
THE DYNAMICS OF NEOLITHIC - BRONZE AGE ANIMAL HUSBANDRY IN THE SOUTH OF EASTERN EUROPE AS INDICATIVE OF PAST CLIMATE CHANGES

by Valentin Dergaciov

Introduction

The integration of scientific and archaeological knowledge which became much more intense over the past decade, increasingly demonstrates the interrelation of socio-cultural and natural phenomena in the past, focusing on human-triggered cataclysms, and suggesting alarming scenarios for the future¹.

The Neolithic and Bronze Age are the periods of human Prehistory highly appropriate for such studies. On the one hand, these periods correspond to the emergence and establishment of food-producing subsistence based on agriculture and animal husbandry, which formed an economic foundation for the subsequent development of civilizations attested by historical sources. On the other hand, the multi-disciplinary studies, which include Quaternary Geology, Geophysics, Astrophysics, Palaeo-oceanography, Palynology and Pedology provide abundant evidence on periodic changes of climate, vegetation, sea-level fluctuations and other natural phenomena that affected Eastern Europe during the Holocene (particularly, at the Atlantic-Sub-boreal transition).

The present paper is focused on the analysis of the trends in the animal husbandry during the Eneolithic – Bronze Age in the South of Eastern Europe aimed at testing the hypothesis that the observable variations were related to climate changes.

Methods of investigation

As the instrument of testing the above-stated hypothesis was used available archeo-zoological evidence on domestic faunal remains, known for the sites of Neolithic-Bronze Age from the South of Eastern Europe, ranging from the Eastern Carpathians and the Lower Danube area, in the west, to the Middle Volga and the South-western Urals in the east.

¹ A.P. Nazaretyan, *Tsivilizatsionnye krizisy v kontekste universal'noi istorii*, Moskva, 2004.

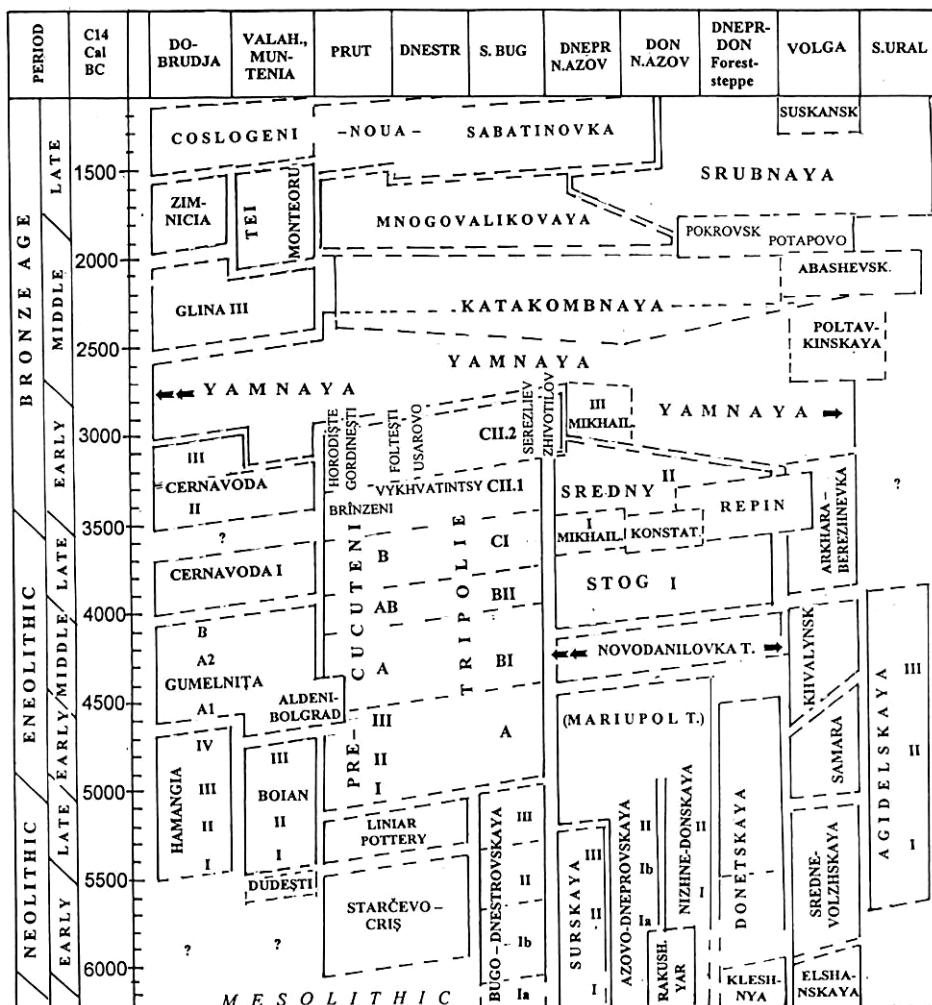


Fig. 1. Periodisation, relative and absolute chronology of cultures of the Neolithic - Bronze Age of the South of the Eastern Europe.

These data originate from both the western (predominantly agricultural) and the eastern (predominantly cattle-breeding) cultural areas. During the course of various chronological periods the borderline between these areas shifted from the Dniester, to the Southern Bug and further to the Dnepr rivers crossing the different landscapes of the steppe and the forest-steppe.

The analysis includes the quantitative assessment of all components of the domestic stock (both the totals and individual species), separately for each cultural area and environmental zone. The abundance of each animal species (including the domestic ones) implies the preferred ecological environment (either for the cattle, or sheep or goat, or pig, or horse). The observed qualitative and quantitative fluctuations in the abundance of main domestic animal species over a prolonged chronological sequence (from the 7th until the end of the 2nd millennia BC) are deemed as reflecting quantitative changes that occurred in the past ecosystems. These fluctuations are analyzed both on the level of individual species, and on the level of the assemblages of the domestic stock, and also separately for cultural areas and the environmental zones.

Cultural background

The studied period of Middle Holocene includes three main archaeological epochs, which marked the emergence and establishment of food-producing subsistence based on agriculture and stock-breeding: the Neolithic, Eneolithic and Bronze Age. Each of these epochs is subdivided into two or three periods and includes panoply of cultures and cultural-historical entities that either coexisted or succeeded each other within these periods in the discussed area. The chronological chart (fig. 1) includes principal cultural entities and their absolute and relative chronologies, both for the steppe and the forest-steppe of the South of Eastern Europe, and also provides an account of archeozoological collections that have been analyzed. The chart is based on the latest field studies that became known to the writer. The absolute chronology is based on the series of calibrated radiocarbon dates which had been published earlier².

For the better understanding of the following results the following points should be taken into account. In the western cultural area (fig. 1, the left-hand part) the chronological boundaries between the cultures and cultural periods were defined with a greater precision as the sedentary way of life presumes the greater number of stable settlements.

