**ARCHAEOLOGICAL RESEARCHES AT
BORDUȘANI - POPINĂ (IALOMIȚA COUNTY)
PRELIMINARY REPORT 1993 - 1994***

1. HISTORICAL BACKGROUND

Silvia Marinescu-Bîlcu

At about 2.5 km NE of Bordușani village (Ialomița county), in the Balta Ialomiței, a terrain which is surrounded by the Borcea channel of the Danube, and by the Danube river itself, lies the site known by the inhabitants as "Popină"; on XIXth century maps it is referred to as "Popina Mare" - plate 1.

The site is mentioned for the first time in Ion Provianu's "Dicționar geografic al județului Ialomița" ("Geographic dictionary of the Ialomița county") - Târgoviște, 1897. Ion Provianu writes: "Popină, hillock in the Balta Island, Ialomița - Balta County, inside the Bordușani commune territory. This hillock is 20 m high and scattered inside it, as well as around it, thick unburned potsherds are found". Pamfil Polonic, in "Raportul din 18 mai 1899" ("The 18 May 1899 report") reproduces *ad litteram* Ion Provianu's text (ins. 5137, p. 121-127 and 22/940, vol. IV, caet. 7, p. 73-79)¹.

Periodically mentioned, Popina was also subject of surface research. In the period between the two World Wars, Grigore Florescu and Vladimir Dumitrescu visit the site, and G. Florescu emphasises the existence of a so called "Drum al melciuşilor" ("Melciuşilor road"), which connected Popina to Capîdava during drought periods. This road was probably put to use during the roman period and it would be interesting to know the role he played. After the Second World War, Ion Barnea visits the zone too, mentioning it and pointing out its importance²; he mentions, besides Gumelnița potsherds, other potsherds, which he attributes to "the first Iron Age and Getlian Age, roman potsherds".

Now and then, archaeological material was gathered by Ion Munteanu (Fetești) and given to the history museums of the Ialomița and Călărași counties.

*Translated from the Romanian by Mihai Tomescu.

The results of the digging campaigns were presented in the Annual Reports Sessions (1986-1995), as well as on the occasion of the scientific sessions organised by the National History Museum of Romania and by the History Museum of the Ialomița County.

At the beginning of the 80s, a group conducted by Silvia Marinescu-Bâlcu and including Alexandra Bolomey, Nicolae Conovici and Marian Neagu studied the site in view of systematic archaeological diggings, but the lack of work force delayed the project.

The digging started in 1986, conducted by Silvia Marinescu-Bâlcu, George Trohani and Gheorghe Matei. From 1987 on, Dragomir Popovici and from 1990 on, Radian Andreescu and Florin Vlad also collaborated, as well as Valentina Voinea and Cătălin Bem, from 1992 on.

The site, extremely rich, showing an impressive and promising thickness of the archaeological deposits, needed a complex, modern research, capable of studying and explaining the evolution of the human communities which lived here, their specific relationships with the environment, the utilisation and administration of the natural resources.

Beginning with 1993, the research became pluridisciplinary, by the collaboration of Mihai Tomescu (palynology), Constanţin Haită (soil micromorphology/sedimentology), Dragoş Moise (archaeozoology - mammals - Neolithic) and Adrian Bălăşescu (archaeozoology - mammals - La Tène). From 1994 on, Iulia Tomescu joined the team in view of charcoal studies, as well as Valentin Radu for palaeoichthyology. Various studies were performed by dr. Eugen Kessler (avifaunal remains), dr. Andrei Sarkany-Kiss (malacology), both from the Babeş-Bolyai University (Cluj), dr. Marton Venczel (herpetology) from Muzeul Țării Crișurilor (Oradea) and dr. Cezarina Bălțeanu from the Anthropology Centre of the Romanian Academy (Iași).

The digging method, which implies a very detailed stratigraphic recording of the field information, was used for the first time in Romania in 1993, during the diggings from Hirşova-tell (Constanţa county), where a romanian-french cooperation programme is still in progress.

During the last campaigns, students from the history faculties of the Bucharest and Constanţa Universities participated to the diggings. They acquired knowledge on matters such as topography or the research directions that were represented by specialists on the site.

The site has the shape of two (twin) tells, the second, smaller one, being placed southwards of the larger one. This type of twin tells was already known in the Gumelnița area (for example at Valea Argovei - Vlădiceasca).

The larger tell is oval-shaped (180 x 70 m), with a height of 15.40 m. Several constructions (the silvic chalet and its annexes) were erected in the southern and central part of its top surface, which is almost oval (140 x 50 m). Because of recent interventions (vegetable garden, orchard, vine plantation), this top surface is inclined in the N-S direction, resulting in 2 m of difference. The southern and eastern limits of the tell are disturbed by a road which destroyed the archaeological deposits down to 1.5 m of depth. Towards the centre-west, a great ice preserving pit was dug before the Second World War. It covers 100-150 sq.m and affects at least the first 4 m of the archaeological deposits. The northern and north-western limits are also affected, at the foot of the tell, by recent human interventions and by natural collapse.

The smaller tell is 8 m high, almost oval (30 x 20 m) and is also destroyed, right at its center, by an ice preserving pit which probably pierces almost down to the base of the archaeological deposits.

Considering these facts, the northern zone of the larger tell, then occupied by domestic waste, was chosen for the diggings.

Initially, a section (SI) of 46 x 2 m was cut from East to West. Beginning with 1988, the zone between SI and the northern limit of the tell was divided in three surfaces - surface α (S α) in the East, surface β (S β) in the west and between them a surface 4 m wide (S γ), which was preserved as stratigraphic witness - plate 2.

The results of the last years' diggings, although partial, already allow us to outline some characteristics and elements which are interesting for the understanding of the human occupation's evolution in this settlement.

The stratigraphy of the archaeological deposits comprises, at the top, 2-3 levels of getic occupation. Underneath, a sarmatic grave (M IX) was discovered in S α .

Downwards, successively, scattered hallstattian (Hallstatt B) potsherds appeared, but without forming a coherent occupation level. Some small ceramic complexes, attributed to the Cernavoda II culture, were also found - in this context was discovered the fragment of a ceramic sceptre with corded ornamentation.

In S α a few graves, which were initially attributed - lacking a significant inventory - to the same culture, were investigated. At present we think they are

Gumelnița graves, but more precise conclusions will be made possible by the anthropologic study of all the skeletons.

Below these levels, the investigation of the Gumelnița occupation levels is now in progress. Their characteristics, as well as those of the La Tène levels, are presented in the following pages.

2. LA TÈNE OCCUPATION

2.1. GETIC LEVELS

George Trohani

The stratigraphy of the La Tène occupation at Bordușani - Popină shows the following features:

from ground-level to 0,25 - 0,35 m of depth: slightly cohesive, restructured, dark brown soil, dusty and rich in ash. Modern and contemporary interventions affect the top layer of this level. The bottom part of the level contains gero-dacic *in situ* complexes; these form the second La Tène occupation level;

- from 0,25 - 0,35 m to 0,35 - 0,55 m: a lenticular levelling deposit made of yellowish loess with grey nuances eastwards, was observed in the central zone of the excavated area;

- from 0,35 - 0,55 m to 0,95 - 1,20 m: light brown sediment, darker, even grey, in the central zone and progressively turns to maroon from East to West. This is the first La Tène occupation level. On one hand it is pierced by pits dug from the second occupation level, but on the other hand, pits dug from this level cut the subsequent levels.

- from 0,90 - 1,20 m to 1,40 m: yellow clay mixed with daub fragments, potsherds, bone fragments, bone, antler and stone tools; it represents a levelling of the pre-existing eneolithic levels.

The excavation of these La Tène levels led to the discovery of about 100 pits and 11 surface dwellings (huts) - plates 3 and 4 -, belonging to at least 4 occupation phases.

The huts, having a NE - SW orientation, were 6,50 - 7 metres long and about 5,50 - 6 metres wide. These have a parallel disposition, with 1,50 - 2 m intervals between them. This disposal on well established rows suggests a care for town - planning, which led to the creation of a street network. This feature is characteristic for both occupation levels, whose dwellings are superposed to a great extent.

The floors were made of well beaten yellow clay, while the walls were made of clay applied to wattle. The huts had gable roofs covered with reed. They generally had two hearths built towards the middle of the north-eastern and south-western walls. Two of the dwellings had three hearths. Three of the discovered hearths, built

in the proximity of north-western walls, obviously had a worshipping role, being shrine hearts, because they had inclined edges and one of them had even incised decorations (lines and circles) - plate 5, fig. 2.

The dwellings, along with the material found *in situ*, will be presented in the following pages.

Dwelling no.1. Its presence was rather supposed on the basis of the existence in Sa, □ A1 - B1, at 0,45 m of depth, of daub lumps. It was pierced by ulterior pits; it might extend southwards, in the unexcavated area.

Dwelling no.2 was almost square-shaped (NS 7,50 m x 8,00 m WE). The entrance was reserved in the western wall. Towards the NW angle, near the wall, a rectangular hearth (0,75 x 0,95 m) was partially preserved. Built directly on the floor, of yellow clay burnt to red towards the upper part, it had a baking crust 3 to 4 cm thick. A square-shaped hearth (0,70 x 0,70 m), also built directly on the floor, was discovered in the SE angle of the hut.

The floor was made of well beaten yellow clay. Walls were made of clay mixed with sand, gravel and chaff, applied to wattle.

Southwards of the entrance, outside the dwelling but within the yellow levelling layer on which it was built, the incomplete, buried remains of a 12 - 13 years old child¹ - plate 5, fig. 1 -, probably a boy, were found. Tightly rolled up, the knees bent up to the chin, he lied on his right side, with the head SE - wards and the pubis NW - wards. One half of a hand made fruitstand was placed over the inferior part of the cranium, over the clavicles and the shoulder blades (scapulae), whereas a great stone was lain over the pelvis.

Noteworthy is the lack of the leg bones from under the knees, of the left hand bones (carpus to phalanxes), of one part of the visceral cranium, of the occipital bone and of the cervical part of the vertebral column, facts which indicates rather a slaughtering than a common burial. In our opinion, this represents a ritual sacrifice made in order to confer strength and stability to the new construction intended to be built on the place. It is a manifestation of the "sacrifice for durability", in which the sacrificed individual is the bearer of a pure and innocent spirit. Children sacrifices have been known almost world-wide, ever since the antiquity, particularly when large constructions, harbours or fortifications were to be built⁴.

Inside the hut, the following ware (plates 6 - 10) was found *in situ* (numbers correspond to the ones on the plan - plates 3 and 4): 1. Hand - made jug, brick - coloured; 2. Amphora; 3. Wheel - made dish, brick - coloured; 4. Jug; 5. Hand - made cup, brick - coloured; 6. Wheel - made fruitstand, brick-grey - coloured; 7. Jar; 8. Hand - made, biconical vessel, grey - coloured, with a zigzag line incised on the brim; 9. Hand - made jar, grey - coloured, with four handle - prominences; 10. Wheel - made fruitstand, grey - coloured; 11. Hellenistic pedestalled dish; 12. Wheel - made dish, grey - coloured; 13. Hand - made jug, grey coloured, deprived of bottom; on its brim lay another hand - made jug's bottom, brick - coloured.

Dwelling no.3 was only partially excavated (its western half) - the eastern half is still overlain by the stratigraphic witness (Sy) positioned between the two excavated areas. With a NW - SE orientation, the hut was rectangular (NW - SE 8,70m x 5,00 m NE - SW). Towards the middle of the northern wall there was a flat, rectangular hearth (0,90 x 0,77 m) with a NW - SE orientation. A bottom, 7 cm thick, burnt sand layer, positioned on the floor, was covered by 4 - 5 cm of burnt clay mixed with sand and fine gravel, covered by a 1,5 - 2 cm thick baking crust.

In the middle of the hut a second hearth was found. A gravel layer (2,5 - 4 cm grained) of limestone and sandstone, situated directly on the floor, was covered by clay, burned to red and forming a 2 cm thick baking crust at the top. This hearth was provided with a low kerb made of burnt clay.

Near the SW angle a third, square shaped (0,80 x 0,80 m) and fragmentarily preserved hearth was found.

Southwards of the central hearth, fragments of door or window case were found, proving the existence of a certain architectural concern.

The *in situ* found inventory (plate 11) contained: 1. Grinding stone; 2. Roman type grinding mill; 3. Hand - made bowl, containing calcite, with painted circles; 4. Jar decorated by impression, secondarily burned; 5. Bowl; 6. Jar bottom; 7. Lid.

Outside the dwelling, westwards, four more grinding stones were found.

Dwelling no.4, rectangular - shaped, was 7,00 m long (NS) and 4,30 m wide (WE). Towards the middle of the west side a porch (NS 3,00 m x 2,40 m WE) was built.

The walls were made of yellow clay mixed with sand, fine grained gravel and a little chaff, applied to wattle. The floor was made of well beaten, yellow clay, with black and red burning traces.

Near the middle of the northern wall a fragmentary shrine-hearth was found. Square-shaped (0,94 x 0,94 m), it was raised in relation with the floor and had inclined edges. Overlying 14 cm of burnt, yellow sandy clay, the active part of the hearth comprised a compact, 7-8 cm thick, burnt layer, with a surface baking crust 5 cm thick. The crust was incised along the two diagonals of a 0,80 x 0,80 m square, and towards the angles of the quarters thus obtained, four little circles were also incised.

In the center of the hut's southern half, a second, flat hearth was built on an amphorae potsherds layer.

