1990b: 50), so it is possible that they are intrusive from S–A IV or even later. They are taken here to represent the final phase of Neolithic occupation.

Taken together, the dates underline the fact that broadly similar patterns of settlement development at different sites are far from synchronous; the new dating from Gomolava probably places its foundation

Figure 8. Estimated date ranges for other Neolithic sites with studied faunal assemblages. Sources: Biagi et al. (2005), Bonsall et al. (2008), Borić (2009), Borić and Dimitrijević (2007), Borić and Miracle (2004), Breunig (1987), Draşovean (2005), Greenfield and Jongisma (2008), Hoffman et al. (2009), Karmanski (2005), Luca (2003), Luca et al. (2006), Spataro (2006), McPherron and Srejović (1988), Tasić (1988), Whittle et al. (2002).
well after the abandonment of Parța, while the sequence at Selevac (as, of course, that at Vinča-Belo Brdo) overlaps with both.

RESULTS AND DISCUSSION

Regional trends

The relative contributions of wild and domestic species at individual sites are plotted in Figure 10a and b. Differences in geographical coverage are immediately apparent between the earlier Neolithic and later Neolithic samples. A cluster of Körös (early Neolithic) sites in the far north of the study region has no counterpart in the later period, although other parts of the Hungarian Plain remain well represented. Wild species continue to play a significant role throughout the Neolithic, but with considerable variation between sub-regions and individual sites. Some of this can be accounted for in terms of environment, but much cannot – note, for example, the difference between the sites of Nosa-Biserna Obala (21) and Ludoš-Budžak (15), located close together on the Plain. Where a direct comparison can be made between periods, there is no consistent trend: wild species appear to become more important in the Banat, for example, while the reverse is true for Đerdap. Figure 11a plots summary data on a slightly less coarse chronological scale, revealing that the contribution of wild species actually increases slightly on average from the earliest to latest Neolithic, although this is dwarfed by variation between sites within each period.

The continued importance of hunted species by the end of the Neolithic – over
a millennium after the introduction of domesticates – should not necessarily be surprising; wild resources frequently play a major part in the subsistence of European Neolithic communities (Boyle, 2006). Wild animals do all but disappear from the faunal record with the onset of the Neolithic in some regions, including the southern Balkans (Perlès, 2001), but such an extreme shift is hard to explain in purely ecological terms. Rather, it suggests deliberate choices regarding appropriate and inappropriate activities (Perlès, 2001: 152; Marciniak, 2005: 205), choices that clearly did not apply in the central Balkan case.

Relative abundances of the main domestic species kept by Neolithic communities are also important, since each has different properties in terms of mobility, management requirements, and potential scale of herding. In the earlier Neolithic (Figure 10c) there is a fairly clear division along geographical lines. Sites among the hills and river valleys in the centre of the region generally have a high ratio of cattle to caprines, while sheep and goats – primarily the former – typically play a leading role at

Figure 10. (a and b) Relative contributions (NISP) of wild and domestic mammals at individual sites in the earlier and later Neolithic. (c and d) Relative contributions (NISP) of the major domesticates at individual sites.
Plains' sites in the north and on the high-altitude plateaux of Macedonia to the south. Domestic pigs play a negligible role apart from at the two sites in Šumadija. Poor recovery will in most cases have biased the totals in favour of cattle, and the effects of unusually thorough sieving are presumably seen at Anzabegovo, Foeni-Sălaș, and Cauce cave (1, 9, 26), but it would be hard to account for the overall pattern in terms of a systematic bias.

Moving into the later Neolithic (Figure 10d), the picture changes dramatically. Cattle become the main domesticate even at sites on the plain, while domestic pigs take on a widespread importance for the first time. Summary data confirm the impression of a clear increase in the importance of cattle among the domesticates and indicate that it took place quite suddenly (Figure 11b), although the shift in geographic coverage may have exaggerated its magnitude slightly.