² J. Görzsdorf, Ja. Bojanžiev, *Zur absoluten Chronologie der bulgarischen Urgeschichte*, in *EurAntiq*, 2, 1996, p. 105-173; C.-M. Mantu, *Cultura Cucuteni. Evoluție, cronologie, legături*, BMA, V, Piatra-Neamț, 1998; E.N. Chernykh, L.I. Avilova, L.B. Orlovskaya, *Metallicheskie provintsii i radiouglerodnaya khronologiya*, Moskva, 2000; C. Bem, *Noi propuneri pentru o schiță cronologică a eneoliticului românesc*, in *Pontica*, XXXIII-XXXIV (2000-2001), 2001, p. 25-121; D. Ya. Telegin, I.D. Potekhina, M. Lillie, M.M. Kovaliukh, *The chronology of the Mariupol-type cemeteries of Ukraine re-visited*, in *Antiquity*, 76 (292), 2002, p. 356-363; D. Ya. Telegin, M. Lillie, I.D. Potekhina, M.M. Kovaliukh, *Settlement and economy in Neolithic Ukraine: a new chronology*, in *Antiquity*, 77 (297), 2003, p. 456-470; S. Ivanova, *Epokha rannei bronzy Prichernomorskikh stepei*, in *RevArh*, SN, 1, 2005, p. 34-43; S. Zh. Pustovalov, *Sotsial'nyi lad katakombnogo suspil'stva Pivnichnogo Prichornomor'ya*, Kyiv, 2005; and others.

These boundaries are blurred and less precise for the eastern cultural zone (fig. 1, the right-hand part) because of a greater demographic mobility of and a comparative rarity of stable sites. In the western cultural area (east of the Carpathians) the Neolithic stock-breeding was the result of a direct invasion of Starčevo-Criș communities from the Balkans, South of the Danube. In the eastern cultural area this process resulted from the interplay of impulses stemming from the Eastern Carpathians, the Caucasus and, possibly, the south-east Caspian area. The communities in the western cultural area had a balanced subsistence based on combined agriculture-cum-stock-breeding focused on the forest-steppe Dniester-Carpathian regions, the Southern Bug and the left-bank of the Dnepr basins and, to a lesser degree, the steppe regions of the north-western Black Sea coastal area. From the very beginning, the subsistence of the communities in the eastern cultural area was predominantly stock-breeding orientated, resulting from the specific character of natural habitats in the forest-steppe and steppe regions. Initially, the cattle-breeding was focused on the forest-steppe area, spreading onto the steppe only when the suitable ecological setting arose there. Both the western and eastern cultural areas display a continuous succession of specific cultural traditions, with abrupt breaks occurring twice during the period of about five thousand years. In one case, this took place during the Middle Eneolithic when the sites of Novodanilovsky type deeply transgress in the area of agricultural communities reaching Thracia, and causing a profound cultural mutation (including the disappearance of Varna Culture). The second case took place in the period of Early Bronze Age when the massive expansion of Pit Grave Culture led to a full collapse of developed agricultural cultures in the Danubian-Carpathian region (on fig. 1 these culture changes are marked by two-sided arrows).

The Data Base

The discussed analysis is based on the evidence of 400 archeozoological collections, available for the period of time and the territory under study, albeit the information pertinent to several collections is incomplete. The specific compositions for these collection is estimated based on the minimal number of bones (MNB) only, as many archeo-zoologists suppose that is the estimation of minimal number of individuals (MNI) is not relevant³. V.I. Tsalkin⁴ has convincingly proven that it is not the case and demonstrated the relationship between MNB and MNI. In the writer's study⁵ additional arguments are quoted. The point is that high values of MNB normally yield diminished values of MNI (in excess of 20%), and vice versa. For this reason, in the present study the preference is given for the archeozoological collections, which include the assessment of both the minimal number of bones (MNB) and the minimal number of individuals (MNI).

³ E.E. Antipina, *Metodicheskie problemy ostatkov zhivotnykh iz arkheologicheskikh pamyatnikov*, in *Noveishie arkheozoologicheskie issledovaniya v Rossii. K stoletiyu so dnya rozhdeniya V.I. Tsalkina*, Moskva, 2003, p. 7-33; A. Morales, E. Antipina, *Srubnaya Fauna and Beyond: a Critical Assessment of the Archaeozoological Information from the East European Steppe*, in M. Levine, C. Renfrew, K. Boyle (eds.) *Prehistoric steppe adaptation and the horse*, Cambridge, 2003, p. 329-351.

⁴ V.I. Tsalkin, *Materialy dlya istorii skotovodstva i okhoty v Drevnei Rusi*, in *MIA*, 51, 1956, p. 7-185.

⁵ V. Dergachev, *O skipetrakh, o lozhadyakh, o voine*, Sankt-Petersburg, 2006.

Such data are available for the total of 242 collections. The summarily characteristics of all these collections are shown in table 1, and their localization, on figure 2. As follows from the tables and maps, the selection is sufficiently representative, effectively covering the both cultural areas: 126 collections in the west (tab. 1), and 116 collections in the east, although the size of the latter area exceeds six times the former one (fig. 2), and the evidence for the forest-steppe is of a higher standard. Remarkably, the sites from the eastern area form clear-cut geographical clusters: the Middle and lower Dnepr, the Azov Sea coastal area, the Middle Donets, the Upper Don, the Middle Volga and South-Western Urals.

The archeo-zoological data shown in table 1 (and in the captions for fig. 2) follow the chronological sequence within the cultural areas in accordance with epochs and periods, but at the same time taking into account regional and environmental peculiarities.

Each period includes either a single or two cultural entities consisting of several archaeological cultures; in several cases displaying different manifestations of the same culture in the forest-steppe, versus the steppe. For example, the Early Neolithic in the western zone (table 1, column 3, NN1-3) is represented by collections of a single culture (Starčevo-Criș) localized in the forest-steppe. Yet the Late Neolithic includes two cultural entities (the Linear Pottery Culture and the Boian), the former being found in the forest-steppe, and the latter, exclusively in the steppe Lower Danube area. Another example concerns the eastern cultural area (table 1, column 3, NN14-17), where the Early Neolithic is represented by two cultures, one of which (Bug-Dniesterian: I a-b) locates in the forest-steppe regions and the second (Surian I-II), in the steppe. In the case of Late Neolithic (table 1, column 3, NN16-17) the first entity, encompassing the forest-steppe, includes four different cultures (Late Bug-Dniesterian, Early Dnieper-Donetsian, Middle-Volga and Early Agidelian). The second entity, focused on the steppe, consists of two cultures (Late Surskian and Early Mariupolian).

As one might expect, the studied collections vary numerically. The late Eneolithic of the steppe in the western area is represented but by a single collection (table 1, column 3, N 9). Yet the Late Bronze Age of the forest-steppe in the east includes 38 collections (table 1, column 3, N 26). These shortcomings do not seriously affect the database as a whole, as it might be easily analysed both vertically, from one period to another, and horizontally, from one area to another.