The *in situ* found inventory (plates 10, 12 - 16) comprised: 1. Amphora with the brim oriented to the south; 2. Jar; 3. Hand made jar, brown-grey-coloured, with a band of impressions and incised lines; 4. Hand-made jug, brick-coloured; 5. Hand-made cup, brick coloured; 6. Eight burnt-clay weights; 7. Small weight; 8. Weight; 9. Grinding stone; 10. Small weight; 11. Small weight; 12. Burnt stone showing an incision; 13. Amphora with the brim oriented to the north; 14. Rushlight, secondarily burned, with laced brim; 15. Jar with four knob-shaped handle-prominences, brown-coloured; 16. Wheel-made dish, grey-coloured, with glazed decoration; 17. Dish made from the bottom of a hand-made storage vessel, grey coloured; 18. Bottom of a hand-made storage vessel, brick-coloured; 19. Hand-made jar, grey-coloured, with a band of impressions between the four knobs; 20. Hand-made jar, brick coloured, with four handle-knobs and a band in relief; 21. Half of an amphora; 22. Bottom of a hand-made storage vessel, brick-coloured; 23. Fruitstand; 24. Lower half of a hand-made jar, brick coloured, with an alveolate band; 25. Little hand-made jar, brick-coloured, with four knob-shaped handle-prominences, the brim oriented to the south; 26. Grinding stone laid on hearth no. 2; 27. Grinding stone found together with the piece number 12; 28. One spindle whorl and 17 weights found in the SE angle; 29. Grinding stone; 30. Fragmentary hand-made jar or jug, brown-coloured; 31. Hand-made jar, brick-coloured, with *umbo* bottom; 32. Burnt clay ball; 33. Wheel-made jug, grey coloured; 34. Grinding stone; 35. Grinding stone; 36. Bronze sheet fragment; 37. Red deer antler fragment;

38. Hand-made globular jar-vessel, painted, brick-coloured; 39. Small weight; 40. Amphora; 41. Grinding stone.

Dwelling no.5 was partially destroyed by modern interventions. It was NW-SE oriented and had a rectangular shape (NW-SE 7,25 m x 5,25 m NE-SW). The floor was made of brown clay and the walls of clay applied to wattle. A hearth was built in the center of the SW quarter.

Few artifacts (plates 17 - 19) were found *in situ*: 1. Wheel-made jug with grey paste, two handles and glazed decoration; 2. Ten weights and a spindle whorl; 3. Round, flat spindle whorl; 4. Flat stone weight with a perforation; 5. Quite large grinding stone with grinder, made of crumbly sandstone; 6. Jar; 7. Weight; 8. Wheel-made fruitstand; 9. Fibula.

Dwelling no.6 lied approximately under the zone excepted from excavation as stratigraphic witness, between the two excavated surfaces. It was almost square-shaped (WE 8,50 m x 8,00 m NS). It was identified, in surface α , on a 4 sq.m wide area, whereas in the β surface it appeared on a 0,50 sq.m wide area.

The floor was incompletely preserved, due to numerous ulterior pits and was made of yellow (in the eastern zone) to brown-yellow (in the western zone) clay.

No hearth or inventory were found.

Dwelling no.7 was represented only by floor fragments made of yellow clay which were found in the east of surface α . It was pierced by numerous ulterior pits.

It contained a square-shaped (0,80 x 0,75 m), flat hearth built directly on the floor. No inventory was found.

Dwelling no.8 was square-shaped (7,50 x 7,50 m). The walls were made of clay and wattle, with some posts. Outside, the walls were somewhat spongy, but smoothened. The floor, made of well beaten yellow clay, was burned to a great extent, red and crusty. A flat, circular hearth (0,75 m in diameter) was built in the center of the hut.

The following artifacts (plates 19 and 20) were found *in situ*: 1. Rhodian amphora with a stamped handle; 2. Kantharos fragment; 3. Potsherd of an imported vessel, showing an erotic scene; 4. Fruitstand; 5. Hand-made jar, with grey, ground shell tempered paste; 6. Jar bottom; 7. Jug; 8. Grinding stone.

Dwelling no.9 was also approximately square-shaped (WE 7,00 m x 6,50-7,25 m NS). The floor was a compact layer of well beaten, yellow clay.

In the NE angle a circular, flat hearth (0,40 m in diameter), slightly sunken in the floor was found. A second hearth was built in the NW angle. It was also flat and circular (0,50 m in diameter), but it was deprived of baking crust. A third hearth was found in the center of the western half of the hut. This one was raised in relation with the floor and its bottom was represented by a layer of clay mixed with gravel and burned to red.

No *in situ* inventory was found.

Dwelling no.10. Its presence was rather supposed; it was destroyed in a great proportion. Only some fragments of clay and wattle and some *in situ* stones, from the walls, remained from this hut.

Dwelling no.11 extends southwards, under the unexcavated zone. The walls were made of clay and wattle, whereas the floor was made of yellow clay. A fragmentarily preserved hearth was found. It was built on a layer of gravel and burnt clay and its baking crust was 1-1,5 cm thick.

The inventory of the hut comprised: 1. Grinding stone; 2. Amphora; 3. Jar; 4. Jar.

As regards the dating of the dwellings, because the study is still in progress, we can afford to make only relative estimates. More precise datings will be possible only after the study of all the found inventory, including that coming from the pits. Thus, taking into account the data we detain now, we chose a more lax chronology.

Stratigraphically, the dwellings pertain to two distinct occupation phases. Dwellings no.8, 9, 6 and 7 (from the West to the East) belong to a first occupation level. Dwellings no.9 and 6 were totally deserted, which means that all inventory was removed - without destruction of the hearths. Dwelling no.8 and, to a great extent dwelling no.7, collapsed over the *in situ* inventory.

A case of particular interest, the inventory of dwelling no.8 contained different vessels: a rhodian stamped amphora contemporary to a kantharos, a fragment from an hellenistic vessel showing an erotic scene and a jar which is geto-dacic by form, but whose paste contains a great amount of ground shells (see Appendix I).

All these artifacts have been dated *grosso modo* between the end of the IInd century B.C. and the half of the Ist century B.C.

After the abandoning of the dwellings, the surface (ruins excepted) was carefully levelled and new dwellings were built. We noticed that, even if the street network was guarded, the new dwellings were not erected exactly on the same emplacements as the ancient ones - displacements of several meters occur. The second occupation level comprises dwellings no.10, 5, 3, 2, 1, 11 and 4.

The more important of them are dwelling no.2, with an inventory of 52 artifacts, dwelling no.4 with 41 artifacts, dwelling no.5 with 8 artifacts and dwelling no.3 with 7 artifacts. The great number of artifacts found *in situ* bears evidence for a hasty abandoning which was not, however, due to fire. Dwelling no.3 might represent an exception, as one jar is strongly burned.

One must also remark that dwellings no.2 and 4 contain several groupings of burnt clay weights and grinding stones, proving a high degree of preoccupation for weaving, fishing and cooking. The lack of large storage vessels and the presence of numerous, perforated flat weights of burnt clay or stone is to be noticed. The latter, let aside their possible use as weights for looms or sinkers for fishing nets, might also represent anchors⁵ for small, light (monoxyle) boats which were probably used in the surrounding marshy area.

The dating of the second occupation level was based on the presence of a great quantity of wheel-made ware with the following attributes: made of grey paste containing calcite (it enlightens its colour - Appendix II), decorated with geometric patterns painted in red and glazed. Thus, we came to the conclusion that the level must be attributed to the second half of the first century B.C.. The possibility of this ware to originate in the first century A.D. cannot be excluded.. This was supposed because similarities can be found in the settlements from Bâta Doamnei⁶, Răcățiu⁷, Barboși⁸, Brad⁹ or Polana¹⁰, in Moldavia.

The clay with considerable amounts of calcium carbonate (marly clay) originates, probably, from Dobrogea, where such deposits are known nowadays. This bears evidence for the existence of connections with the surrounding regions, let aside the contacts with the hellenistic and roman world. All these facts shall, however, be better proved by further, thorough study.

APPENDIX I: Geto-dacic potsherds with shell-tempered paste

Material - 23 potsherds of various dimensions with shell fragments and some almost entire shells.

Taxons identified without destruction of sherds:

a) Class *Gastropoda*

- family *Viviparidae* - genus *Viviparus*;
- family *Planorbidae* - genus *Planorbis*, *Planorbarius* (*P. corneus*);
- family *Thiaridae* - genus *Fagotia*=*Esperiana* (*E. esperi*, *E. actularis*);
- family *Lithoglyphidae* - genus *Lithoglyphus* (*L. apertus*?);
- family *Bithyntidae* - genus *Bithynia*;
- family *Valvatidae* - genus *Valvata*;

b) Class *Bivalvia*

- family *Unionidae*;
- family *Dreissenidae*.

All are fresh-water molluscs which live both in the Danube and in the surrounding stagnant waters.

The shells may have been taken along with the clay used in the pottery, but may have also been intentionally mixed with it. The mixing of ground shells with the pottery clay leads to the obtaining of a stronger paste. This paste is at the same time lighter and ensures a better thermal insulation.

Considering that the number of geto-dacic vessels with shell-tempered paste is very small, we can also figure an eventual ritual purpose.

Gabriela Andrei

The presence of the calcium carbonate (CaCO_3) in part of the geto-dacic ware from Borduşani may be due to two situations:

a) The firing temperature was too low to allow the complete dissociation of calcite, which remains (partially) non-transformed;

b) Even if the firing temperature is high enough and the calcite is totally dissociated, the firing time might not have been long enough for the calcium oxide (CaO) - resulted from the calcite dissociation ($\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$) which begins at 700°C and is completed at 900°C - to combine with the other constituents of the paste. Thus, a certain amount of calcium oxide remains in the paste and, passing through the intermediary phase of slaked lime - Ca(OH)_2 -, fixes carbon dioxide (CO_2) from the atmosphere: $\text{CaO} + \text{H}_2\text{O} = \text{Ca(OH)}_2$ and $\text{Ca(OH)}_2 + \text{CO}_2 = \text{CaCO}_3 + \text{H}_2\text{O}$. The process is called recarbonisation and leads to the apparition of "recarbonated nodules".

Doina Şeclăman

The great quantity of pieces (3829) yielded by the La Tène levels from Borduşani-Popină allows the reconstitution of a more or less complete image on the alimentary economy of the geto-dacic population that inhabited the site (animal husbandry, hunting, fishing).

The palaeofaunistic material is very diversified, belonging to several systematic classes - 6,18% invertebrata (*Bivalvia* and *Gasteropoda*) and 93,82% vertebrata (*Pisces*, *Amphibia*, *Reptilia*, *Aves* and *Mammalia*) - see table 1. 70,2% of the pieces were found within the occupation levels, whereas 29,8% came out from various complexes (pits no.71, 78, 79, 81, 82, 83, 90 and dwellings no.5, 8 and 9).

The pits have various forms and dimensions (depths ranging from 0,5 to 2,18 m and diameters comprised between 0,5 and 1,8 m). The abundance varies between 8 faunal pieces in the pit no.82, 30 pieces in pit no.78, and 272 pieces in pit no.79 or 313 pieces in pit no.90. Dwellings no.5 and 9 yielded 1, respectively 2 pieces, whereas dwelling no.8 yielded 93 pieces.

Most of the pieces belong to mammals (54,2%), followed by the fish (36,35%).

The present study concerns only the mammal pieces. From the 2074 pieces belonging to mammals, 1544 (74,44%) were identified. Although the mammal pieces found in complexes represent only a quarter of the total amount of pieces (complexes plus cultural layers), the Minimum Number of Individuals (MNI) coming from complexes (79) exceeds the MNI found within the occupation levels (73). This seems fairly normal considering that each complex was treated as a distinct entity, a fact which induced the increase of the supposed MNI.

Among the domestic mammals 6 species were identified - *Equus caballus*, *Bos taurus*, *Ovis aries*, *Capra hircus*, *Sus scrofa domesticus* and *Canis familiaris* -, while among the wild mammals there were 10 identified species - *Cervus elaphus*, *Capreolus capreolus*, *Sus scrofa ferus*, *Canis lupus*, *Vulpes vulpes*, *Lutra lutra*, *Mustela nivalis*, *Lynx lynx*, *Castor fiber* and *Lepus europaeus*.

From the total amount of mammal bones, the domestic mammals represent 84, 13%, with a presumed MNI of 113 (74,32% of the total MNI), whereas the wild

ones represent 15,7%, with a presumed MNI of 39 (25,68% of the total MNI) - table 2.

Domestic mammals (diagram 1)

Equus caballus (horse) - table 3 - is poorly represented (2,07% of the pieces). The estimated MNI is of 7, out of which 4 were found in complexes and 3 in the occupation levels. They are aged as follows:

- 1 individual aged less than 3 1/2 years old (ulna unfused proximally);
- 5 adult individuals;
- 1 senescent individual (advanced wear of the inferior molars).

No evidence has been found on the pieces, regarding the use of horses for alimentary purposes. Unhappily, due to the absence of whole horse bones, we could not estimate any size for the individuals.

Bos taurus (cow) - table 4 - is the most abundant species as number of bone pieces (33,8%). 24 individuals were identified, 11 coming from the complexes and 13 from the occupation levels. The slaughtering ages vary as following:

- 1 individual aged less than 6 months;
- 2 individuals aged 2 years old;
- 10 individuals aged more than 2 years old;
- 6 individuals aged more than 3 1/2 years old.

The pre-adult/adult ratio is 1:3.

The discovery of whole, well preserved metapodals allowed to estimate the size of some of these individuals - a female's metacarpal shows a size of 108,9 cm, while a pair of metatarsals yields a size of 99,2 to 99,7 cm for another female, therefore a mean size of 104,3 cm for the females. The absence of entire male bones hindered any estimation of size, but the males were certainly more robust, for their bones are more massive.

Ovicaprinae - *Ovis aries* (sheep) - table 5 - and ***Capra hircus*** (goat).

The ovicaprinae of Borduşani comprise 16 sheep and 4 goats.

Among the sheep, 8 were found in complexes and 8 in the occupation levels.

Their slaughtering ages are:

- 4 months for 1 individual;
- 1 year 4 months for 2 individuals;
- 2 years for 4 individuals;

- more than 2 1/2 years for 4 individuals;
- more than 3 1/2 years for 5 individuals.

Using the biometry, one male and 15 females were identified.