The relative importance of caprines in the southern sites is unsurprising, since they lie in a transitional zone between the temperate and semi-arid Balkans that is well suited to sheep and goat husbandry. The role of caprines in the north during the earlier Neolithic is harder to explain: while the Plain may well have been less wooded than other areas, with more open grassland, its often marshy conditions prior to recent drainage would have rendered it less than ideal for sheep (Bartosiewicz, 2005: 51), and indeed arguably more suitable for cattle or pigs. Tradition might potentially have played a role in the earliest Neolithic, with Körös shepherding perhaps reflecting a reluctance to modify herding practices developed in a very different environment (see Whittle, 2005: 68). Caprines may have been kept on a relatively small scale, perhaps grazing on cleared land in an intensive garden agriculture system, as suggested for central Europe and the southern Balkans (Bogaard, 2004; Halstead, 2006). In this case, their prominence at many northern sites would imply that all animals are represented in small numbers, i.e. that relatively little meat was consumed.

The changes in the later Neolithic are difficult to account for in environmental terms, especially since any increase in

![Figure 11. Box-plots showing (a) contribution of wild mammals and (b) cattle as a percentage of domesticates, by chrono-typological period (see text for definitions).](image-url)
land clearance would be expected actually to favour sheep. The shift instead towards cattle and pigs could be seen as a delayed adjustment to local conditions, but the lag of almost a millennium would be surprising. If maintenance of a culturally important shepherding tradition is invoked then one might ask why this changed relatively suddenly. An alternative scenario involves changing mobility patterns: whereas small herds of sheep would have been suitable for intensive grazing with frequent movement between cleared areas (see Greenfield & Jongsma, 2008), pigs are more suited to herding around a fixed point, potentially making use of wetter and/or more wooded territory on the fringes of settled areas. Cattle could fit into either model, but are arguably better suited to the latter.

At the same time, social imperatives for herding should not be underestimated. Domestic animals in non-market societies are typically killed for particular social events rather than exclusively for subsistence (Keswani, 1994; see also: Blanton & Taylor, 1995; Parker Pearson, 2000: 223), and there is no reason to think that the Balkan Neolithic was an exception. The sheer size of cattle – and to a lesser extent pigs – makes it almost a given that they were routinely consumed on a level above the ‘household’ or nuclear family group (Halstead, 2007). Nor should one ignore the potential social value of live animals, both for prestige and for their frequent role in exchange (Reid, 1996; Russell, 1998), and cattle in particular are the only temperate European domesticate to meet Ingold’s (1980: 224–26) criteria for an animal to act as a unit of wealth.

**Age-at-death data**

The limited available age data for caprines and cattle in the central Balkan Neolithic are plotted in Figure 12.3. In both cases a subtle shift is observed over time, particularly between the LN1 and LN2 periods.

For caprines the shift is fairly clear. All sites show a fairly gradual slaughter of animals over the first three years of life, which speaks of a generalist management policy rather than specialization for any particular resource. In later sites, however, fewer animals were killed during the first two years of life and particularly during the first six months. This appears to be a gradual trend through the later Neolithic and could potentially be interpreted as a slight shift in focus towards milk production within the low-intensity ‘type B’ model, which is characterized by gradual slaughter of lambs over the first year (see Vigne & Helmer, 2007). Thanks to biochemical evidence, ruminant milk is now thought to have been used to some extent from the outset of the European Neolithic (Evershed et al., 2008), but there is little in these age profiles to suggest a shift to the kind of specialized dairying implied by Sherratt’s (1981) secondary products revolution. Selevac is something of an exception and might represent relatively specialized milk production, with a much larger cull in the first six months of life than seen elsewhere, although the pooling of all phases is problematic. The shift at the other sites could alternatively reflect increasing concern with herd security, especially if herd sizes were smaller than in earlier periods or if caprines came to play a supporting role to other species.