Table 1 includes the totals of all identified animal remains for each cultural entity (table 1, column 5), the totals of all domestic species, and the percentage rates of MNB for individual species and their means (column 6). The percentage rates in this case are calculated from the total assemblage of animal remains. Further follow numbers and percentages of five basic species of domestic animals (columns 7-11).

Additional remarks concern the interpretation of horse remains in the deposits of Neolithic and Eneolithic sites. Following the controversy around the identification of the horse at Sredni Stog II-type sites in the 1990s, numerous archeozoologists became sceptical about the occurrence of any domestic horses in the Neolithic and Eneolithic.

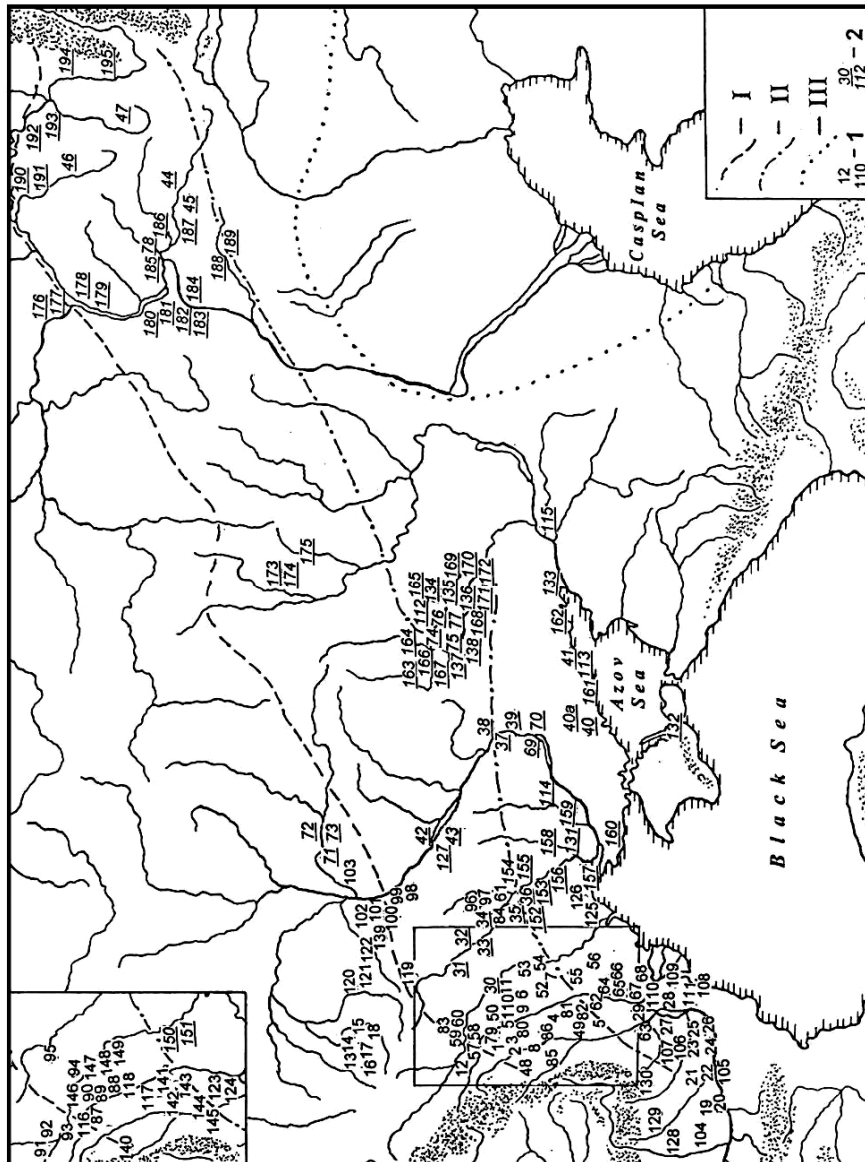


Fig. 2. Archeo-zoological complexes of the Neolithic - Bronze Age of the South of the Eastern Europe. Signs: I – borderline of forest and forest-steppe; II – borderline of forest-steppe and steppe; III – borderline of steppe and semi-desert; 1 – complexes of the west (agricultural); 2 – complexes of the east (predominantly cattle-breeding) cultural zones.

NEOLITHIC (Early and Late). *Starčevo-Criș*: 1. Pogorăști, 2. Balș, 3. Glăvănești Vechi, 4. Valea Lupului, 5. Trestiana, 6. Sacarovca I, 7. Seliște. **Linia Pottery**: 8. Traian-Dealul Fântânilor, 9. Rogojeni, 10. Florești, 11. Țira, 12. Zastavne, 13. Golyshv, 14. Gnidava, 15. Rovno, 16. Girka Polonka, 17. Burlakiv Yar, 18. Basiv Kut. **Boian**: 19. Izvoarele, 20. Tangâr, 21. Radovanu, 22. Casciorele, 23. Vărăști, 24. Coslogeni, 25. Vlădiceasca, 26. Bogata, 27. Siliște-Conac, 28. Lunca, 29. Galați. **Bugo-Dnestrovskaya**: 30. Soroca I-III, V, 31. Pechera, 32. Sokol'tsy I-II, 33. Baz'kov Ostrov I-II, 34. Solgutov-Ostrov I-II, 35. Pugach, 36. Gard. **Surskaya**: 37. Surskiy Ostrov I-5, 38. Igren' 5, 39. Shulaev Ostrov, 40. Semenovka I. **Mariupol'skaya I (Azovo-Dneprovskaya, Nizhnedonskaya)**: 38. Igren' 8, 40a. Chapaevka, 41. Razdol'noe. **Dnepro-Donetskaya I**: 42. Buz'ki, 43. Melyukhov Bugor. **Srednevolzhskaya**: 44. Ivanovskaya, 45. Vilovatskaya. **Agidel'skaya I**: 46. Mullino I-II, 47. Davlenkovo I-II.

ENEOLITHIC (Early). **Precucuteni-Tripolie A**: 8. Traian-Dealul Viei, 9. Rogojeni I, 10. Florești, 48. Târpești, 49. Târgu Frumos, 50. Putinești I, 51. Alexandreuca I, 52. Isacova II, 53. Solonceni I, 54. Holercani I, 55. Ruseștii Noi, 56. Cărbuna, 57. Bernovo Luka, 58. Lenkovtsy, 59. Luca Vrublevetskaya, 60. Bernashevka, 61. Sabatinovka II. **Bolgrad-Aldeni II**: 62. Suceveni, 63. Lișcoteanca I, 64. Lopățica, 65. Cocoara I, 66. Vulcănești II, 67. Bolgrad, 68. Ozernoe. **Mariupol'skaya II**: 40. Semenovka II, 41. Razdol'noe 2, 69. Sobachki, 70. Sredny Stog. **Dnepro-Donetskaya II**: 71. Grisevka I-II, 72. Pogorelovka, 73. Lisogubovka, 74. Tuba 2, 75. Novoselovka, 76. Starobel'sk, 77. Zanovskoe I. **Samarskaya**: 44. Ivanovskaya, 45. Vilovatskaya, 78. Lebyazhinka III. **Agidel'skaya II**: 46. Mullino III, 47. Davlenkovo III.