Whole bones enabled size estimation of these mammals. The measurement of 6 pieces (2 metacarpals, 1 metatarsal and 3 calcanei) resulted in sizes comprised between 58,9 and 64,63 cm (Teichert Index), therefore a mean size of about 61,64 cm, a value very close to those obtained in geto-dacic sites of the same period from the South-East of Romania¹¹. This mean size of the Borduşani sheep is also very close to the value (60,34 cm) of this mean in Europe during the La Tène period¹².

Capra hircus (goat) - table 6 - is poorly represented as number of pieces and MNI - 4, out of which 2 came from complexes (pits) and 2 from the occupation levels. One individual is a male, while the 3 others are females.

Slaughtering ages are:

- 1 year for 1 individual;
- more than 2 years for 1 individual;
- more than 3 1/2 years for 2 individuals.

The size of one of the individuals, measured on a radius, is 64,87 cm (Schramm index).

Sus scrofa domesticus (pig) - table 7 - is abundant as number of pieces (31,28%). The estimated MNI is of 48 individuals, therefore the double of the bovids MNI in this site. 30 individuals were found in complexes and 18 within the occupation levels. Their age group distribution is:

- 2 individuals aged 3 to 6 months old;
- 2 individuals aged 6 months old;
- 3 individuals aged 9 months old;
- 13 individuals aged 1 year old;
- 8 individuals aged 1 year 3 months to 1 year 6 months old;
- 14 individuals aged 1 1/2 years old;
- 4 individuals aged 2 years old;
- 1 individual aged more than 2 1/2 years old;
- 1 individual aged more than 3 1/2 years old.

Slaughtering ages were obtained by the study of the deciduous and permanent dentition, excepting individuals aged more than 3 1/2 years old, for which the slaughtering age was estimated on a proximally fused femur. The more

aged individuals (2 aged 2 years old, one aged 2 1/2 and one aged 3 1/2 years old) were males, a fact which leads to the conclusion that they were possibly kept for reproduction.

The biometric study performed on whole bones (5 astragali, 2 calcanei and 1 metacarpal III) led to sizes of 65,17 to 76,5 cm. The mean size (n=8) is 70,3 cm (Teichert index), which means that Borduşani pigs were medium sized.

One individual showing advanced wear of teeth and an intensely decayed M3 was observed.

Canis familiaris (dog) - table 8. Although represented by a small number of pieces (5,5% of the total), there are 14 individuals (MNI) aged (by dentition) as following:

- 1 individual aged 6 months old;
- 1 individual aged 1 year old;
- 12 adult individuals (aged more than 1 1/2 years old).

7 of them came from complexes and 7 from the occupation levels.

The size of dogs, measured on one humerus, 3 radius and 3 femurs, has a variance of 51,6 to 62,4 cm (Harcourt index), with a diaphysary index of 6,9 to 8,08; the mean size obtained according to the Koudelka index is 57,7 cm. The Harcourt index shows a medium towards large size of the Borduşani dogs, while the diaphysary index suggests they were medium robust.

In characterising the Borduşani dogs by their apendicular skeleton, dimension scales (one for the size and the other for the diaphysary index) proposed by Udrescu¹³ were used. They show that these dogs have dimensions close to the top values of dog sizes known from other geto-dacian sites.

Wild mammals (diagram 2)

Even if the number of pieces and the MNI are smaller than those of the domestic mammals, the number of species for the wild mammals is bigger. Ten species of wild mammals were identified, out of which the *Artiodactyla* order is the most represented, by the *Cervidae* family (*Cervus elaphus* and *Capreolus capreolus*) and the *Suidae* family (*Sus scrofa ferus*).

Cervus elaphus (red deer) - table 9 - is the most abundant hunted wild mammal, a fact proved by the numerous pieces belonging to him and the presumed MNI - 14, out of which 9 found in complexes and 5 within the occupation levels.

Their ageing by dentition gave:

- 4 pre-adult individuals;
- 8 adult individuals;
- 2 senescent individuals (advanced wear of the jugal teeth).

Capreolus capreolus (roe deer) is poorly represented as number of pieces (0,52%) and MNI (1,97%). Three individuals were identified, all of them within the occupation levels.

Sus scrofa attila (wild boar) - table 10. Five individuals were discovered: 1 male and 4 females. Two of them came from complexes (pits) and 3 from the occupation levels.

Size was estimated (Teichert Index) on 3 bones (1 calcaneum, 1 astragalus and 1 metacarpal III); the mean size is 103 cm.

Carnivores (Ord. *Fissipeda*) are well represented in the osteological material at Borduşani. Five species were identified: *Canis lupus* and *Vulpes vulpes* (Fam. *Canidae*), *Lutra lutra* and *Mustela nivalis* (Fam. *Mustelidae*), *Lynx lynx* (Fam. *Felidae*).

Canis lupus (wolf) - table 11 - is poorly represented as number of pieces (0,71%) and MNI - 3, out of which 2 found within the occupation levels and one in a pit. One of the individuals shows on the left mandible (at the level of the carnassial) an inflammatory process which affects the lingual surface.

Vulpes vulpes (fox) - table 12 - is the most abundant wild mammal after red deer - 7 individuals were identified, 3 of them from complexes (pits) and 4 from the occupation levels.

Lutra lutra (otter) - table 13 - was identified due to a humerus belonging to an adult individual, found within the occupation levels. The maximum length of the bone is 75 mm, the width of the proximal epiphysis is 19 mm and that of the distal epiphysis is 24,5 mm.

Mustela nivalis was identified on the cranium of an adult discovered in a dwelling.

Lynx lynx is represented by two mandibles belonging to the same adult individual found in the occupation levels. This individual is the only lynx discovered in the South-East of Romania until the present. His presence so far away from the mountains can be explained only by considering that winters were more glacial than usual, forcing him to descend southwards in search of prey.

Castor fiber (beaver) is the only representative of Order *Rodentia*. He was identified due to 4 pieces belonging to 3 adults, one discovered in pit 71 and the two others within the occupation levels. One of them shows a length of 37 mm of the jugal teeth.

Lepus europaeus (hare), the only representative of Order *Lagomorpha* was identified on a distal tibia fragment belonging to an adult found within the occupation levels.

Conclusions

The animal economy of the geto-dacic community from Borduşani was centred upon domestic mammals. The pig occupies the first place in the animal husbandry (see diagram 3), fact proved by the great number of individuals - 45, therefore 52% of the total domestic mammals. This seems normal considering the surrounding biotopes of Borduşani-Popină - lakes, marshes and forests -, ideal for their breeding in semi-wildness conditions. This habitude is encountered even nowadays in the Balta Ialomitei island.

Bovids and ovlds were exploited mainly for their secondary products, milk and wool; their slaughtering ages and pre-adult/adult ratio show the consideration given to adult individuals. Bovids were supposedly also exploited for draught.

Horses were probably used for traction (no evidence was found for the use of horse on alimentary purposes).

The abundant dogs are presumed of being used for guard (of dwellings, flocks) and hunting, for they are medium towards large sized.

Hunting seems that it represented a secondary activity, practised for the obtaining of supplementary food and as mean of defence against predator carnivores.

Similar to other geto-dacic sites, where red deer, roe deer and wild boar represent 71% of the total wild mammals¹⁴, at Borduşani fragments belonging to these species form 75% at the total wild mammals.

Bird hunting is proved by the existence of a very little number of bone pieces. Considering that small bones were eaten by dogs, only the large ones are preserved.

In the same way as the abundance of dog individuals, the great number of hunted carnivores can be explained by the necessity of protecting the community flock.

Fishing also played, probably, an important role in the alimentary economy of the site's population - 36,35% of the total pieces belong to fish. They are often represented by cranium bones, vertebrae corps, ribs.

Table 1. Bordușani-Popină. The distribution of the bone pieces by taxons.

TAXON	NUMBER	%
GASTEROPODA	133	3,47
BIVALVIA	104	2,71
PISCES	1392	36,35
AMPHIBIA	1	0.02
REPTILIA	16	0,41
AVES	109	2,84
MAMMALIA	2074	54,2
TOTAL	3829	100

Table 2. Bordușani-Popină. Species frequencies by number of bone pieces (NP) and minimum number of individuals (MNI).

SPECIES	NP	%	MNI.	%
<i>Equus caballus</i>	32	2,07	7	4,6
<i>Bos taurus</i>	522	33,8	24	15,79
<i>Ovis aries</i>	105	6,8	16	10,52
<i>Capra hircus</i>	8	0,52	4	2,63
O/C	67	4,33	-	-
<i>Sus domesticus</i>	483	31,28	48	31,57
<i>Canis familiaris</i>	85	5,5	14	9,21
TOTAL mamifere domestice	1302	84,3	113	74,32
<i>Cervus elaphus</i>	130	8,42	14	9,21
<i>Capreolus capreolus</i>	8	0,52	3	1,97
<i>Sus scrofa attila</i>	39	2,52	5	3,28
<i>Canis lupus</i>	11	0,71	3	1,97
<i>Vulpes vulpes</i>	45	2,98	7	4,68
<i>Lutra lutra</i>	1	0,06	1	0,65
<i>Mustela nivalis</i>	1	0,06	1	0,65
<i>Lynx lynx</i>	2	0,12	1	0,65
<i>Castor fiber</i>	4	0,25	3	1,97
<i>Lepus europaeus</i>	1	0,06	1	0,65
TOTAL mamifere salbatice	242	15,7	39	25,68
TOTAL MAMIFERE	1544	100	152	100

Diagram 1. Bordușani-Popină. Frequencies of the domestic mammal species by number of bone pieces and minimum number of individuals

Diagram 2. Bordușani-Popină. Frequencies of the wild mammal species by number of bone pieces and minimum number of individuals

Cervidae=*Cervus elaphus* and *Capreolus capreolus*, *Carnivora*= *Canis lupus*, *Vulpes vulpes*, *Lutra lutra*, *Mustela nivalis* si *Lynx lynx*

Diagram 3. Bordușani-Popină. Frequencies of the alimentary species of domestic mammals by number of bone pieces and minimum number of individuals.

Table 3. Bordușani-Popină. *Equus caballus* - osteometrical data

Anatomical element /measurements ⁵⁵	number	extremes (nun)	mean (mm)
HUMERUS			
Bp	1	72,5	-
BT	1	69	-
METACARPUS			
Bp	2	35; 37	-
PHALANX 1			
GL	3	75- 82	77,33
Bp	3	52,5- 53,5	52,83
BFd	3	46- 46,5	46,16
Dp	3	34- 34,5	34,16
SD	3	31,5- 35	32,66
Bd	3	43,5- 45,5	44,16
BFd	3	40- 42,5	40,83

PHALANX II			
GL	2	44; 46	-
Bp	2	51; 52	-
BFd	2	45; 46	-
Dp	2	30; 33	-
SD	2	44; 46	-
Bd	2	48,5; 50	-
BFd	2	26; 27	-

Table 4. Bordușani-Popină. *Bos taurus* - osteometrical data

Anatomical element /measurements ⁵⁸	number	extremes (mm)	mean (mm)
MANDIBLE			
10(L)	4	32- 34	32,75
10(B)	4	11-15	12,875
SCAPULA			
SLC	2	44,5; 49,5	-
GLP	1	62	-
LG	2	44; 52	-
BG	2	36; 44,5	-
HUMERUS			
Bd	2	75; 80,5	-
BT	3	62- 77	69
RADIUS			
Bp	2	73,5; 89	-
BFp	2	67; 79	-
Bd	1	80,5	-
BFd	1	74	-
METACARPUS			
GL	1	180	-
Bp	3	53- 61,5	56,16
SD	3	31- 34	32,5
Bd	1	58	-
shoulder height	1	1089	-
Matolcsi index			
TIBIA			
Bp	3	75- 83	79
Bd	7	51- 63,5	57
ASTRAGALUS			
GLl	7	57- 65	60,85
GLm	7	52- 58	55,31
DI	8	31- 36,5	33,37
Dm	6	32- 37	34
Bd	7	38- 43	39,42
CALCANEUS			
GL	5	105- 129	120,6
GB	7	32,5-42	38,21
OS CENTROTARSALE			
GL	2	57; 60	-

METATARSUS			
GL	2	188; 189	-
Bp	7	39,5- 53	46,14
SD	5	22- 28	24,4
Bd	4	47,5- 61	52,7
shoulder height	2	992,6;	-
Matolcsi index		997,9	

Table 5. Bordușani-Popină. *Ovis aries* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
SCAPULA			
SLC	2	15,5; 17,5	-
GLP	2	28,5; 32	-
LG	2	22; 22,5	-
BG	2	18,5; 19,5	-
HUMERUS			
Bp	1	37	-
Bd	6	28,5- 31	29,58
BT	6	27- 29	27,83
ULNA			
LO	2	37; 40	-
DPA	4	22,5- 25,5	24,25
SDO	4	19,5- 21	20,375
BPC	4	17- 18,5	17,375
METACARPUS			
GL	2	128; 130	-
Bp	3	22- 23	22,5
SD	3	12- 13,7	12,56
Bd	2	24; 25	-
shoulder height	2	625,2;	-
Teichert Index		635,7	
PELVIS			
LA	2	25,5; 26	-
TIBIA			
Bd	4	24,5- 27,5	25,875
METATARSUS			
GL	1	130	-
Bp	4	19,5-22,5	20,875
SD	5	10,5-12	10,9
Bd	5	23-26	24,4
shoulder height	i	590,2	-
Teichert index			
ASTRAGALUS			
GL	3	26-28,5	27,16
GB	3	16,5-18,5	17,5
shoulder height	3	589,6-	616
Teichert index		646,3	

Table 6. Bordușani-Popină. *Capra hircus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
HUMERUS			
Bp	2	34,5; 38,5	-
RADIUS			
GL	1	163	-
Bp	1	32,5	-
BFp	1	30,5	-
SD	1	178	-
Bd	1	30	-
BFd	1	26	-
shoulder height	1	648,7	-
Schramm index			