The data for cattle are more problematic, partly due to the small sample sizes of most assemblages. Whereas Greenfield (2005) argued for meat-oriented herding during

---

3. Greenfield’s (2005) data have been used here as presented, without attempting to address apparent artefacts of rounding in the corrected counts. Hence, some sample sizes include decimals when by definition the total sample should be a whole number. This has an imperceptible impact on the shape of the mortality curves and does not affect interpretation.
the Neolithic, Vigne and Helmer (2007: 29) take the same data as evidence for milk production. Leaving aside the new sample from Gomolava, there seems to be a reduction over time in the number of animals killed during the first 18 months of life. In some later Neolithic cases this is made up for by an increased cull of cattle between around 18 months and 3 years old, with a similar number of animals surviving to maturity as at the earlier sites. If the small samples are trusted, then this change could represent a shift away from milking and towards more focused production of meat.

Stragari (early Vinča) and the very large sample from Gomolava (late Vinča) both show a markedly different pattern, however, with high kill-offs in the first 18 months and again in early adulthood. This would have resulted in herds with a large number of young adults, which in the case of Stragari is interpreted by Vigne and Helmer (2007) as dairying. A fairly high female:males ratio at Gomolava (2.43:1 based on 24 sexed pelves; Orton, 2008: 120) supports this interpretation, although an almost identical ratio is observed at Opovo (2.44:1, pelves and metrical data, \( n = 519 \); Russell, 1993: 356), where the presumed meat-focused profile applies. Taxonomic frequencies are unfortunately not available for Stragari, but Gomolava has a notably high relative frequency of cattle. Comparing mortality profiles between phases at Gomolava reveals almost identical curves (Orton, 2008: 190). Taken together, the cattle data

![Figure 12. Age profiles for (a) caprines and (b) domestic cattle from central Balkan Neolithic assemblages. Earlier Neolithic sites are plotted in grey, later Neolithic sites in black. Sites are listed in rough chronological order in the legends. Small samples (\( n < 25 \)) are plotted using dashed lines. Data from Greenfield (2005), apart from Gomolava (Orton, 2008), Selevac (Legge, 1990), and Opovo cattle (Russell, 1993).]
point towards a diversification from fairly generalist early Neolithic herding to slightly more specialized meat and milk production at different sites in the later part of the period.

**Intra-site trends**

Figure 13a shows the relative abundance of wild species at central Balkan Neolithic sites on an absolute chronological scale,

---

**Figure 13.** Contribution of wild mammals (a) and cattle as a percentage of domesticates (b) at central Balkan Neolithic sites, plotted on an absolute chronological scale. Error bars represent the ranges shown in Figures 7–9.
with trends over time at individual sites highlighted. The absence of multi-phase assemblages from the earlier part of the Neolithic is not a research bias but simply reflects the generally short-lived nature of the vast majority of sites in this period.

The increase in representation of wild species noted above is much less apparent here. Several sites – Gomolava, Selevac, and Sânandrei – actually have the opposite trend, with clear decreases between phases in the relative frequency of hunted species. Most of the remaining sites show little change, although at Parţa a sharp increase in the representation of hunted species between the first and second phases is followed by a decline in the last stage of Neolithic occupation.

Plotting the contribution of cattle among domesticates in the same format reveals considerable diversity in trajectories (Figure 13b). Interestingly, the sites with clear decreases in the abundance of wild species also show phase-on-phase increases in the relative importance of cattle, while at some sites with increasing hunting, such as Liubcova, the reverse is true. In fact, there seems to be a general, though not universal, negative relationship between the contributions of cattle amongst domesticates and of wild species, hinting that we may be seeing absolute changes in the amount of cattle represented. Parţa has a more complex pattern of change: the relative importance of domestic cattle decreases after phase 7b/c, although the contribution of wild cattle increases dramatically at the same point.

The occurrence of common trends in animal use at Selevac and Gomolava – only partially overlapping chronologically – is interesting given that these are two of the main sites on which models of change over time during the central Balkan Neolithic have been based. Parţa also falls into this category, however, but shows a very different pattern of change. Sânandrei, a multi-layered lowland tell site (Jongsma & Greenfield, 1996), is smaller and less thoroughly investigated. Although the contribution of cattle at Selevac appears significantly lower than at Gomolava and elsewhere, this is probably in large part due to unusually thorough sieving.