ENEOLITHIC (Middle and Late). **Cucuteni A-Tripolie BI**: 48. Târpești, 53. Solonceni II, 55. Ruseștii Noi, 61. Sabatinovka I, 79. Drăgușeni-Ostrov, 80. Trușești, 81. Bălțați, 82. Dumești, 83. Polivanov Yar, 84. Berezovskaya GES. **Cucuteni A-B, B - Tripolie B, CI**: 4. Valea Lupului, 8. Traian-Dealul Fântânilor, 85. Ghelăiești, 86. Cucuteni-Cetățuia, 87. Mitoc, 88. Iablona I, 13, 15, 89. Caracușeni Vechi I, 90. Brânzăni IV, VIII, 91. Koshilovtsy, 92. Sukhostav, 93. Kunisovtsy, 94. Stena, 95. Voroshilovka, 96. Vladimirovka, 97. Kolomiyschchina, 98. Khalep'e, 99. Starye Bezradichi, 100. Podgortsy 2, 101. Chapaevka, 102. Syrtsy, 103. Evminka I. **Gumelnița A-B**: 20. Tangâr, 104. Drăgănești-Olt, 105. Gumelnița, 106. Însurăței Popina, 107. Bordsani, 108. Năvodari-La Ostrov, 109. Luncovița, 110. Carcaliu. **Cernavoda I**: 111. Cernavoda I. **Khvalynskaya**: 44. Ivanovskaya, 45. Vilovatskaya. **Sredny Stog**: 43. Meljukhov Bugor, 70. Sredny Stog, 112. Alexandriya, 113. Dereivka. **Mikhailovka E. - Konstantinovka**: 114. Mikhailovka, 115. Konstantinovka.

BRONZE AGE (Early). **Horodiștea-Foltești - Tripolie C7II**: 100. Podgortsy I, 116. Horodiștea, 117. Erbiceni, 118. Costești IV, 119. Sandraki, 120. Pavoloch, 121. Trayanov, 122. Gorodsk, 123. Stoicani, 124. Foltești, 125. Mayaki, 126. Usatovo. **Cernavoda III**: 111. Cernavoda III. **Yamnaya**: 114. Mikhailovka L., 127. Desyatina.

BRONZE AGE (Middle). **Glina III - Tei - Monteoru**: 128. Glina, 129. Popești, 130. Sărata Monteoru. **Katakombnaya**: 131. Matveev Les, Matveevka I, 132. Kirovo, 133. Liventsovka, 134. Aleshin Ruchey, 135. Mezhruchejnoe 136. Kajdashino, 137. Peschanoe 2, 138. Serebrjanskoe.

BRONZE AGE (Late). **Komarow - Trezcinieck**: 139. Malopolovetskoe 2-3. **Noua**: 4. Valea Lupului, 140. Piatra-Neamț, 141. Rateșu Cuzei, 142. Drăghești, 143. Bârlad, 144. Gârbovăț, 145. Cavadinești, 146. Slobodca Șirăuți, 147. Petrușani, 148. Odaia, 149. Ghindești. **Sabatinovka**: 132. Kirovo, 150. Mereni, 151. Gura Galbenă, 152. Shchutskoe, 153. Vinogradnyj Sad, 154. Bugskoe 1-2,4, 156. Stepovoe, 157. Voronovka II, 158. Peresadovka, 159. Dremailovka, 160. Novokievka, 161. Nikolaevka, 162. Bezymyannoe 1-2. **Srubnaya (Don)**: 163. Liman Ozero, 164. Usovo Ozero, 165. Kapitanovo I, 166. Il'ichovka 1-2, 167. Nikolaevka, 168. Dibrava I, 3, 169. Zheltoe, 170. Stepanovka, 171. Alexandrovsk, 172. Proval'e, 173. Mosolovo, 174. Razdol'noe, 175. Sadovoe 6. **Prikazanskaya**: 176. Balymskaya, 177. Atabaevskaya, 178. Stepnoe Ozero, 179. Gul'kinskaya. **Srubnaya, Cherkaskul'skaya and al.**: 78. Lebyazhinka V, 180. Bektyashka, 181. Danilovo Ozero, 182. Aktushi, 183. Moechnoe Ozero 1-3, 184. Sachkovo, 185. Suskanskoe 1-2, 186. Poplavskoe, 187. S'ezzhee, 188. Uspenskoe, 189. Maksutovo, 190. Deukovskaya I, 191. Izmanlejskaya, 192. Urazaevo I, 193. Zhukovskaya, 194. Kipel'skoe, 195. Inzelga.

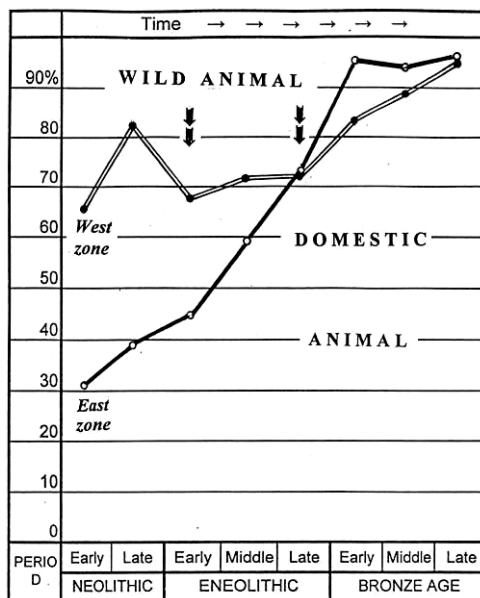


Fig. 3. The dynamic of the domestic herd complex distribution on the periods of Neolithic - Bronze Age of the west and east cultural zones.

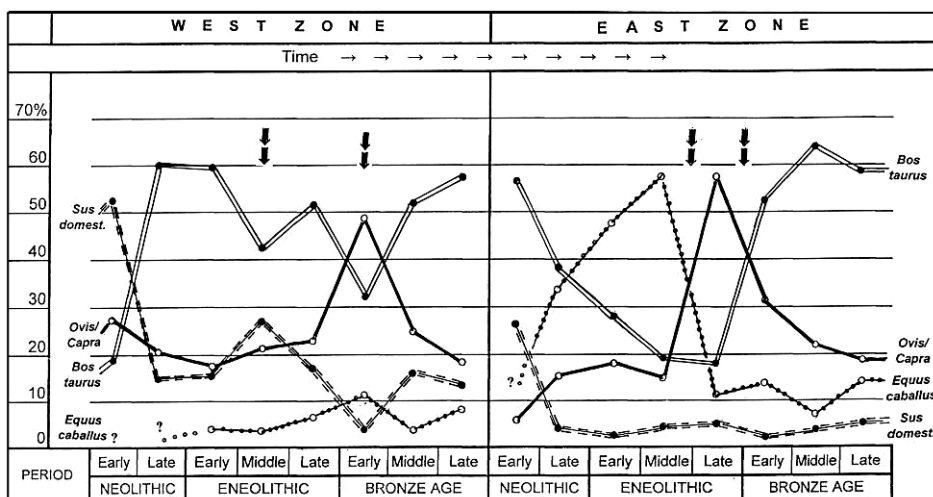


Fig. 4. The dynamic of the principal species of the domestic herd distribution (except dog) on the periods of Neolithic - Bronze Age of the west and east cultural zone. Time of the main crisis situations is shown by arrows.