Table 7. Bordușani-Popină. *Sus scrofa domesticus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
CRANIUM			
30	4	24,5- 28	26
31	4	16-17	16,375
MANDIBLE			
10(L)	3	30- 33,5	31,83
10(B)	3	14,8- 15,5	15,1
SCAPULA			
SLC	4	19,5- 23,2	22,05
GLP	4	31- 34,5	33,125
LG	4	24- 28,5	26,875
BG	4	21- 24	22,5
HUMERUS			
Bp	1	42	-
Bd	5	35- 41,5	38,5
BT	5	27- 32	29,7
RADIUS			
GL	1	147	-
Bp	5	25- 33	28,3
SD	5	14- 21	17,2
Bd	1	37	-
shoulder height	1	786,2	-
Teichert index			
ULNA			
DPA	4	35- 39	36,375
BPC	4	20- 25	22,625
TIBIA			
SD	2	16; 17	-
Bd	5	25- 34	29,1

ASTRAGALUS			
GLI	5	36,5-40,5	38,3
GLm	5	34-37,5	35,3
DI	5	18,5-20	19,12
Dm	5	18-23	20,7
Bd	5	21-24,5	22,5
shoulder height	5	670,5-748	705,5
Teichert index			
CALCANEUS			
GL	2	67; 70	-
GB	4	18,5- 20,5	19,62
shoulder height	2	651,7; 680	-
Teichert index			

Table 8. Bordușani-Popină. *Canis familiaris* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
MANDIBLE			
8	4	67- 81	75
9	4	63,5- 76	70,1
10	5	31- 36,5	33,7
11	8	35,5- 43,5	38,9
12	8	31- 39,5	34,25
13(L)	9	16- 22,5	20,8
13(B)	9	6- 9	8
14	12	14- 21	19,4
15(L)	4	7,5- 9,3	8,4
15(B)	4	5- 6,4	5,6
18	4	39- 61,5	54,75
19	12	16,5- 28	24,1
20	8	15- 21,5	18,4
25	2	159,4; 173	-
26	4	150,3- 191	169,2
HUMERUS			
GL	1	183	-
Bp	4	41- 45,5	43,6
SD	2	13; 13,5	-
Bd	5	28- 36	31,16
shoulder height:			
- Koudelka index	1	617	-
- Harcourt index	1	601	-
RADIUS			
GL	3	156- 181	168
Bp	3	18- 19	18,5
SD	4	12- 14	12,9
Bd	4	23- 26	24,08
shoulder height:			
- Koudelka index	3	502- 583	541
- Harcourt index	3	516- 595	554

ULNA			
DPA	3	20- 26	22,6
SDO	3	17- 22	19
BPC	3	13-17	14,5
PELVIS			
GL	3	158- 164	161,6
LA	5	22- 25	23,7
SB	3	9- 10	9,4
FEMUR			
GL	3	185- 203	195
Bp	3	36- 42	39
DC	3	20- 22	21
SD	3	14	14
CD	3	48- 49	48,3
Bd	3	32- 33,5	32,8
shoulder height			
- Koudelka index	3	557- 611	587
- Harcourt index	3	568- 624	600
TIBIA			
SD	2	14; 14,5	-
Bd	2	23; 25	-
PHALANX I			
GL	3	27- 28,5	27,8
Bp	3	8,9-9	8,8
SD	3	5,6-6	5,9
Bd	3	7,5-8	7,75

Table 9. Bordușani-Popină. *Cervus elaphus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
SCAPULA			
SLC	3	34- 39,5	37,33
GLP	1	58,5	-
LG	3	43- 45	43,83
BG	3	39- 42,5	41,16
HUMERUS			
Bd	3	55,5- 65,5	61,33
BT	3	51,5- 60	56,66
METACARPUS			
Bp	4	43- 58	48,75
Sd	3	23,5-28	25,16
TIBIA			
Bd	4	52,5- 58	55,25
ASTRAGALUS			
GLI	10	55,5- 62	58,85
GLm	11	52- 59,5	55,4
DI	10	29- 39	33
Dm	11	30,5- 38	33,13
Bd	10	35- 39	37,24

CALCANEUS			
GL	2	117; 124	-
GB	2	36; 40	-
OS CENTROTARSALE			
GB	4	37- 46,5	43
METATARSUS			
Bp	3	38- 44	42
SD	2	22; 26	-
PHALANX I			
Gl.pe	9	58- 68	62,44
Bp	9	21- 25,5	23,22
SD	10	19- 24	23,95
Bd	10	16,5- 22	18,65

Table 10. Bordușani-Popină. *Sus scrofa attila* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
SCAPULA			
SLC	2	30; 34	-
GLP	2	45; 46	-
LG	2	35; 38	-
BG	2	29; 30	-
TIBIA			
Bd	2	40; 43,5	-
CALCANEUS			
GL	2	101; 117	-
GB	4	28- 36	31,25
height shoulders			
Teichert index	2	969; 1118	-
ASTRAGALUS			
GLI	2	53,5; 54,5	-
GLm	2	47,5; 50	-
DI	2	27,5; 29	
Dm	2	33,5; 34	
Bd	2	31; 32	

Table 11. Bordușani-Popină. *Canis lupus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
MANDIBLE			
8	2	91; 93,5	-
10	2	44,5; 45,5	-
13(L)	2	27; 28	-
13(B)	2	10; 11	-
14	2	26,5; 27	-
15(L)	3	11,5- 12	11,83
15(B)	3	7,7- 8	7,9

TIBIA			
Bd	2	31; 32	-
CALCANEUS			
GL	1	63,5	-
GB	2	22,5; 24	-

Table 12. Bordușani-Popină. *Vulpes vulpes* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
HUMERUS			
Bp	2	21,5; 22	-
Bd	2	21; 23	-
RADIUS			
Bp	1	14,5	-
Bd	2	12; 12,2	-
PELVIS			
LA	4	14,5-16	15,22
TIBIE			
Bd	4	14- 16,5	15,5
CALCANEUS			
GL	2	34,5; 36	-
GB	2	11,5; 12,5	-

Table 13. Bordușani-Popină. *Lutra lutra* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
HUMERUS			
GL	1	75	-
Bp	1	19	-
Bd	1	24,5	-

3.2. POTTERY

Silvia Marinescu-Bîlcu, Dragomir Popovici and Radian Andreescu

The pottery falls into two categories, depending on fabric: coarse ware - well fired, containing ground sherds in the paste, sometimes brittle - and fine ware - made of fine sand tempered paste and fired to black or dark brown.

Most of the ware represents common use pottery, sometimes showing barbotine decoration or being negligently moulded. This category comprises biconical vessels and jars with harrow brim, sometimes everted. These forms, with predilection, have decorations painted in pasty black, which are not present in the case of the fine ware.

The larger biconical vessels, with high neck and everted brim, are made of coarse paste, being carefully smoothed at the interior. They have prominent, rounded off shoulders and oblique or vertical plastic decorations forming one or, more seldom, two rows.

The fine paste ware is the most frequent. It is represented mostly by dishes and bowls, each of these with several types. The dishes, in particular, can have thicker walls and larger sizes.

The bowls most frequently show fascicles of fine, narrow channels, parallel to the shoulder, at the base of the neck. They sometimes have notches at the level of the maximum diameter, together with blunt, conical or triangular prominences.

Most of the fine ware is carefully polished, sometimes even at the interior.

Apart from the plastic decorations, the pottery is also painted in red and/or white. Graphite painting occurs more seldom, being very rare compared to the totality of the pottery found up to the present.

Potstands

A particular category of pottery is represented by the so-called potstands (plate 34). These are certified as soon as the end of the Boian culture, having cylindrical shape, with an horizontal or slightly inclined band at the top; they are decorated with channels, notches or graphite painted (Tangâru, Petru Rares).

In the Gumelnița A1 phase, this type of potstand is encountered together with the ring-shaped type (Tangâru, Hârșova), which become predominant in the Gumelnița A2 phase (Hârșova, Bordușani).

At Bordușani more than 30 such potstands were found. They are generally fragmentary, but they are remarkable for their typologic diversity. From this point of view, the potstands were included in two categories: plain, ring-shaped potstands (I) and legged ring-shaped potstands (II).

Plain ring-shaped potstands have a more or less concave section, with two exceptions which have oval or convex sections. Their lower part is sometimes thickened, probably for an increased stability. The diameter of the potstands varies between 15 and 25 centimetres, while their height is of 4 to 8 centimetres.

The incised decoration predominates, presenting white or, more seldom, red incrustations. The incisions form horizontal bands or angles and circles. A few pieces are painted with white or red. Noticeable are two potstands, one of them being decorated with the tulip motif, while the other has a chess board motif painted in red and white. Another piece shows white bands forming angles on a red background. The polished and the graphite decorations are rare.

The second, less frequent category is represented by the legged ring-shaped potstands. These generally have a convex section, with a little brim at the top, and four symmetrically disposed legs at the lower part. A few pieces have incised decoration, but most of them are not decorated. We noticed an almost entirely recovered piece which is carefully worked and presents also the feet of the legs. It is possible for this piece (and maybe also for other ones) to have been provided with a zoomorphous head, in the style of a potstand found at Hârșova.

The diameter of these potstands varies between 14 and 15 centimetres, with heights of 5 - 6 centimetres.

It is difficult to figure out the meaning of this type of pieces. If for the plain ring-shaped potstands a practical utilisation can easily be imagined, for the legged ones we cannot exclude a cultic functionality, taking into account the headed potstand found at Hârșova.

3. ENEOLITHIC OCCUPATION

3.1. GUMELNIȚA LEVELS

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Cătălin Bem, Florin Vlad and Valentina Voinea

Stratigraphy (plates 21 and 22)

The topmost part of the stratigraphic section from Bordușani - Popină shows an organic level which corresponds to the soil developed on the material of the La Tène levels. It is brown of colour, with an aggregated structure due to bioturbation (burrows) and contains scattered anthropic components. This soil level is underlain by the Gumelnița A2 levels, which also suffered pedogenetic influences. Therefore, down to about 2 m of depth, the initial features of the Gumelnița levels are dim, due to leaching and redeposition of carbonates, bioturbation and fissures caused by humidity and temperature variations.

The upper part of the Gumelnița levels is also strongly damaged by gytic (La Tène) pits, which destroyed most of the Gumelnița complexes.

Below, the other Gumelnița occupation levels are well preserved and permitted the observation of the stratigraphic relationships and, therefore, of the chronology of the complexes which were integrally or partly investigated. The microtopography of the site can also be observed.

Under these circumstances, five occupation levels were identified, the investigation of the fifth one being now in progress.

Level I (-0,50 to -0,70 m) - marked by the remains of dwelling no.6 (L6), destroyed in the most part, of complex no.1 (S₁) and of a hearth, also destroyed. This level is cut by the pit of the samnatic grave (M IX).

Level II (-1,60 to -1,80 m) - represented by the remains of dwelling no.8 (L8) and by two hearths from the A5-A6 and E7-E8 squares.

Level III (-2,00 to -2,20 m) contained the remains of burnt dwellings (L9 and L10) and of a hearth from the G3-G4 squares, which was subsequently destroyed.

Level IV (-2,40 to -2,60 m) - it can be the same as level III, considering that the remains of L 10 show a N-S inclination, with a 0,40 m difference. The remains of dwellings no.12 and 13 (L12, L13) were, however, attributed to this level.

Level V (plate 23) - is marked by the remains of destroyed, unburned dwellings (L15, L16, L19, L20, L21 and L22) and by foundation trenches which

were discovered and investigated only partially (C33, C36, C62, C68, C79, C98, C113, C131).

Dwelling structures

Dwelling no.12 (L12)

It was identified and investigated only in sector 6 so far, on a 12 sq.m area. It seems to extend in sectors 1, 2 and 7 and to be E-W oriented.

The dwelling was built on the destruction level of a burnt dwelling, after previous levelling and beating of these remains. The northern and western walls were made of clay and were 20-25 cm thick. No successive construction phases could be observed, but only stages marked by successive and partial reconditionings of the floor - 5 stages, with 3-6 reconditionings each, have been identified.

Corresponding to these, 5 stages of utilisation and reconditioning of the C2 oven (placed in the SE angle of sector 6, near the northern wall of the dwelling) were observed. The oven was built on the first floor and seems to have been open towards the south. The first four stages maintained the same emplacement, while in the fifth stage the oven was enlarged, reaching 2,00 x 1,85 m. Each time, both the vault and the hearth of the oven were renewed.

The profiles of the potsherds found on the floor of these dwelling are presented in plate 29.

Dwelling no.15 (L15)

It was discovered and investigated partially in sectors 3, 4, 8 and 9 on an area of about 15 sq.m and was affected by further interventions. The disposal of its remains suggests an E-W orientation. The minimum dimensions of this dwelling are 7 x 6 m. The northern and western walls are partly visible; they are made of clay, with a maximum thickness of 44 cm, and show several exterior plasterings. No wooden structure could be observed within these walls. The clay was mixed with chopped straw.

The interior of the dwelling shows three reconditionings of the floor, corresponding to three occupation phases.

In the NE corner of the dwelling, the remains of a combustion structure (hearth) were investigated; the hearth was partly destroyed by the foundation trench (C 98) that disturbed the eastern side of the dwelling. The hearth too,

showed periodic reconditionings - plastering, 2-2,5 cm thick, of fine clay mixed with sand.

Dwelling no.16 (L16)

It was investigated in sectors 2, 3, 7 and 8 on an area of about 30 sq.m. Its northern, eastern and western limits are affected by ulterior pits and foundation trenches (C79, C13), but seems to have been E-W oriented. The dwelling was built on the remains of a burnt dwelling.

The eastern wall was preserved on 3 m of length, while the southern wall was preserved only on 0,75 m and is 0,30-0,35 m thick. The western wall, placed at 3 m from the eastern one, was preserved on 3,90 m of length and is 0,20-0,30 m thick. No remains of the wooden structure of the wall were found. Though it has not been integrally investigated, evidences from the floor sequence suggest that the walls are not contemporaneous, one of them pertaining to an ulterior interior compartmentation of the dwelling.