The decline in wild species at some large, long-term sites might reflect increasing habitat disturbance, as argued by Legge (1990: 221–22) for Selevac. Anthropogenic impact on the Balkan Neolithic landscape is now believed to have been much more subtle and complex than a simple forest-clearance model would imply; however (Gardner, 1999), and the pollen record shows no detectable deforestation around Gomolava (van Zeist, 2002: 112). Chapman’s (1990) model of change from on-site gardens to off-site plots at Selevac and elsewhere might actually increase potential for opportunistic or protective ‘garden hunting’, provided that plots remained relatively small and dispersed. The increased importance of cattle certainly cannot be accounted for in this way – if anything, forest clearance would favour caprine herding.

Depletion of local wild fauna is perhaps more likely, although only Sânandrei shows the relative switch to smaller game expected in such circumstances, while the low density of settlements would presumably have allowed repopulation from unsettled areas. Systematically reported age data for hunted species on Vinča sites are very rare, but the contribution of prime-aged red deer and wild pig at Gomolava decreases significantly over time, matching the overall contribution of those species (Orton, 2008: 113–14). The implication is that opportunistic hunting continued while targeted pursuit of prime-aged game became less frequent, suggesting that it was demand rather than supply that declined over time.
There would certainly be a limit to the amount of game that could be caught within a practical radius of the increasingly permanent sites of the later Neolithic, however, so it is not surprising that growing populations at sites such as Selevac apparently became more reliant on domestic animals over time. Grazing land around such sites would also have been increasingly limited, and the growing dominance of cattle may represent a shift from intensive husbandry around garden plots to large-scale cattle herding at a greater distance from settlements. This would have interesting implications for the models of change outlined in the introduction (above), both in terms of mobility patterns and of community cohesion.

**Conclusions**

The available zooarchaeological data for the central Balkan Neolithic reveal a marked increase in the importance of cattle in the latter part of the period, largely at the expense of caprines. Plotting zooarchaeological data from individual sites by phase on a single chronological scale reveals a range of trajectories. Hunting remains important throughout in many places, although it declines rapidly over time at several individual sites with long-term occupations. There is some evidence for common links between animal use and settlement developments at Gomolava and Selevac, but any universal connection is undermined by almost the opposite trend at Parţa.

There is a limit to how much can be said about connections between animal use and settlement histories from the data currently available. Zooarchaeological results are not always reported by phase, and several long-lived sites such as Okolište have had to be treated as a single unit. Improved dating would also be useful at several sites – notably Selevac – in order to establish rates of change and to confirm contemporaneity/overlap between different sites and sequences. Nonetheless, the overall impression is of diversity, with some sites reinforcing the overall regional trends while others seem to work against them.

On the basis of labour costs, Halstead (1996) argues that large-scale herding in prehistory would have required heavy specialization in a single species and a degree of mobility, at least for herds and herdsmen if not necessarily for the population as a whole. By the second half of the Vinča period, the dominance of cattle at many sites makes large-scale herding a distinct possibility. A logistical separation of herding from other activities might have permitted greater residential permanence on the part of those not directly involved with the herds, promoting a shift away from residential mobility and towards a pattern of radiating mobility in which a segment of the community was actually increasingly mobile on a seasonal or otherwise short-term basis. The development of large-scale cattle herding may thus have been one element in a transition from ‘moving on’ to ‘moving around’ – that is, from frequent relocation of settlements to extensive mobility around settlements (see Whittle, 1997) – among some later Neolithic communities. Importantly, this process does not seem to have been either universal or synchronous: sedentism rested upon establishment of commitment to specific places and particular communities, rather than any region-wide ‘settling-down’ of the population.