It became largely accepted that the domestication of the horse started not earlier than the Late Eneolithic and Early Bronze Age⁶. As shows the writer's research based on the statistical analysis of archeo-zoological and archaeological evidence, the domestication of horse, or, rather, the specialized horse-breeding, started already during the developed Neolithic stage. The origins of this process should be sought in the Middle Volga (the Middle Volga Culture) and South-Western Urals (Agidelian Culture); from whence it further spread over the steppe and forest-steppe, encompassing the entire eastern cultural area; and, by the final Early Eneolithic, reaching the western cultural area⁷. Correspondingly, the horse was included into the list of domestic species of the eastern area starting with the Late Neolithic, and, starting with the Early Eneolithic, into that of the western area (table 1, column, 10).

The bottom rows of table 1 contain the data on MNB and MNI on separate species both from the western and eastern cultural areas, demonstrating specific features of animal husbandry in each area.

Analysis

Primarily our analysis was targeted at identifying the general trends in the animal husbandry in the both cultural areas with the possible identification of indices of crisis.

As follows from the graph (fig. 3), each of the cultural areas displays specific features in the development of animal husbandry. In the western area, where food-producing economy was introduced by the Starčevo-Criş groups, who had vast experience in farming practices. Subsequently, the rate of domesticates in that area initially reaches about 65%, much higher than the corresponding figure in the east: only 30%. By the end of the Bronze Age the rate of domesticates reaches 95-96% in the both areas, with the wild animals practically disappearing. Yet the dynamics of this process remained substantially distinct, proceeding at a much more rapid pace in the east, mostly due to the intensive horse-breeding. If one excludes the horse, the development of animal husbandry in the east during the first initial periods (the Neolithic-Eneolithic) becomes regressive. This is one of the arguments in favour of the inclusion of the horse into the list of domestic animals in the eastern area.

The indices of crisis (shown by vertical arrows on fig. 3) become apparent at the transition from the Neolithic to Early Eneolithic, when the rate of domestic species sharply falls from 82% to 68%. This trend is retained up until the late Eneolithic, after which the rate of domesticates sharply rises with the transition to the Bronze Age.

To discuss this phenomenon in a greater detail, we should refer to the indices of domestic species, calculated as percentages of the total assemblage and scrutinize them separately for each cultural area following the chronological sequence (table 1, columns 7-11; fig. 4).

⁶ M. Levine, *Dereivka and the problem of horse domestication*, in *Antiquity*, 64 (245), 1990, p. 727-740; Eadem, *The Origins of Horse Husbandry on the Eurasian Steppe*, in M. Levine, Yu. Rassamakin, A. Kislenko, N. Tatarintseva, *Late prehistoric exploitation of the Eurasian steppe*, Cambridge, 1999, p. 5-58; D.W. Anthony, D.R. Brown, *The Origins of Horseback Riding*, in *Antiquity*, 65 (246), 1991, p. 22-38; N. Benecke, *Archäozoologische Studien zur entwicklung der Haustierhaltung in Mitteleuropa und Südkandinavien von den Anfängen bis zum ausgehenden Mittelalter. Schriften zur Ur- und Frühgeschichte*, B. 46. Berlin, 1994.

⁷ V. Dergachev, *O skipetrakh ...*.

The juxtaposing of the western and eastern cultural area immediately reveals their principle distinction: the prevalence of cattle, sheep-goat and pig in the west during the entire Neolithic - Bronze Age sequence with a minor participation of horse. In the east, the leading domestic species are horse, cattle and sheep-goat, with the minimal occurrence of pig. This observation is further confirmed by the rates of these species assessed from the total assemblage for each area. If the cattle and sheep-goat show similar values in the both areas (ranging from 40% to 58%), those for the pig vary significantly: 79% in the west and 21% in the east. Indices for the horse are reversed: nearly 25% in the west and 75% in the east (table 1, two bottom rows). In the former case we are dealing with the „European triad” (cattle + sheep-goat + pig), and in later case, with what we refer to as an „East European triad” (cattle + sheep-goat + horse). In our opinion, this constitutes the main distinction in the animal husbandry between the western vs. eastern cultural areas.

The critical manifestations are apparent in the both cultural areas, yet they differently affect various animal species (fig. 4).

Without taking into account Early Neolithic, which we consider as an initial period of adoption and acculturation, the development of animal husbandry in the western area during Late Neolithic and early Eneolithic periods features the high rate of cattle (~ 65%) and relatively low rates of sheep / goat and pig (~ 15-20%).

With the transition to Middle Eneolithic the rate of cattle is reduced by 20% with simultaneous small-scale increases of sheep / goat and pig. Later on, in Late Eneolithic, the situation returns to the previous state. The transition to Early Bronze Age is marked by yet another significant reductions in the rates of cattle (from 51% to 32%) and pig (from 17% to 5%) with simultaneous increases of sheep / goat (from 22% to 49%). With Middle Bronze Age the situation returns to the initial state (increasing rates of cattle and the simultaneous reduction of sheep / goat). Hence, we are witnessing two critical states with profound structural mutations in the structure of animal husbandry. The former took place in Middle Eneolithic, when the reduction in the rate of cattle was compensated by slight increases of pig and, partly, sheep / goat. The later one occurred in Early Bronze period when the rapid reduction in the rates of cattle and pig was compensated by the similar increases in the rate of sheep / goat (fig. 4, the left hand side, vertical arrows).

In contrast to the west, the horse and sheep / goat played domineering roles in the animal husbandry in the east (fig. 3, right hand side). But right until the Middle Eneolithic the rate of horse continuously increases and that of cattle reduces. These trends became reversed with the transition to the Late Eneolithic period, when rates of horse reduced from 57% to 11% with the simultaneous increase of sheep / goat from 15% to 58%. Another mutation marked the transition from the Late Eneolithic to the Early Bronze Age, when the reduction of the sheep / goat rate from 58% to 30% was accompanied by that of the cattle from 18% to 52%. Hence, both the eastern and western cultural areas demonstrate two principle periods of crisis in the development of animal husbandry. The first one corresponds to the transition from Middle to Late Eneolithic, when the fall in the abundance of the horse was compensated by an equally rapid increase in the numbers of sheep / goat. The second one marked the transition from Late Eneolithic to Early Bronze Age, when the sheep / goat dominance was replaced by that of the cattle.