The profiles of the potsherds found on the floor of this dwelling are presented in plate 30.

Dwelling no.19 (L19)

The remains of this dwelling were found in sectors 6, 7, 11, and 12, on a 45 sq.m area.

They were represented by lumps of greenish-yellow sediment which fouled a 45-50 cm thick wall-destruction level.

The fact that the wall fragments covered only the perimeter of the dwelling pleads for an intentional destruction. The presence, within the destruction level, of lenticular units containing domestic waste (ash, organic remains, fish scales) suggests that the interior of the dwelling was utilised, for a short period, as domestic waste disposal zone; afterwards, the portions of wall that still held up, were destroyed or even levelled.

After the removal of this destruction level, the lowest parts of the walls could be observed on the northern side (on 4 m of length) and on the southern side (on about 8 m of length) of the dwelling. The eastern wall was very poorly preserved because of a foundation trench (C 36) which destroyed most of the eastern limit of the dwelling.

Three stages of evolution were noticed in the case of this dwelling. The first is marked by the crushing, levelling and beating of the remains of a burnt dwelling, resulting in a bed about 10 cm thick.

Noticeable from the viewpoint of the construction technique is the northern wall. Two parallel rows of stakes were planted at 20-25 cm intervals. A trellis work was made of rods between the stakes of each row, and the resulting space (between the two rows) was filled with sediment mixed with domestic waste - ash, potsherds. The structure was then plastered on both sides with clay. The total thickness of the wall reached 40-50 cm. Three reconditionings of the floor, totalling 5-6 cm of thickness, were observed for this first stage.

The second stage consists in the construction of a new platform of burnt, crushed and beaten daub which was brought especially for this purpose. The floor that overlays this platform shows four reconditionings. Northwards of this surface, on a small area were observed the remains of a structure whose utility could not be determined. Considering the negligent preparation of the floor (which shows three reconditionings), this structure could represent an annex with wooden walls - no clay wall fragments were noticed.

The third stage shows an impressive succession of reconditionings of the floor, coupled with occupation levels, 3 to 5 cm thick each, reaching a total thickness of 14-15 cm. This succession is paralleled by the succession of reconditionings of the hearth (C1) which was discovered in the dwelling, near the southern wall. This stage also records a spatial extension of the dwelling, southwards this time - floors were observed, on a 5-6 sq.m area, along the southern wall, overlaying domestic waste deposits and probably pertaining to a light building (annex) with wooden walls.

The profiles of the potsherds found on the successive floors of this dwelling are presented in plates 31 and 32.

Dwelling no.20 (L20)

It was observed in sectors 7, 8, 12 and 13. Only the destruction level of this dwelling - about 45 cm thick and covering a 17 sq.m area - was investigated.

Dwelling no.21 (L21)

The remains of this dwelling were discovered in sector 4, covering a 10 sq.m area.

Dwelling no.22 (L22)

It was identified in sector 9 - the remains of a wall 1 m long.

Foundation trenches

Complex no.33 (C33)

It was identified in sectors 7,8 and 9 and investigated partially on 10.5 m of length. It is E-W oriented, has a U-profile and is 0.40-1.00 m wide. The maximum depth reaches 0.90 m.

On its path, 15 pits for wooden posts or stakes were observed. These posts and stakes probably formed the resistance structure of a building. The analysis of the pits' spatial disposal and depth suggested the existence of two phases, and therefore for the reconstruction of the building on the same emplacement.

Complex no.98 (C98)

It was observed in sector 4 on 6 m of length, with a N-S orientation. It has a U-profile and widths of 0.80 to 1.20 m. The maximum depth reaches 0.90 m. Towards the northern limit of the sector, the trench changes its orientation, going westwards. The pits for 5 posts and 2 stakes were found inside. As is the case with complex 33, the depth and disposal of these pits plead for the reconstruction of a building on the same emplacement.

Complex no.62 (C62)

It was investigated in sectors 7 and 12, on about 6.5 m of length. It has a N-S orientation, a U-profile, and widths of 0.60-0.70 m, with a maximum depth of 1.65 m.

The stratigraphy ascertains three phases of utilisation with slight changes of axis, with varying widths, but preserving approximately the same emplacement.

Complex no.63 (C63)

It was observed in sectors 7 and 12, being approximately parallel to complex no.62. It is 6 m long, N-S oriented, has a U-profile, a maximum width of 0.65-0.70 m and a maximum depth of 1.10 m. Eleven pits for posts - which formed the resistance structure of a building - were found inside this trench.

Only one phase of construction and utilisation could be ascertained by stratigraphic observations, though the greater depth of some of the pits could suggest a partial reconstruction of the building. We cannot, however, prove the existence of two utilisation phases.

Conclusions

The researches performed on the Borduşani tell are completely justified by these first, preliminary results, which contribute to a better understanding of the Eneolithic from the Lower Danube basin. The following conclusions are thus only partial and we are sure that the future will see them changing, more or less.

It was noticed that the deeper the digging went, the better was the state of preservation of the archaeological remains. This situation conducted to the emphasising of several elements:

- the discovery and investigation of dwellings which were destroyed, but not by fire; this required a characteristic methodology, especially their digging by the successive removal of each stratigraphic unit (SU);

- a few building techniques have been noticed, but they still cannot be correlated to the utilisation and functional structuration of the space. We can cite dwellings with foundation trenches (sometimes very impressive), with wooden floor or with only a platform prepared from destruction remains, etc.;

- as concerns the walls, we could distinguish exterior walls, sometimes including a wooden resistance frame, from interior walls that used to divide the space of the dwellings;

- the dwellings seem to be disposed on rows, E-W oriented and with the entrance possibly placed in the western wall;

- the existence of a certain orientation of the dwellings suggests the frequency of the situations which imposed this choice.

- in most of the situations, after their abandon, the ruined dwellings became domestic waste depositing zones utilised by the inhabitants of the neighbouring dwellings.

The ample development of the stratigraphy of the dwelling levels in tells explains the extension of the deposits and proves the intensity of the construction activities in such settlements.

On the other hand, it must be emphasized that the diggings results called attention to the importance of the stratigraphic disturbances, which affect to a great extent (more than 30%) the stratigraphy of the Gumelnița levels. The consequences of this fact are noteworthy in what concerns the interpretation of both the archaeological material (pottery, tools, adornments etc.) and the results of the pluridisciplinary researches.

3.2. POTTERY

Silvia Marinescu-Bîlcu, Dragomir Popovici and Radian Andreescu

The pottery falls into two categories, depending on fabric: coarse ware - well fired, containing ground sherds in the paste, sometimes brittle - and fine ware - made of fine sand tempered paste and fired to black or dark brown.

Most of the ware represents common use pottery, sometimes showing barbotine decoration or being negligently moulded. This category comprises biconical vessels and jars with harrow brim, sometimes everted. These forms, with predilection, have decorations painted in pasty black, which are not present in the case of the fine ware.

The larger biconical vessels, with high neck and everted brim, are made of coarse paste, being carefully smoothed at the interior. They have prominent, rounded off shoulders and oblique or vertical plastic decorations forming one or, more seldom, two rows.

The fine paste ware is the most frequent. It is represented mostly by dishes and bowls, each of these with several types. The dishes, in particular, can have thicker walls and larger sizes.

The bowls most frequently show fascicles of fine, narrow channels, parallel to the shoulder, at the base of the neck. They sometimes have notches at the level of the maximum diameter, together with blunt, conical or triangular prominences.

Most of the fine ware is carefully polished, sometimes even at the interior.

Apart from the plastic decorations, the pottery is also painted in red and/or white. Graphite painting occurs more seldom, being very rare compared to the totality of the pottery found up to the present.

Potstands

A particular category of pottery is represented by the so-called potstands (plate 34). These are certified as soon as the end of the Boian culture, having cylindrical shape, with an horizontal or slightly inclined band at the top; they are decorated with channels, notches or graphite painted (Tangâru, Petru Rares).

In the Gumelnița A1 phase, this type of potstand is encountered together with the ring-shaped type (Tangâru, Hârșova), which become predominant in the Gumelnița A2 phase (Hârșova, Bordușani).

At Bordușani more than 30 such potstands were found. They are generally fragmentary, but they are remarkable for their typologic diversity. From this point of view, the potstands were included in two categories: plain, ring-shaped potstands (I) and legged ring-shaped potstands (II).

Plain ring-shaped potstands have a more or less concave section, with two exceptions which have oval or convex sections. Their lower part is sometimes thickened, probably for an increased stability. The diameter of the potstands varies between 15 and 25 centimetres, while their height is of 4 to 8 centimetres.

The incised decoration predominates, presenting white or, more seldom, red incrustations. The incisions form horizontal bands or angles and circles. A few pieces are painted with white or red. Noticeable are two potstands, one of them being decorated with the tulip motif, while the other has a chess board motif painted in red and white. Another piece shows white bands forming angles on a red background. The polished and the graphite decorations are rare.

The second, less frequent category is represented by the legged ring-shaped potstands. These generally have a convex section, with a little brim at the top, and four symmetrically disposed legs at the lower part. A few pieces have incised decoration, but most of them are not decorated. We noticed an almost entirely recovered piece which is carefully worked and presents also the feet of the legs. It is possible for this piece (and maybe also for other ones) to have been provided with a zoomorphous head, in the style of a potstand found at Hârșova.

The diameter of these potstands varies between 14 and 15 centimetres, with heights of 5 - 6 centimetres.

It is difficult to figure out the meaning of this type of pieces. If for the plain ring-shaped potstands a practical utilisation can easily be imagined, for the legged ones we cannot exclude a cultic functionality, taking into account the headed potstand found at Hârșova.

3. ENEOLITHIC OCCUPATION

3.1. GUMELNIȚA LEVELS

Silvia Marinescu-Bilcu, Dragomir Popovici,
Cătălin Bem, Florin Vlad and Valentina Voinea

Stratigraphy (plates 21 and 22)

The topmost part of the stratigraphic section from Bordușani - Popină shows an organic level which corresponds to the soil developed on the material of the La Tène levels. It is brown of colour, with an aggregated structure due to bioturbation (burrows) and contains scattered anthropic components. This soil level is underlain by the Gumelnița A2 levels, which also suffered pedogenetic influences. Therefore, down to about 2 m of depth, the initial features of the Gumelnița levels are dim, due to leaching and redeposition of carbonates, bioturbation and fissures caused by humidity and temperature variations.

The upper part of the Gumelnița levels is also strongly damaged by gytic (La Tène) pits, which destroyed most of the Gumelnița complexes.

Below, the other Gumelnița occupation levels are well preserved and permitted the observation of the stratigraphic relationships and, therefore, of the chronology of the complexes which were integrally or partly investigated. The microtopography of the site can also be observed.

Under these circumstances, five occupation levels were identified, the investigation of the fifth one being now in progress.

Level I (-0,50 to -0,70 m) - marked by the remains of dwelling no.6 (L6), destroyed in the most part, of complex no.1 (S₁) and of a hearth, also destroyed. This level is cut by the pit of the samnatic grave (M IX).

Level II (-1,60 to -1,80 m) - represented by the remains of dwelling no.8 (L8) and by two hearths from the A5-A6 and E7-E8 squares.

Level III (-2,00 to -2,20 m) contained the remains of burnt dwellings (L9 and L10) and of a hearth from the G3-G4 squares, which was subsequently destroyed.

Level IV (-2,40 to -2,60 m) - it can be the same as level III, considering that the remains of L 10 show a N-S inclination, with a 0,40 m difference. The remains of dwellings no.12 and 13 (L12, L13) were, however, attributed to this level.

Level V (plate 23) - is marked by the remains of destroyed, unburned dwellings (L15, L16, L19, L20, L21 and L22) and by foundation trenches which

were discovered and investigated only partially (C33, C36, C62, C68, C79, C98, C113, C131).

Dwelling structures

Dwelling no.12 (L12)

It was identified and investigated only in sector 6 so far, on a 12 sq.m area. It seems to extend in sectors 1, 2 and 7 and to be E-W oriented.

The dwelling was built on the destruction level of a burnt dwelling, after previous levelling and beating of these remains. The northern and western walls were made of clay and were 20-25 cm thick. No successive construction phases could be observed, but only stages marked by successive and partial reconditionings of the floor - 5 stages, with 3-6 reconditionings each, have been identified.

Corresponding to these, 5 stages of utilisation and reconditioning of the C2 oven (placed in the SE angle of sector 6, near the northern wall of the dwelling) were observed. The oven was built on the first floor and seems to have been open towards the south. The first four stages maintained the same emplacement, while in the fifth stage the oven was enlarged, reaching 2,00 x 1,85 m. Each time, both the vault and the hearth of the oven were renewed.

The profiles of the potsherds found on the floor of these dwelling are presented in plate 29.

Dwelling no.15 (L15)

It was discovered and investigated partially in sectors 3, 4, 8 and 9 on an area of about 15 sq.m and was affected by further interventions. The disposal of its remains suggests an E-W orientation. The minimum dimensions of this dwelling are 7 x 6 m. The northern and western walls are partly visible; they are made of clay, with a maximum thickness of 44 cm, and show several exterior plasterings. No wooden structure could be observed within these walls. The clay was mixed with chopped straw.

The interior of the dwelling shows three reconditionings of the floor, corresponding to three occupation phases.

In the NE corner of the dwelling, the remains of a combustion structure (hearth) were investigated; the hearth was partly destroyed by the foundation trench (C 98) that disturbed the eastern side of the dwelling. The hearth too,

showed periodic reconditionings - plastering, 2-2,5 cm thick, of fine clay mixed with sand.

Dwelling no.16 (L16)

It was investigated in sectors 2, 3, 7 and 8 on an area of about 30 sq.m. Its northern, eastern and western limits are affected by ulterior pits and foundation trenches (C79, C13), but seems to have been E-W oriented. The dwelling was built on the remains of a burnt dwelling.