The hypothesis of increasingly large-scale herding might be explored through on-site penning, although there is currently little clear evidence for or against the practice at later Neolithic sites. Large ancillary structures associated with particular houses in the second phase at Gomolava (Iab) could plausibly have housed cattle belonging to
the occupants, although this is only one possible interpretation. For that matter, livestock could quite feasibly have dwelt alongside humans in the largest post-hole structures during this phase (see plan in Brukner, 1980). The disappearance of large ancillary buildings in the last Vinča phase at the site and a reduction in house size might imply that livestock were increasingly kept off-site. A similar case could be made for Banjica (see Tripković, 2007). This argument remains highly tentative without independent confirmation from, for example, phytolith or soil micromorphology studies. Currently, the only direct evidence for animals in houses is anecdotal: caprine hoof prints were found in clay house floors at Matejski Brod (Nad, 1953) and at Stubline-Crkvina (A. Crnobrnja, pers. comm.).

Cattle herding may have come to play a cohesive role, helping to promote the formation and maintenance of the large communities seen at the end of the Balkan Neolithic. Increasingly competitive social relations must have increased the value of owning – and exchanging – livestock. Conversely, increased reliance on domesticates for subsistence might have served to promote competition. Domestic animals – simultaneously subjects and objects – constitute the inalienable artefact *par excellence*, and herds can come to materialize complex networks of enchained social relations (Orton, 2010). This could apply equally to caprines and even pigs, but the high individual value of cattle might make them particularly important for exchange, while the necessity of sharing large carcasses has already been mentioned. At the same time, the practical activities involved with herding itself are likely to have involved a degree of co-operation above the ‘household’ level, creating additional ties between people.

The proposed position of cattle as foci in the negotiation of social tensions may be reflected in their apparent symbolic role. While Balkan Neolithic zoomorphs are typically either stylistic or non-specific, most of those judged to be representational resemble cattle (Bailey, 2000: 184). Nangoğlu (2008: 10) takes the representation of humans and domesticates but not wild species during the earlier Neolithic to indicate a focus on ‘humans and animals within the community’. This argument seems to hold for the later Neolithic, suggesting some continuity in the place of domestic animals within society, perhaps with an increasing focus on cattle. Clusters of figurines found *in situ* (Chapman, 1981: 73; Šljivar & Jacanović, 2005) might represent herds (Marangou, 1996).

By the late Vinča period, bucrania are reported from most extensively excavated settlements, including Gomolava Ib, Stubline, Jakovo, Uivar, and Vinča itself. A systematic review is badly needed, but bucrania appear to be primarily a later Neolithic phenomenon associated particularly with houses (Chapman, 1998: 125), prompting suggestions of links to ideas of cattle ownership and household wealth (Chapman, 1981: 68; Russell, 1998). If correct, a shift in the symbolic associations of cattle from the community to the house/household would certainly be interesting.

Cattle mortality profiles from Gomolava and Stragari indicate herds with a large number of young adults, implying a degree of specialization for milk production, while those from other later Neolithic sites, including Opovo and Petnica, fit better with fairly focused meat production. Selevac also falls loosely into the latter group, although the pooling of phases may mask changes over time. Could the development of large-scale herding have been linked to milking in at least some cases? If so, this need not be a straightforward causal link: the social value of live animals might have created the conditions for the adoption and refinement of dairying as
much as vice versa, and we now know that milking probably took place on a low level throughout the Neolithic. Nonetheless, systematic use of secondary products would increase the value of live animals, while also expanding the variety of products that could be shared, exchanged, or gifted. If the smaller sample from the earlier site of Stragari can be trusted, it would indicate a development that took place on multiple occasions.

The relationship remains to be established between increasingly large, domestic-focused settlements on the one hand, and smaller sites with continued reliance on hunting on the other. The new dates presented here confirm, for example, that Opovo was founded around the same time as Gomolava and occupied during Gomolava Ia and Iab, in an environment that was not dramatically different, albeit probably slightly wetter (see Van Zeist, 2002; Borojević, 2006: 107–119). Why did one become a major tell with an apparent specialization in cattle herding, while the other remained small and hunting-focused until its abandonment probably a little over a century later? The size and make-up of founder communities may have played a role (see Tringham, 1992; Chapman, 2008), but is difficult to establish. It is not entirely clear that the initial population at Gomolava was actually all that small (cf. Brukner, 1988: 21), while some final Vinča sites such as Divostin II and Mali Borak – both of which have particularly low numbers of wild remains and large amounts of cattle – may have been very large at the point of foundation. The idea of seasonal occupation at Opovo – with occupants spending some of their year at larger sites such as Gomolava or Vinča itself – has been rejected (Russell, 1993: 380) although it cannot be ruled out for other small sites.