Importantly, in the both areas the critical situations arose during either the same, or culturally related chronological periods. The first one took place in Middle Eneolithic in the west and at the transition from Middle to Late Eneolithic, in the east. The later crisis corresponded to the transition from Late Eneolithic to Early Bronze Age in the both areas. The both critical mutations took form of the increased values of the same species, the sheep and goat (fig. 4). Based on these similarities, one might reasonably suggest that the observed mutations in the animal husbandry were triggered by the same cause, apparently, the environmental change.

These preliminary conclusions may be further tested by the similar analysis conducted separately for each environmental zone; the resulting figures are shown in table 1. Unfortunately not all cultural periods within each zone are adequately provided by the available evidence, but the existing gaps might be easily bridged by analogy, using the data from the neighbouring areas.

The western area is sufficiently provided by the data from the sites focused on the forest-steppe (table 1, column 3, cultural entities 1-2, 4, 7-8, 10, 12-13). Their geographical location shown on figure 5 (the left-hand side). The data for the steppe are less complete (table 1, column 3, cultural entities 3, 5-6, 9, 11). No data are available for Early Neolithic, Middle and Late Bronze Age, due to the absence of corresponding sites. Yet, following the above-stated principle of analogy, the data on Pit-Grave and Catacomb Cultures were used to characterise the Middle Bronze Age, and those of Sabatinovka, the Late Stone in the steppe Prut-Dniester interfluves (fig. 5, right-hand side).

As one might see, the animal husbandry both in the forest-steppe and steppe regions of the west included the same species (the cattle, sheep / goat and pig), which twice underwent strong quantitative mutations. In the forest-steppe these mutations marked the transition from Early to Middle Eneolithic, and, subsequently, the Middle to Late Eneolithic transition (fig. 5, left-hand side part). In the former case the mutation took form of a strong reduction in the rate of the cattle (from 65% to 42%), with a simultaneous increase of pig rate by more than 10%. The later mutation consisted of the reduction of the pig rate with a simultaneously increasing cattle and, partly, sheep and goat. This structure remained unchanged with only minor variations until the end of the Bronze Age.

More dynamic and cardinal changes are apparent for the steppe zone, where animal husbandry is acknowledgeable only since the Late Neolithic (fig. 5, right-hand part). In that area, the main mutations occurred during the Middle, Late Eneolithic and Early Bronze Age. The transition from Middle to Late Eneolithic was marked by a rapid rise in the rate of cattle at the expense of small sheep and goat. At the transition from the Eneolithic to Early Bronze Age the rate pig dropped with the sharp increase in the rate of sheep and goat which attain the dominant position with more than 60%. Later on, the structure is changed again with the rapid increase of cattle and the reduction of sheep and goat.

For the east (fig. 6) more or less complete information is available only for the steppe areas (table 1, column 3, cultural entities, 17, 19, 21-23, 25, 27). As for the forest-steppe, such information exists only for six from out of eight entities (table 1, column 3, cultural entities 14, 16, 18, 20, 24, 26). However, like in the previous case, the general trend might be reliably restored, using the principle of analogy with the data from the neighbouring and ecologically similar units.

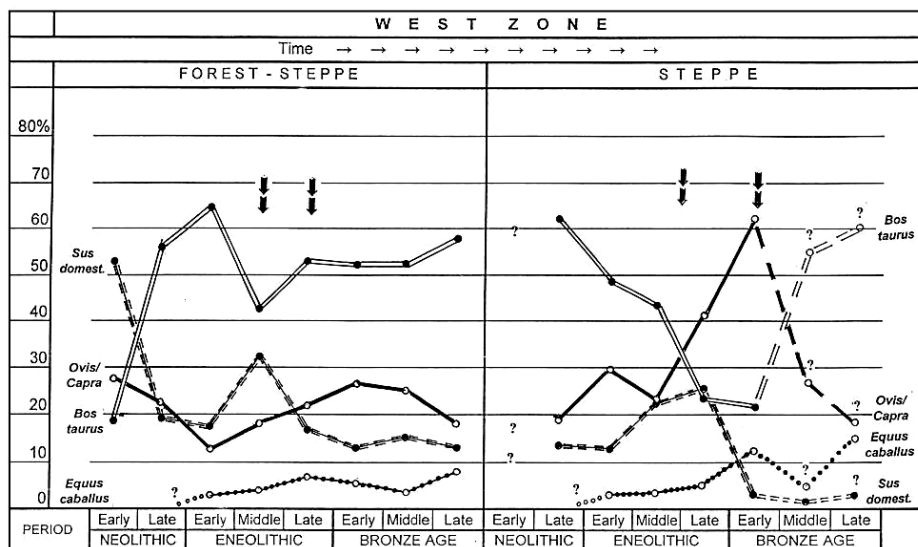


Fig. 5. The dynamic of the main species of the domestic herd distribution (except dog) on the periods of Neolithic - Bronze Age in the forest-steppe and steppe regions of the west cultural zones. Time of the main crisis situations is shown by arrays.

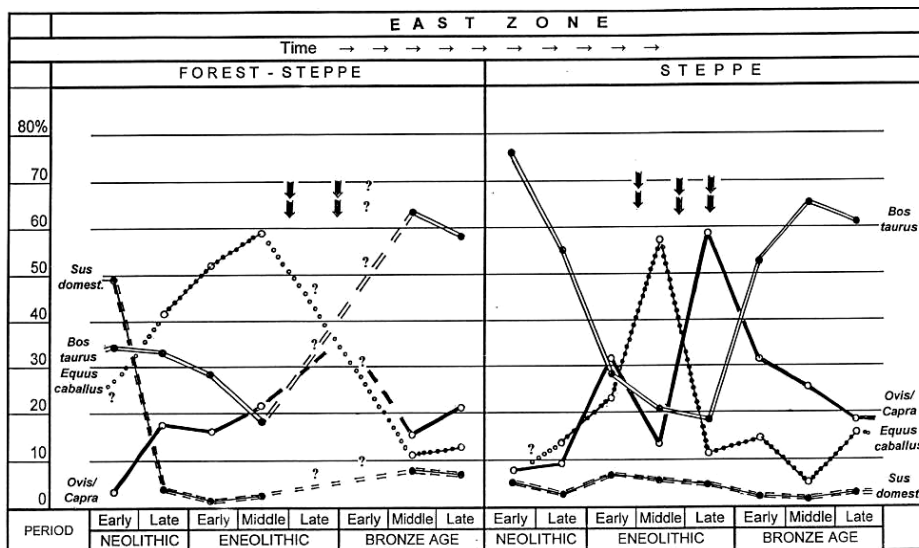


Fig. 6. The dynamic of the main species of the domestic herd distribution (except dog) on the periods of Neolithic - Bronze Age in the forest-steppe and steppe regions of the east cultural zone. Time of the main crisis situations is shown by arrows.