The eastern wall was preserved on 3 m of length, while the southern wall was preserved only on 0,75 m and is 0,30-0,35 m thick. The western wall, placed at 3 m from the eastern one, was preserved on 3,90 m of length and is 0,20-0,30 m thick. No remains of the wooden structure of the wall were found. Though it has not been integrally investigated, evidences from the floor sequence suggest that the walls are not contemporaneous, one of them pertaining to an ulterior interior compartmentation of the dwelling.

The profiles of the potsherds found on the floor of this dwelling are presented in plate 30.

Dwelling no.19 (L19)

The remains of this dwelling were found in sectors 6, 7, 11, and 12, on a 45 sq.m area.

They were represented by lumps of greenish-yellow sediment which fouled a 45-50 cm thick wall-destruction level.

The fact that the wall fragments covered only the perimeter of the dwelling pleads for an intentional destruction. The presence, within the destruction level, of lenticular units containing domestic waste (ash, organic remains, fish scales) suggests that the interior of the dwelling was utilised, for a short period, as domestic waste disposal zone; afterwards, the portions of wall that still held up, were destroyed or even levelled.

After the removal of this destruction level, the lowest parts of the walls could be observed on the northern side (on 4 m of length) and on the southern side (on about 8 m of length) of the dwelling. The eastern wall was very poorly preserved because of a foundation trench (C 36) which destroyed most of the eastern limit of the dwelling.

Three stages of evolution were noticed in the case of this dwelling. The first is marked by the crushing, levelling and beating of the remains of a burnt dwelling, resulting in a bed about 10 cm thick.

Noticeable from the viewpoint of the construction technique is the northern wall. Two parallel rows of stakes were planted at 20-25 cm intervals. A trellis work was made of rods between the stakes of each row, and the resulting space (between the two rows) was filled with sediment mixed with domestic waste - ash, potsherds. The structure was then plastered on both sides with clay. The total thickness of the wall reached 40-50 cm. Three reconditionings of the floor, totalling 5-6 cm of thickness, were observed for this first stage.

The second stage consists in the construction of a new platform of burnt, crushed and beaten daub which was brought especially for this purpose. The floor that overlays this platform shows four reconditionings. Northwards of this surface, on a small area were observed the remains of a structure whose utility could not be determined. Considering the negligent preparation of the floor (which shows three reconditionings), this structure could represent an annex with wooden walls - no clay wall fragments were noticed.

The third stage shows an impressive succession of reconditionings of the floor, coupled with occupation levels, 3 to 5 cm thick each, reaching a total thickness of 14-15 cm. This succession is paralleled by the succession of reconditionings of the hearth (C1) which was discovered in the dwelling, near the southern wall. This stage also records a spatial extension of the dwelling, southwards this time - floors were observed, on a 5-6 sq.m area, along the southern wall, overlaying domestic waste deposits and probably pertaining to a light building (annex) with wooden walls.

The profiles of the potsherds found on the successive floors of this dwelling are presented in plates 31 and 32.

Dwelling no.20 (L20)

It was observed in sectors 7, 8, 12 and 13. Only the destruction level of this dwelling - about 45 cm thick and covering a 17 sq.m area - was investigated.

Dwelling no.21 (L21)

The remains of this dwelling were discovered in sector 4, covering a 10 sq.m area.

Dwelling no.22 (L22)

It was identified in sector 9 - the remains of a wall 1 m long.

Foundation trenches

Complex no.33 (C33)

It was identified in sectors 7,8 and 9 and investigated partially on 10.5 m of length. It is E-W oriented, has a U-profile and is 0.40-1.00 m wide. The maximum depth reaches 0.90 m.

On its path, 15 pits for wooden posts or stakes were observed. These posts and stakes probably formed the resistance structure of a building. The analysis of the pits' spatial disposal and depth suggested the existence of two phases, and therefore for the reconstruction of the building on the same emplacement.

Complex no.98 (C98)

It was observed in sector 4 on 6 m of length, with a N-S orientation. It has a U-profile and widths of 0.80 to 1.20 m. The maximum depth reaches 0.90 m. Towards the northern limit of the sector, the trench changes its orientation, going westwards. The pits for 5 posts and 2 stakes were found inside. As is the case with complex 33, the depth and disposal of these pits plead for the reconstruction of a building on the same emplacement.

Complex no.62 (C62)

It was investigated in sectors 7 and 12, on about 6.5 m of length. It has a N-S orientation, a U-profile, and widths of 0.60-0.70 m, with a maximum depth of 1.65 m.

The stratigraphy ascertains three phases of utilisation with slight changes of axis, with varying widths, but preserving approximately the same emplacement.

Complex no.63 (C63)

It was observed in sectors 7 and 12, being approximately parallel to complex no.62. It is 6 m long, N-S oriented, has a U-profile, a maximum width of 0.65-0.70 m and a maximum depth of 1.10 m. Eleven pits for posts - which formed the resistance structure of a building - were found inside this trench.

Only one phase of construction and utilisation could be ascertained by stratigraphic observations, though the greater depth of some of the pits could suggest a partial reconstruction of the building. We cannot, however, prove the existence of two utilisation phases.

Conclusions

The researches performed on the Borduşani tell are completely justified by these first, preliminary results, which contribute to a better understanding of the Eneolithic from the Lower Danube basin. The following conclusions are thus only partial and we are sure that the future will see them changing, more or less.

It was noticed that the deeper the digging went, the better was the state of preservation of the archaeological remains. This situation conducted to the emphasising of several elements:

- the discovery and investigation of dwellings which were destroyed, but not by fire; this required a characteristic methodology, especially their digging by the successive removal of each stratigraphic unit (SU);

- a few building techniques have been noticed, but they still cannot be correlated to the utilisation and functional structuration of the space. We can cite dwellings with foundation trenches (sometimes very impressive), with wooden floor or with only a platform prepared from destruction remains, etc.;

- as concerns the walls, we could distinguish exterior walls, sometimes including a wooden resistance frame, from interior walls that used to divide the space of the dwellings;

- the dwellings seem to be disposed on rows, E-W oriented and with the entrance possibly placed in the western wall;

- the existence of a certain orientation of the dwellings suggests the frequency of the situations which imposed this choice.

- in most of the situations, after their abandon, the ruined dwellings became domestic waste depositing zones utilised by the inhabitants of the neighbouring dwellings.

The ample development of the stratigraphy of the dwelling levels in tells explains the extension of the deposits and proves the intensity of the construction activities in such settlements.

On the other hand, it must be emphasized that the diggings results called attention to the importance of the stratigraphic disturbances, which affect to a great extent (more than 30%) the stratigraphy of the Gumelnița levels. The consequences of this fact are noteworthy in what concerns the interpretation of both the archaeological material (pottery, tools, adornments etc.) and the results of the pluridisciplinary researches.

The 122 pieces discovered during the 1993-1995 campaigns belong to the Gumelnița A2 levels - 115 were found in precise stratigraphic contexts (S4), 6 passim and one in the infilling of a La Tène pit from S8. The majority of them are fragmentary, show wear marks and were concentrated in domestic waste zones:

- SU (stratigraphic unit) 1182 with 25 pieces, out of which only 4 are complete;

- SU 1057 = 1065 with 5 pieces, out of which 3 are strongly damaged.

These two domestic waste zones are related to the functioning of some dwellings. The diversity and the abundance of the pieces are arguments for this relationship.

The infilling of the foundation trenches contained 28 pieces, most of them from complex C62 (9 pieces) and C63 (9 pieces). Considering the stratigraphic context, the grouping and the usual shape of the pieces, it is possible for some of them to have fallen in the trench infilling from the domestic waste level cut by the second and third phase of the trench (C62). Their utility is obvious both from the shape and the strong wear marks - In the same category were included the astragals piece no.109 and 110 (C63) and piece no.116 (C33), with the lateral side worn out.

The density of the pieces in the occupation levels is reduced (25 pieces in 15 levels) because the destroyed unburned dwellings were rebuilt after a certain cleaning of the interior.

Artifact fragments were occasionally found (5 pieces) in the construction levels.

Several criteria were adopted for the classification of the artifacts:

- from the point of view of nature of the raw material: bone, antler, teeth, shell;

- from the utility viewpoint, the following categories were considered: I - tools, II - weapons, III - parts of compound pieces (handles, supports etc.), IV - adornments (ornaments), V - figurines, VI - varia;

- from the functional point of view, on the basis of ethnographic comparisons, several types were already established¹⁵, which we designated by

greek letters: 1 - point, 2 - chisel, 3 - spatula, 4 - smoothing tool, 5 - flaker, 6 - weaving shuttle, 7 - arrow point, 8 - harpoon, 9 - knife, 10 - dagger, 11 - boomerang, 12 - axe, 13 - hammer, 14 - handle, 15 - intermediate piece, 16 - sickle support, 17 - circular perforated piece, 18 - vessel, 19 - bead, 20 - bracelet, 21 - ring, 22 - pendant, 23 - garment adornments;

- from the active part's shape viewpoint: A - with sharp distal end, B - with round (blunt) distal end, with variants: a - punctiform active part, b - linear active part, c - active surface.

The utilisation of these four criteria allowed a more accurate analysis, which surpasses the strictly morphologic and functional limits. A more flexible classification was thus obtained by the different notation of each criteria, a classification which permits further eventual modifications imposed by the microscopic examination of the pieces.

BONE PIECES

I. TOOLS

IAa. Tools with sharp punctiform distal end

IIAa. POINTS (30 pieces) - table 14, plate 35 (fig. 1, 2), plate 36 (fig. 7)

Awls on anatomical proximum (AP): 7 pieces - pieces no.3, 7, 9, 14, 23, 25, 34. Most of them are made on metapodals (3) and ulnae (2) of small - ovicaprins (O/C), *Capreolus capreolus* (Cc) - or great - Bos/Cervus (B/C) - ruminants. The awl no.9, cut in an ovicaprin ulna, shows an artificial concavity on the distal extremity, suggesting the repeated piercing of a reduced stiffness material.

Questions are raised by the deep and short, horizontal or oblique incisions on the diaphysary wall of awl no.34. Their interpretation as marks of the vegetal fibres used to fasten the piece does not seem convincing. The pronounced polish due to long time utilisation (probably on vegetal material) covers the entire surface of the piece, excluding the possibility of its fixing to a support. Moreover, the incisions appear also on the base of the distal extremity, so that the fastening of the piece on such a large surface would have deprived it of any utility. The unorganised incisions could not be due to a vegetal fibre wrapped around the awl.

Awls on anatomical distum (AD) (5 pieces - 1, 15, 18, 19, 29). Four out of the 5 pieces have the distal extremity torn apart: 2 suid fibulae, one carnivore radius and the fragment of a bird bone. The single entire piece of this type was cut in an O/C tibia. As can be noticed, the awls made of suid and carnivore bones have low

frequencies, being less resistant than the ruminant bones. Pieces no.18 and 19 show short, unorganised notches on the diaphysys' edges.

Awls on diaphysys (16 pieces - 4, 5, 8, 10, 11, 13, 16, 17, 21, 22, 26, 27, 28, 31, 32, 33). This is the most frequent awl category. Ruminant tibiae and metapodals were preferred: 3 on O/C tibiae, one on a B/C tibia, 3 on B/C and 2 on O/C metapodals. A single piece was cut in a B/C rib. Pieces no. 13, 26, 31 and 33 show short, deep notches on their strongly polished surfaces.

Awls on indeterminable skeletal elements (2 pieces). Piece no.2, pronouncedly worn, shows numerous horizontal and oblique notches on the diaphysary wall, while piece no.12 has a sharp, conic point and a strongly polished distal extremity.

IAb. Tools with sharp linear distal end

I2Ab. CHISELS (35 pieces) - table 15, plate 35 (fig. 3)

Chisels on AP (2 pieces - 59 and 97). They were cut in an *Ovis* radius and in a *Bos* ulna. Piece no.57 has the AP perforated, probably for fastening to a handle. The strongly polished surface, as well as the oblique wear of the bit, prove a long utilisation.

Chisels on AD (piece no.39). The piece was cut in an O/C tibia and shows wear traces.

Chisels on diaphysys (32 pieces - 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 58, 59, 60, 61, 62, 63, 64, 66, 67, 68, 98). Most of the pieces were cut on the diaphysary wall of higher resistance, easy to work bones: 10 on O/C tibiae, 4 on B/C ulnae and 8 on femurs (3 carnivores, 2 O/C, 2 suids, 1 B/C). Piece no.44 - cut in a B/C humerus - is covered by superficial incisions, circularly disposed on the diaphysys wall and probably due to the fastening of the piece to a handle. The natural shape of the suid femur explains the preference for this skeletal element with reduced resistance (chisels 45 and 55, both fragmentary).

IBb. Tools with blunt linear distal end.

I3Bb. SPATULAE (4 pieces) - table 16

Spatulae on diaphysys (pieces no.92, 93, 94, 95). Long B/C ribs were preferred for the working of these pieces. The active end is convex, carefully cut and polished.

IBc. Tools with active surface.

14Bc. SMOOTHING TOOLS (10 pieces - 24, 43, 96, 109, 110, 111, 112, 113, 114, 116) - table 16. All of them were made of astragals and show wear traces on the lateral face of the tarsus. Only one of them is partially perforated (ornament piece ?).

II. WEAPONS

IIAa. Weapons with sharp punctiform distal end

II7Aa. ARROW POINTS (piece no.30) - table 17. The piece is morphologically indeterminable. It was found in the infilling of a foundation trench (C33) and has a slightly broken point and a rectangular transverse section. The convex base was carefully cut.

IIAb. Weapons with sharp linear distal end

II9Ab. KNIVES - table 17

Knife on diaphysys (piece no.91). The knife has a curved tip, the blade slightly sharpened and a strongly polished surface.

II10Ab. DAGGERS - table 17

Daggers on AP (pieces no.90 and 119). Both of them were cut in long, resistant bones - B/C metapodals. Piece no.119 shows notches on the convex side of the diaphysys. Both pieces are strongly polished.