This comparison of trends in animal use between sites arguably raises more questions than it answers, but is one step towards integrating subsistence data with settlement histories and absolute chronology – a project that I argue must be undertaken if we are to understand the changes that took place during the Balkan Neolithic. While an overall shift towards cattle herding is clear, and can be traced over time at some of the larger sites, it is certainly not universal, emphasizing that changes over time in the Neolithic took place on the level of individual communities and should be approached on this level.

Acknowledgements

The core of the research presented here was conducted as part of a PhD project fully funded by the University of Cambridge. It could not have been completed without the help of numerous colleagues, but particularly Svetlana Blažič, Dušan Borić, Vesna Dimitrijević, Andrej Starović, and my supervisor Preston Miracle. The new AMS dates were funded by ORADS grant NF/2007/2/8, held jointly by the author and Preston Miracle. Samples were provided by Svetlana Blažič, Nerissa Russell, and Andrej Starović, with the help of staff at the Museum of the Vojvodina, The National Museum at Valjevo, and Petnica Science Center. Ruth Tringham and Mira Stevanović provided useful documentation for Opovo.

Helpful comments on earlier drafts were provided by Arzu Demirergi, Timothy Kaiser, Marko Porčić, Alasdair Whittle, and three anonymous referees, but any shortcomings remain my own. Marko also provided vital references and stimulating discussion, while Mariana Egri supplied a vast quantity of relevant Romanian literature.

References

Arnold, E.R. & Greenfield, H.J. 2006. The Origins of Transhumant Pastoralism in


Orton – Herding, Settlement, and Chronology


**Biographical Note**

David Orton is a research associate at the McDonald Institute for Archaeological
Research, University of Cambridge, where he currently works on Medieval historical ecology in northern Europe. His background is in Balkan prehistory and he also has research interests in Turkish Neolithic and Chalcolithic zooarchaeology.

Address: McDonald Institute for Archaeological Research, University of Cambridge, Downing Street, Cambridge CB2 3ER, UK. [email dco21@cam.ac.uk]

Gestion des troupeaux, villages et chronologie dans les Balkans néolithiques

Le Néolithique dans les Balkans centraux est témoin de changements dramatiques des genres d'implantation, de l'architecture et de la culture matérielle avec l'apparition à la fin de cette période d'implantations importantes et souvent d'une grande longévité, qu'on peut raisonnablement qualifier de villages. Cet article examine le rôle des pratiques de gestion de troupeaux dans le développement de ces grandes communautés plus ou moins sédentaires. À l'aide de résultats de datation radiocarbone (incluant 27 nouvelles datations AMS de Gomolava, Opovo et Petnica), on place les données zooarchéologiques disponibles dans un cadre chronologique, permettant ainsi la comparaison des changements inter- et intra-sites à travers la région. Les données révèlent le développement de grands troupeaux de bétail à la fin du Néolithique, évolution dont on examine les implications quant à la mobilité et la cohésion communautaire. Cette tendance est reconnue clairement au fil du temps sur certains sites, mais, tout comme pour les villages, elle n'est ni universelle ni synchronse à travers la région et souligne le fait que ce changement s'est effectué et devrait être compris au niveau des communautés individuelles. Translation by Isabelle Gerges

Mots-clés: Vinča, histoires des villages, Néolithique des Balkans, zooarchéologie, sédentarisme, mobilité, gestion des troupeaux de bétail

Viehzucht, Siedlungswesen und Chronologie im Balkan-Neolithikum


Stichworte: Vinča, Siedlungsgeschichte, Balkan-Neolithikum, Archäozoologie, Sesshaftigkeit, Mobilität, Rinderzucht