As follows from the graphs (fig. 6), in contrast to the west, and ignoring the data on the Early Neolithic, the main structural mutations are apparent in the rate of three main species: the horse, cattle and sheep / goat. Yet, if the horse (which rate was in the increase) and the cattle (which rate was reducing) were the principal species in the forest-steppe, the steppe was dominated by the cattle (at a reducing rate), and the horse, which rate started rapidly increasing only with the transition from the Early to Middle Eneolithic. This observation confirms the suggestion that the domestication of horse initially took place in the forest-steppe and subsequently spread over the steppe.

As in the case of the west, the critical states of the same age are acknowledgeable both in the forest-steppe and steppe segments of the eastern area. In the forest-steppe these crises are recognisable for Middle, Late Eneolithic and Early Bronze Age. Although the concrete data are not available for the two latter periods, the corresponding mutations are visible in the changes of relative abundance of species: the reduction in the rate of horse with the simultaneous increase and of sheep and goat and following reducing of the latter and sharp increasing of neat cattle. In the steppe regions these mutation to the form of a reduced rate of cattle and increased rate horse during the Middle Eneolithic, followed by the decreased rate of horse and the rapid rise of sheep and goat during the Late Eneolithic and the decline of sheep and goat and the rise of cattle with the transition to Early Bronze Age. Hence, the structure of animal husbandry in the steppe was much more dynamic (fig. 6).

Discussion

The above analysis proves the occurrence of two principle epochs in the animal husbandry, both in the west and the east. The former includes the sites ranging from the Neolithic to the final Middle - early Late Eneolithic. This epoch was that of gradual establishment of animal husbandry, with the rate of domesticates ultimately reaching 75% of the total faunal assemblage in the west and 50% in the east. The pattern of animal husbandry became optimally adapted to local environments. At that time the animal husbandry was focused on the forest-steppe, gradually encroaching into the steppe. The cattle, pig and sheep / goat were domineering species in the western cultural area, whereas the horse remained very rare. The horse, cattle and sheep / goat were most common in the eastern zone, the pig being of a secondary significance.

The later epoch coincided with the Bronze Age, when the domestic livestock reached 90-95% of the total animal assemblage. This epoch also marked significant changes both in the structure of animal husbandry and its spatial extension.

On the one hand, the cattle acquire the leading position in the structure of animal husbandry both in the east and the west, with the simultaneous rise of the sheep / goat in the both areas. Yet in the west, the pig retains the third position with the increased significance of the horse. In the east, the horse, which initially was at the first place, gradually moves down to the third position, the pig retaining the second place.

On the other hand, the transition from the Eneolithic to the Bronze Age marks the expansion of animal husbandry into hitherto less developed steppe areas. In the west, the stock-breeding remains focused on the forest-steppe (the steppe being sufficiently, albeit less included), whereas in the east the focus of animal husbandry becomes centred in the steppe.

In the forest-steppe, the eastern and western cultural areas feature the different values of dominant domesticates (the cattle, followed by sheep / goat and pig in the west; the cattle, followed by sheep / goat and horse in the east), whereas the same species in the same succession remained dominant in the steppe, both in the west and the east: the cattle, followed by sheep / goat and horse, with minimal values for the pig.

Hence the following indices of the crises in the early development of animal husbandry are acknowledgeable in the studied areas: 1 – simultaneously changes in the domestic stock as a whole and the abundance of individual species: the cattle – in the west; horse and partly sheep / goat in the east; 2 – rapid and spontaneous increases in the abundance of sheep / goat (up to 50-60% of the domestic animal total) in the steppe both in the east and west and its subsequent decrease in the Middle and Late Bronze Age; 3 – relatively rapid expansion of animal husbandry from the forest-steppe over the steppe, particularly in the east; 4 – establishment of traditional structures of animal husbandry in the cultural areas the forest-steppe, alongside the formation of the structure common one for all cultural areas in the steppe, consisting of cattle + sheep / goat + horse.

Significantly, all major transformations in the structure of animal husbandry occurred relatively simultaneously within all cultural areas: in one case at the transition from Middle to Late Eneolithic, and at another, at the transition from Late Eneolithic to Early Bronze Age. Hence, these transformations correspond to the global restructuring of the cultural setting in both cultural areas.

Deep transformations in animal husbandry in both cultural areas clearly coincide with the disappearance of established Neolithic and Eneolithic cultures (fig. 1). During the course of Early Bronze Age these cultures were substituted by a single cultural entity that featured the Pit-Grave-type burials under barrows in the huge areas of forest-steppe and steppe from the Volga and Urals in the east, until Middle Danube and Thracia, in the west.

On a lesser chronological scale, the transformation at the transition from Middle to Late Eneolithic coincided with the mutations within the traditional Neolithic-Eneolithic cultures. The transformation at the transition from Eneolithic to Early Bronze Age coincided with the emergence of amorphous and short-lived cultural entities, or sites.

As an early example one may quote the mutations of the Khavalynian, the traditional Neolithic-Eneolithic culture of the Middle Volga, which spread from the forest-steppe over to vast semi-desert and desert areas in North Caspian Lowland. Another example is that of the emergence and spread of Sredni Stog II Culture with Kivityany and Skelyany-type sites⁸. The Lower Milkailovka Culture includes the sites of Konstantinovka or Repin type, which „elusive” character was recognized by Nikolova⁹.

⁸ Yu. Rassamakin, *The Eneolithic of the Black Sea Steppe: Dynamics of Cultural and Economic Development 4500-2300 BC*, in M. Levine, Yu. Rassamakin, A. Kislenko, N. Tatarintseva, *op.cit.*, p. 59-182; D. Ya. Telegin, A.L. Nechitailo, I.D. Potekhina, Yu. V. Panchenko, *Srednestogovskaya i Novodanilovskaya kul'tury eneolita Azovo-Chernomorskogo regiona*, Lugansk, 2001.

⁹ A.V. Nikolova, *O meste „repinskikh” pamyatnikov v yamnoi kul'turno-istoricheskoi obshchnosti: nekotorye voprosy istoriografii*, in *Problemy arkheologii Podneproviya*, Dnipropetrovsk, 2002, p. 37-59.

Different, albeit essentially similar and simultaneous transformations are acknowledgeable in the western area (fig. 1). On the one hand, it features deep transformations at the transition from Cucuteni A-Tripolye BI to Cucuteni A-B - B - Tripolye BII-CI. On the other hand, the local cultural sequence includes at a later stage the emergence of alien „steppe” cultural entities: Usatovo-Foltești, Serezlievka and „Post-Mariupol”-type sites (*sensu* Kovaleva). The Gumelnița - Varna Culture follows a completely different trajectory and totally disappears at the transition to Late Eneolithic (Cucuteni A-B stage), being supplemented by Cernavoda I - Pevets-type sites, and still latter, by those of Cernavoda II and Cernavoda III-type.

As follows from the above-said, there exist clear relationships between the mutations in the structure of animal husbandry and transformations in the general cultural setting. On the other hand, it becomes equally obvious, that these mutations were triggered by extra-cultural phenomena, namely, changes in the natural environments of the steppe and forest-steppe.