III. PARTS OF COMPOUND PIECES

III14. HANDLES (15 pieces) - table 18, plate 35 (fig. 4, 5), plate 37 (fig. 2)

Handles on AP (piece no.86). Only one piece, strongly torn out, was discovered. The sustaining side is strongly polished and shows circular, superficial incisions (wear marks?).

Handles on AD (8 pieces - 73, 77, 79, 84, 87, 88, 89, 102). Most of the handles pertain to this type and were worked on O/C metapodals with a medullar cavity diameter of 4-6 mm, carefully cut and polished. Tibiae were also used (one O/C and one carnivore). The utility of these pieces is suggested by the piece no.89 - a handle cut in a *Canis* tibia, with a bone point inserted in the medullar cavity. Copper points (awls) might have been used instead of the bone points¹⁸. Most of the handles show, on the diaphysary wall, deep, short, unorganised incisions similar to those on the awls. This is a new counter-argument to the interpretation of the incisions as traces of the vegetal fibres utilised to fix the pieces to a support.

Handles on diaphysys (6 pieces - 69, 70, 74, 75, 80, 83). Anatomical elements with large medullar-cavity diameter were preferred for the working of this handle

type - great mammals' bones: B/C (2 metapodals, one tibia, one radius), suids (one femur and one radius).

IV. ADORNMENTS

IV22. PENDANTS - table 18

Pendants on diaphysys (piece no.120). The piece, which was cut in a *Bos* rib, has a triangular shape, perforated in one of the angles (plate 37, fig. 5).

V. FIGURINES - table 18, plate 37 (fig. 3 and 6)

Figurines on diaphysys (pieces no.118 and 121). One of them, awkwardly cut in a *Bos* rib, was found in the infilling of the foundation trench C62. On a length of 62 mm, the human anatomy (head, trunk and legs) is just slightly sketched. The other figurine, found in a La Tène pit infilling (from Sß) follow the classical Gumelnița plastic art patterns¹⁷. Although fragmentarily preserved, the symmetrically disposed perforations and the schematic silhouette characteristic to this type can be distinguished.

VI. VARIA - table 19, plate 36 (fig. 4-6), plate 37 (fig. 1)

Varia on AD (piece no.72): The piece was worked on a O/C metatarsal and could have been used as an awl or as a handle.

Varia on diaphysys (10 pieces). This category includes pieces whose utility could not be precised due to their bad preservation state (the case of pieces no.6, 20, 65, 72, 107, 108) or to the lack of analogies (pieces no.103, 104, 115 and 106). Piece no.106, cut in a long *Bos* rib, could have been used for weaving¹⁸.

ANTLER PIECES - table 20

II. WEAPONS

II8Aa. HARPOONS (pieces no.100 and 101) - plate 36 (fig. 1-3). The piece no.100, discovered on the floor of dwelling L19 is carefully worked and has sharp barbs.

III. PARTS OF COMPOUND PIECES

III14. HANDLES (5 pieces - 71, 76, 81, 82, 85). Four fragmentary handles were cut in *Cervus* antler. Their bad preservation state does not allow further specifications. The fifth handle, also fragmentary, was worked on a *Capreolus* antler tine.

IV. ADORNMENTS

IV22. PENDANTS (piece no.105). This remarkable piece, found within the domestic waste unit SU 2008, has an angular shape, the extremities and the curved side being perforated.

TUSK PIECES - table 21

IV. ADORNMENTS

IV22. PENDANTS (piece no.122). This fragmentarily preserved piece was obtained by the longitudinal splitting of a wild boar tusk.

SHELL PIECES - table 21

IV. ADORNMENTS

IV19. BEADS (pieces no.117). Two tubular beads (plate 37, fig. 4) cut in *Dentalium* shells were found in the infilling of the foundation trench C62.

Conclusions

The information yielded by the 121 analysed pieces shows the preference for certain anatomical elements depending on the shape and utility of each type of piece. Thus, the pieces which are usually submitted to high pressure - awls, daggers, chisels, handles - were worked mostly on small (O/C or more rarely Cc) or large (B/C) ruminants' metapodals and tibiae. The metapodals reach 21,78%, followed by the tibiae with 19,80% of the total anatomical elements. The *Bos* ulna (6,73%) was frequently used to make chisels, and more rarely awls, due to its high resistance and to the flattened shape of the AD. Astragals were used for smoothing/polishing (especially in pottery), without any modification of their natural sinusoidal shape. Flat pieces (spatulae, pendants) were cut in great ribs - B/C (12,87%).

Antler was mostly used for the working of handles used for the fixing of larger diameter pieces.

From the total of 121 pieces, 102 were identified typologically, 100 cut in mammal raw material and 2 in *Dentalium* shells. Considering the number of 1526 mammal bone remains found during the 1993-1994 campaigns and the 72 worked pieces found in the same period, the worked pieces represent approximately 5% (4,71%) of the mammal bone remains. At Drăgușeni-Ostrov, in a chronologically close level (Cucuteni A4), the same ratio is of only 3%¹⁹.

The preference for the ovicaprins (40,4%) and B/C (37,3%) bones is explained by their abundance in the settlement - O/C represent 22,4% and bovids 21,9% of the total identified species.

Placed in a marshy region, with a rich fauna, the Bordușani-Popină tell provided favourable conditions for the development of the "bone" industry, which somewhat compensated the rarity of the lithic material.

Table 14. Bordușani-Popină. Bone pieces. Tools

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf.	Year	Section	Square	SU	Completeness	Depth (m)	Observations
IIAa	3	C.c	metacarpus	fragm	α	1993	11	C7	1005	62	2.49-2.61	
	7	C.c	left metatarsus	fragm	α	1994	12	E7	1182			incisions on diaphysys edges
	9	O/C	ulna	entire	α	1994	12	D7	1182		2.75	
	14	Bos	right ulna.	fragm	α	1994	12	D7	1182		2.87	short incisions on diaphysys edges
	23	S.	fibula	fragm	α	1994	11	B7	1260			
	25	O/C	right radius	fragm	α	1994	0	I4	1000		2.40	
	34	Bos	right metacarpus	entire	α	1994	13	G8	1000		2.59	numerous unorganised incisions
	1	Ovis		fragm	α	1993	6	B5	1002			
	15	carnivor	right radius	fragm	α	1994	12	D7	1182		2.87	
	18	S.	right fibula	fragm	α	1994	13	G7	1392		2.95	
	19	S.	right fibula	fragm	α	1994	8	I6	1400		2.78	
	29	O/C	right tibia	fragm	α	1995	12	E7	1401	62	3.38	
	4	O/C	metacarpus	fragm	α	1993	7	D4	1057			
	5	O/C	tibia	fragm	α	1993	11	C8	1085			
	8		unidentifiable	fragm	α	1994	11	C8	1260		2.75	
	10		unidentifiable	fragm	α	1994	12	F8	1182		2.76	
	11		unidentifiable	fragm	α	1994	12	F8	1182		2.79	
	13		unidentifiable	fragm	α	1994	12	D7	1182		2.75	short, unorganised incisions
	16	Bos	metapodal	fragm	α	1994	12	F7	1182		2.86	

17	O/C	tibia	fragm	α	1994	12	E7	1240		2.90	longitudinal fissures
21	O/C	metatarsus	fragm	α	1994	12	E7	1253		2.87	
22	unidentifiable	entire	α	1994	12	E7	1253			2.87	
26	D/C	metapodal	fragm	α	1995	14	K7	1488		2.74	deep, unorganised incisions
27	B/C	metapodal	fragm	α	1994	12	E7	1253		2.87	
28	unidentifiable	fragm	α	1995	1	B1				2.75	
31	B/C	tibia	fragm	α	1995	2	E1	13400		2.65	few short incisions near AP
32	B/C	rib	fragm	α	1995	6	B5	1070		2.60	
33	O/C	tibia	fragm	α	1995	7	F5				deep, short, unorganised incisions
2	unidentifiable	fragm	α	1993	7	D4	1057				
12	unidentifiable	fragm	α	1994	7	E5	1056			2.75	

Table 15. Bordușani-Poplină. Bone pieces. Tools.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
I2Ab	57	Ovis	left radius	fragm	α	1995	7	E6	1384	62		perforated AP
	97	Bos	left ulna	fragm	α	1994	12	F8	1182			
	39	O/C	right tibia	fragm	α	1993	7	D4	1057			
	35	O/c	tibia	fragm	α	1993	11	C9			2.65	
	37	O/C	left tibia	fragm	α	1993	6	B5	1071			
	42	carnivor	right femur	fragm	α	1993	2	E3	1066		2.56	
	44	B/C	left humerus	fragm	α	1994	13	G7	1368		2.58	circular, superficial incisions (fastening to a handle ?)
	45	S.	right femur	fragm	α	1994	12	D8	1182		2.88	
	46	unidentifiable	fragm	α	1994	12	E7	1182				
	48	unidentifiable	fragm	α	1994	12	E8	1339			3.01	
	52	O/C	right tibia	fragm	α	1994	12	D8	1182		2.59	
	55	S.	femur	fragm	α	1994	7	E4	1205		2.60	
	56	Bos	right ulna	fragm	α	1995	13	H7	1432		2.90	
	61	S?	ulna	fragm	α	1995	14	K8	1490		2.90	
	62	Bos	right ulna	frag	α	1995	7	D6E6	1058	63	2.70	

64	O/C	right radius	fragm	α	1995	4	K2	1814	98		
68	Bos	right ulna	fragm	α	1995	8	I4	1244	33	2.95	
36	O/C	femur	fragm	α	1993	6	C4			2.42	
38	carniv or	right tibia	fragm	α	1993	6	C6	1001		2.57	
40	carniv or	right femur	fragm	α	1993	6	C4	1007		2.51	
41	Ovis		fragm	α	1993	2	D3	1065		2.60	
43	O/C	tibia	fragm	α	1994	9	I4	1000		2.60	
47	carniv or	femur	fragm	α	1994	7	E4	1058		2.66 2.69	
49	O/C	left tibia	entire	α	1994	12	F8	1182		2.81	
50	B/C	metapodal	fragm	α	1994	13	H7	1368		2.58	
51	O/C	left tibia	fragm	α	1994	7	E6	1058	63	2.85	
53	O/C	tibia	fragm	α	1994	12	F7	1182		2.70	utilised after partial destructio n
54	Bos?	femur?	fragm	α	1994	13	H8	1368		2.89	
58	S	right humerus	fragm	α	1995	12	E8	1403	63	2.95	
59	Bos	metacarpus	fragm	α	1995	12	E7	1403	63	2.90	
60	O/C	femur	fragm	α	1995	12	F8	1401	62		
63	unidentifiable		fragm	α	1995	7	D6E6	1058	63	2.70	
66	O/C	tibia	fragm	α	1995	7	D6E6	1058	63	2.70	
67	unidentifiable		fragm	α	1995	passim					
98	unidentifiable		fragm	α	1994	13	H7	1368		2.77	

Table 16. Bordușani-Popină. Bone pieces. Tools.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
I3Bb	92	B/C	rib	fragm	α	1994	12	E7	1182		2.69	
	93	B/C	rib	fragm	α	1994	7	E5	1320		2.86	
	94	C/C	rib	fragm	α	1994	3	I1	1295		2.95	
	95	unidentifiable		fragm	α	1995	9	I6	1377		2.75	
I4Bc	24	O/C	astragalus	entire	α	paslm						
	43	O/C	astragalus	entire	α	paslm						perforated ?
	96	O/C	astragalus	entire	α	1994	13	G7	1368		2.58	
	109	O/C	astragalus	entire	α	1994	7	E6	1058	63	2.57	
	110	O/C	astragalus	entire	α	1994	7	E6	1058	63	2.67	
	111	O/C	astragalus	entire	α	1994	12	F7	1182		2.67	
	112	O/C	astragalus	entire	α	1994	2	F3	1185		2.60	
	113	O/C	astragalus	entire	α	1994	12	F8	1182		2.70	
	114	O/C	astragalus	entire	α	1994	12	F7	1182		2.89	
	116	O/C	astragalus	entire	α	1994	9	J4	2025	33	2.51	

Table 17. Bordușani-Popină. Bone pieces. Weapons.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
II7Aa	12	unidentifiable		fragm	α	1994	7	E5	1056		2.75	
	30	unidentifiable		entire	α	1995	8	G5	1244	33	2.70	
II9Ab	91	unidentifiable		fragm	α	1994	12	E7	1182		2.76	strongly polished on the whole surface
II10Ab	90	B/C	metapodal	fragm	α	1994	11	B7	1279		2.62	
	119	B/C	metapodal	fragm	α	1995	9	K6	1377	98	2.75	unorganised incisions on the convex surface of the diaphys.