Based on the available radiocarbon dates, the crises in the structure of animal husbandry may be dated, the former, to 4500-4000 BC, and the latter, to 3500-2800 BC. Over the last 10-15 years the problem of interrelation between environment changes and the evolution of socio-cultural entities during the Holocene in Eastern and South-Eastern Europe has been repeatedly discussed¹⁰. Notwithstanding considerable difference of opinion, several common features in the assessment of Late Holocene environment change are apparent. At

¹⁰ K.V. Kremenetski, *Paleoekologiya drevneshikh zemledelet'sev i skotovodov Russkoi ravniny*, Moskva, 1991; Idem, *Prirodnaya obstanovka golotsena na Nizhnem Donu i v Kalmykii*, in *Stepi i Kavkaz (kul'turnye traditsii)*, Moskva, 1997, p. 30-47; Idem, *Steppe and Forest-steppe Belt of Eurasia: Holocene Environmental History*, in M. Levine, C. Renfrew, K. Boyle (eds.) *op.cit.*, p. 11-27; I.V. Ivanov, I.B. Vasil'ev, *Chelovek, priroda i pochvy Ryn-Peskov Volgo-Ural'skogo mezhdurechiya v golotsene*, Moskva, 1995; H. Todorova, *The Neolithic, Eneolithic and Transitional Period in Bulgarian Prehistory*, in D.W. Bailey, I. Panayotov (eds.), *Prehistoric Bulgaria, Monographs in World Archaeology*, 22, 1995, p. 79-98; Eadem, *Der balkano-anatolische Kulturbereiche vom Neolithikum bis zur Frühbronzezeit*, in *In memorium James Harvey Gaul*, Sofia, 1998, p. 27-54; Eadem, *Probleme der Umwelt der prähistorischen Kulturen zwischen 7000 und 100 v. Chr.*, in *Das Karpatenbecken und die osteuropäische Steppe*, München, 1998, p. 65-70; Eadem, *Durankulak*, Band II. *Die Prähistorischen Gräberfelder von Durankulak*, Sofia, 2002; E.A. Spiridonova, A.S. Aleshinskaya, S.N. Korenevski, V.L. Rostunov, *Sravnitel'nyi analiz prirodnoi sredy vremeni sushchestvovaniya maikopskoi kul'tury v Tsentral'nom Predkavkaz'e*, in *MIKNSK*, 2, 2001, p. 144-162; P.P. Barykin, *Kul'turno-khozyaistvennaya traditsiya i ekologicheskie protsesy stepnogo Povolzh'ya v period 10-5 tys. let nazad*, in *VAP*, 2, 2002, p. 50-58; M.A. Bower, *Green Grows the Steppe: How can Grassland Ecology Increase our Understanding of Human-Plant Interactions and Origins of Agriculture*, in M. Levine, C. Renfrew, K. Boyle (eds.) *op.cit.*, p. 29-41; M. Filipova-Marinova, E. Bozilova, *Palaeoecological evidence of the vegetation history and human occupation in the coastal area of Sozopol (South-eastern Bulgaria)*, in *Dobrudzha*, 21 (2003), 2004, p. 279-291; A. Aleksandrovskii, V. Balabina, T. Mishina, *Materialy k istorii paleolandshafta verkhnego techeniya reki Maritsa v srednem golotsene*, in *Dobrudzha*, 21 (2003), 2004, p. 292-308; V. Voinea, *Cauze privind sfârșitul eneoliticului în zona litoralului vest-pontic. Așezarea de pe insula „La Ostrov”, lacul Tașaul (Năvodari, jud. Constanța)*, in *Pontica*, 37-38 (2004-2005), 2005, p. 21-46.

the transition from Middle to Late Atlantic period (or from Middle to Late Eneolithic and until the final Early Bronze Age, according to archaeological chronology), the whole area between the middle Volga and the northern Pontic Lowland was affected by climatic fluctuations with a general trend towards the growing aridity. This was the main factor behind the increased reliance on sheep and goat in the structure of animal husbandry during that period, both in the western and eastern cultural areas.

Several writers tend to relate the observed changes with the transgressive / regressive fluctuations in the level of the Black Sea¹¹, which had been recently confirmed by under-water survey in Bulgaria¹². This writer's recent studies¹³ seem to indicate that the Black Sea level fluctuations were at the source of both climate changes and the socio-cultural mutations. In its turn, these mutations caused the transformations not only in the structure of animal husbandry, but also in the structure of agriculture. In all likelihood, the climate changes were the main factor that triggered large-scale human migrations. Two such migrations are acknowledgeable in the studied area. The former occurred in Middle Eneolithic, and the latter, in Early Bronze Age. The former is documented by the Novodanilovka-type sites¹⁴. The latter, universally accepted (with the only exception of Ivanova¹⁵), featured the expansion of Pit-Grave Culture.

Conclusions

The dynamics in the development of animal husbandry analyzed in a long chronological sequence, confirms the views of natural scientists, regarding considerable climate changes that occurred at the transition from Middle to Late Atlantic, and from Late Atlantic to Sub-Boreal periods of the Holocene. At the same time, this analysis reveals rich potentialities of archezoological data and a proxy evidence of past climate changes.

¹¹ I.V. Ivanov, *Izmeneniya klimata Yuzhnoi Ukrainy v golotsene*, in *Problemy arkheologii Podneproviya 2*, Dnipropetrovsk, 1985, p. 27-32; I.V. Ivanov, I.B. Vasil'ev, *op. cit.*; H. Todorova, *The Neolithic, Eneolithic ...*, in D.W. Bailey, I. Panayotov (eds.), *op. cit.*, p. 79-98; Eadem, *Der balkano-anatolische Kulturbereiche ...*, in *loc. cit.*, p. 27-54; Eadem, *Probleme der Umwelt der prähistorischen Kulturen ...*, in *loc. cit.*, p. 65-70; K.K. Shilik, *Kolebaniea Chernogo morya po geologicheskim, arkheologicheskim i istoricheskim dannym*, in *Dobrudzha*, 14-16 (1997-1999), 1999 p. 41-55.

¹² M. Lazarov, *Les sites submergés le long du Pont Ouest dans le contexte de l'histoire pontique et méditerranéenne*, in *Pontica*, XXVI, 1993, p. 7-18; H. Todorova, *Durankulak*, Band II; H. Angelova, V. Draganov, *Underwater archaeological excavations of submerged Late Eneolithic and Early Bronze Age settlements in Kiten and Sozopol*, in *ThrPon*, VI, 2, 2003, p. 9-22; M. Filipova-Marinova, E. Bozilova, *op. cit.*, in *loc. cit.*; V. Voinea, *op. cit.*, in *loc. cit.*

¹³ V. Dergachev, *Neolitizatsiya Severo-Pontiiskoi ...*, in *loc. cit.*, p. 4-33.

¹⁴ Idem, *The Novo-Danilovo sites (The problem of genesis and interpretation)*, in *EAA 9-th Annual Meeting*, Sankt-Petersburg, 2003, p. 122-123

¹⁵ S. Ivanova, *op. cit.*, in *loc. cit.*