Table 18. Bordușani-Popină. Bone pieces. Parts of compound pieces, adornments, figurines.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
III14	86	O/C	left metatarsus	fragm	α	1994	11	C7	1279		2.82	
	73	O/C	metacarpus	fragm	α	1994	13	G7	1368		2.58	deep. unorganised incisions on the diaphysis edge
	77	O/C	left tibia	fragm	α	1994	3	H2	1267		2.52	unorganised incisions on the diaphysary wall
	79	O/C	left metacarpus	fragm	α	1994	12	F7	1221		2.90	unorganised incisions on diaphysys
	84	O/C	left metacarpus	entire	α	1995	9	J4	2025	33		unorganised incisions on diaphysys
	87	O/C	left metatarsus	entire	α	1994	9	J4	1370		2.67	unorganised, superficial incisions on diaphysys
	88	O/C	left metatarsus	fragm	α	1994	12	F7	1182		2.68	
	89	Canis f	left tibia	fragm	α	1993	7	D4	1057		2.69	compound piece with bone point
	102	O/C	metacarpus	fragm	α	1994	8	H4	1244	33	2.60	unorganised incisions on diaphysys
	70	Bos	left tibia	fragm	α	1993	6	C4C5	1020			
	74	Bos	right metacarp.	fragm	α	1994	12	E8	1182		2.49	
	75	Bos	right metatars.	fragm	α	1994	11	B7	1280			
	80	Cervus	radius	fragm	α	1995	13	I7	1498			
	83	S	right lemur	fragm	α	1995	12	E7	1401	62		

	69	S	humerus	fragm	α	1993		B6			2,66	
IV22	120	B/C	rib	fragm	α	1994	4	J3	1371		2,47	
V	118	Bos	rib	entire	α	1995	12	F8	1401	62	2,95	
	121	unidentifiable	rib	fragm	β	1995	1	1112				

Table 19. Bordușani-Popină. Bone pieces. Varia.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
VI	72	O/C	metatarsus	fragm	α	1994	12	E7	1258		2,98	
	6		unidentifiable	fragm	α	1994	11	C8	1314		3,00	
	20		unidentifiable	fragm	α	1994	3	H2	1295		2,64	
	65	B/C	right tibia	fragm	α	1994	12		1000		2,52	
	103		unidentifiable	fragm	α	1994	12	D8	1182			perforated
	104		unidentifiable	fragm	α	1994	7	E6	1058	63	2,85	perforated ?
	106	Bos	rib	entire	α	1994	12	D8	1240		3,04	perforated at one end; polished surface; weaving shuttle ?
	107	Bos	rib	fragm	α	1994	passim					see piece no.106
	108	Bos	rib	fragm	α	1994	12	E8	1182		2,57	see piece no.106
	115	S	right tibia	fragm	α	1995	4	L3	1814	98		

Table 20. Bordușani-Popină. Antler pieces. Weapons, parts of compound pieces, adornments.

Type	Inventory number	Identification		Preservation state	References							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
II8Aa	100	Cervus	antler	fragm	α	1995	12	D8	1265		3,09	on the floor of L19
	101	Cervus	antler	fragm	α	1994	12	F7	1182		2,91	
III14	71	Cervus	antler	fragm	α	1994	14	K7	1390		2,62	
	76	Cervus	antler	fragm	α	1995	12	D8	1182		2,56	

	81	<i>Cervus</i>	antler	fragm	α	1995	9	J6	1377		2.80	
	82	<i>Cervus</i>	antler	fragm	α	1995	12	F8	1401		2.90	
	85	C.c.	antler tine	fragm	α	1995	4	K3	1814	98		
IV22	105	<i>Cervus</i>	antler	fragm	α	1995	7	D5	2008		2.75	perforations at the ends and in the angular region

Table 21. Bordușani-Popină. Tusk and shell pieces. Adornments.

Type	Inventory number	Identification		Preservation state	Reference							
		Taxon	Anatomical element		Surf	Year	Sector	Square	SU	Complex	Depth (m)	Observations
IV22	122	S	tusk	fragm	α	1994	7	E5	1281		2.65	
IV19	117	<i>Dentalium</i>	shell	entire	α	1995	12	F7	1401	62	2.90	two beads

3.4.1. General background of the micromorphological study

The neo-eneolithic settlement from Borduşani-Popină is situated in the flood-plain zone of Balta Ialomitel, which had the character of a muddy sedimentary zone during the Holocene epoch.

The stratigraphy of the archaeological deposits consists in a succession of units with silt and silty loam sedimentary matrix, with variable colour and structure, which contains different types and amounts of anthropogenic components:

- relatively pure grey, yellow, yellow-greenish and brownish sediments with elongated and vesicular voids and vegetal prints containing altered vegetal debris;
- microlayered units with variable amount of millimetric to centimetric anthropogenic constituents: charcoal, ash, bones, daub;
- reddish burnt daub containing large fragments of charcoal and yellow-orange unburned construction materials with vegetal prints and wood remains;
- ashy, organic and compound waste deposits;
- brown, organic rich soil units.

The sedimentary units have variable thickness, ranging between some millimeters, in the case of the occupation units formed within the dwelling structures, and some decimeters, for the reddish and yellow-orange daub units and for the natural soil units which occupy the upper part of the stratigraphic section. The units interpreted as constructed floors and the constructed units which form the walls are some centimeters thick.

3.4.2. Field problems and sampling strategy

During the 1993 campaign, a selective sampling was performed on the main stratigraphic section (southern section) in order to establish a classification of the main sedimentary types of the archaeological units. This classification of the different sedimentary facies at a microscopic level allows the interpretation of the sedimentary units in terms of formation processes. We consider this classification a useful mean which contributes to a better integration of the microscopic analysis with the field perception of the archaeological deposits.

In 1994, a selective sampling was performed on the archaeological structures studied in the surface S_a during the excavations. For the present study 12 samples are analysed.

The micromorphological study tries to settle some field problems as follows:

- raw materials and the mode of preparation of the construction materials;
- mode of construction of the archaeological structures;
- mode of fitting out of the floors;
- nature of the accumulated materials and related human activities;
- nature and degree of the transformations of the archaeological constituents and their significance in terms of anthropic activities.

3.4.3. Method and materials

The micromorphological studies need undisturbed, oriented samples of sediment. The size of the sample depends on the sampling strategy and on various aims of the research²⁰

The sampled blocks of sediment and soil are impregnated with synthetic resin in order to enhance their cohesion and stoniness. Our samples were impregnated at the Laboratory for Metals Restoration of the National History Museum of Romania. After their consolidation and drying, thin sections were prepared at the Laboratory of Soil Micromorphology of the National Institute for Pedological Research and Agrochemistry, Bucarest²¹

The basis of this classification consists in the recognition of the anthropogenic, pedogenic and sedimentary features which are diagnostic for the main formation processes²². This work is elaborated on the same principles as in the case of the neo-eneolithic site of Hârşova-tell²³

The main types of sedimentary units are presented in the following table.

Main types of sedimentary units		
Type	Diagnostic features	Function
1. Construction materials		
1.1. Raw sediments	vesicular and fissural voids	Constructed floors
	dense, homogenous fine mass	Fitting out plasterings on
	anthropic components absent	floors
	phytoliths absent	

1.2. Mixtures

1.2.1. Less careful

preparation, straw binder

channel voids

high porosity low homogeneity

anthropic components absent

phytoliths common

Walls, successive plasterings

Constructed floors

1.2.2. More careful

preparation

a) straw and chaff binder

channel voids

low porosity, dense,

homogenous fabric

anthropic components absent

phytoliths common

Walls, successive plasterings

Constructed floors, fitting out

plasterings on constructed

floors

b) dung binder

vesicular and fissural voids

dense, homogenous fabric

anthropic components absent

phytoliths present

fine, altered vegetal debris

Plasterings on the walls

and on the constructed

floors

2. Accumulated materials

2.1. *In situ* accumulation

vesicular and fissural voids

dense, homogenous fabric

a) Ashes and charcoal

Hearth structures

b) Organic

vuggy structure

fissural voids

homogenous fine mass

c) Mineral

Accumulation of ochre on

constructed floor

2.2. Secondary accumulation

a) ashes and charcoal

fissural voids

fine interbedding with silty

units

heterogeneous

dense fabric

variable degree of combustion

Accumulation on the

constructed floors; spread

zone of anthropogenic

constituents

b) organic

various organic components

Accumulation on floors

	variable degree of decay various construction materials	
2.3. Waste	vuggy, chamber voids loose, chaotic fabric heterogeneous variable degree of decay	Waste zones
3. Destruction	large chambers heterogeneous loose-packing of the fragments of construction materials large charcoal fragments, ashes or decayed wood may be present	Breakdown of anthropogenic structures with/without firing
4. Fitting out of the inhabited surfaces	fissural voids fine layered units with decayed plant remains and inter-connected phytoliths homogenous, dense packing	Vegetal mat on constructed floors
5. Natural deposits		
5.1. Natural accumulation	fissural voids dense, homogenous fine layered clay and fine silt units	Water reshuffling; accumulation
5.2. Natural transformation	fissural voids ferruginous and phosphatic impregnations fissural network decayed vegetal remains organic rich fine mass crumbly, aggregated structure	Physical and chemical transformation Pedological transformation

3.4.4. Anthropogenic deposits; preliminary results on their interpretation

3.4.4.1. Construction materials

The construction materials are prepared from silty sediments containing abundant coarse, rounded and subrounded calcareous silt, flaky mica and quartz grains in a well-sorted calcitic groundmass. This type of sediments represents fine alluvia which occur in the vicinity of the tell and even in the alluvial bar which forms the base of the settlement.

The main type of construction materials is characterised by the presence of elongated voids containing inter-connected phytoliths. The ferruginous impregnations and the fine vegetal debris also testify that these channels result from the decay of the original straw and chaff binder.

These construction materials are prepared by the addition of vegetal matter to the fine alluvial sediments. They differ by the degree of homogeneity and the porosity and are interpreted as resulting from a more or less careful preparation. These mixtures with straw and chaff binder occur in the case of walls with successive units and constructed floors.

Another type of mixture containing organic matter is represented by the construction materials which contain fine, altered vegetal debris. Their high degree of fragmentation and decay could be explained by their provenance from herbivore faeces. These materials occur as plastering units on the external part of the walls and on the constructed floors.

Another type of mixture is represented by a construction material occurring in the central part of a house wall. This material contains fine (<1 cm) fired daub fragments and charcoal fragments.

The construction material consisting only in raw sediments presents a dense, homogenous fine mass and vesicular porosity. In the voids there are no traces of organic matter. This type of material occurs as house walls, constructed floors and the plastering of the bottom of a grave.

3.4.4.2. Constructed floors and associated activities.

Dwelling no.19

In the case of this dwelling structure we have studied the sedimentary units corresponding to two inhabited zones separated by an internal wall.

In the northern zone we noticed a succession of constructed floors and occupational units. The floors are 2-3 centimeters thick and are made of raw sediments and covered, in two cases, by vegetal mats. These are indicated by the vegetal remains altered *in situ* (plate 38, photo A). In the field they can be recognised as thin microstratified units containing dark brownish organic impregnations. At the microscopic level, the occupational units, 1-2 millimeters thick, are characterised by the absence of anthropogenic constituents, a fact which suggests a well maintained floor surface. The studied succession presents, at its upper part, two centimetric units which were interpreted as fitting out plasterings on the floor, made of raw sediments. They were not covered with mats.

In the southern zone of the dwelling we observed a succession of construction and fine occupation units (plate 38, photo B). The base of this succession is represented by a constructed floor made of a mixture of fine sediment and rare fragments of unfired daub. This unit contains rare fish bones and fine charcoal fragments. The floor is fitted out with fine (0.4-1 cm thick) units made of two types of materials:

- a mixture of sediment and fine, brownish, altered vegetal debris originating, most probably, in herbivore faeces;
- raw sediments.

The occupation units are 2-3 mm thick and contain very rare anthropogenic constituents. They show features which are diagnostic for a moist environment: very thin accumulations of clay size particles, formed by water reshuffling, vertical fissures, greenish ferruginous impregnations. This situation can be interpreted as resulting from the maintenance consisting in the moistening of the floor surface.

In the same zone of the dwelling, in the proximity of a hearth, the occupation units contain fine charcoal fragments and fish bones distributed on the floor surface (plate 40, photo B), which suggest an activity surface related to the preparation of food.

The internal wall of this dwelling shows the following structure:

- in the internal part, an alternance of units prepared from raw sediments and 2-3 mm thick units containing fine, altered vegetal debris. This alternance is interpreted as representing the successive stages of plastering of the internal part of the wall. The first construction unit of the wall overlies the constructed floor of the house.

- In the central part of the wall, we observed a vertical alternance of two sedimentary units prepared by addition of anthropogenic constituents: fragments of burnt daub (3-7 mm) and charcoal, separated by a 1-1,5 cm thick unit made of raw sediment. This unit presents a characteristic microlayering indicating, most probably, that it was laid down in wet state. Further study is necessary in order to specify if the central part of the wall was built with mud bricks.

In the case of a wall fragment we could notice that the internal zone of the dwelling structure presents a succession of 0,5-1 cm thick constructed floors, covered by 1-2 mm thick units (plate 39, photo B) which can also be observed on the wall of the house.

The constructed floors (plate 39, photo A) are prepared from a mixture of sediment and fine vegetal fragments as straw binder. The fine overlaying units are made of a mixture containing fine, altered vegetal debris which can originate, most probably, in herbivore faeces. The units representing the plastering of the wall correspond, as type of material and preparation, to those of the house floor and can be related to three phases of reconditioning of the house.

In the case of a dwelling structure studied on the main stratigraphic section, at the upper part of the constructed floor we noticed a 2-3 mm thick ochre layer, associated with fine clay units formed by *in situ* accumulation through water reshuffling (plate 40, photo A). The presence of the ochre level, which was observed only here, is interpreted as related to activities of preparation or utilisation of this material. This unit is overlain by another constructed floor, also associated with 1-2 mm thick clay units accumulated under wet conditions. The upper part of the sample presents a loose fabric unit with large fissures, corresponding to the abandon phase of the structure.

In the case of another dwelling structure, studied on the same stratigraphic section, we observed a succession of fine occupation units and units of fitting out plastering of the constructed floor. The floor is made of daub containing straw binder and presenting a high degree of homogeneity. It is plastered with raw sediments. The occupation units contain fine anthropogenic constituents: charcoal and fish bones. These units are interpreted as formed in a less carefully maintained zone, probably meant for culinary activities.

In the case of a child grave (M XIV), the sedimentary unit situated under the skeleton represents the plastering of the bottom of the inhumation pit and is made

of raw sediment. The fissures resulting from the drying of the water saturated sediment, indicate that it was applied in wet state (plate 41, photo A).

Overlaying this sedimentary unit, we noticed a 1-2 mm thick unit which contains vegetal fragments and presents a characteristic microlayering. In the cellular voids there are accumulated humic particles originating in the decay of the human body (plate 41, photo B). This unit is interpreted as vegetals laid on the plastering before the burial.

GRAVE M XIV (plate 42) - Sa, sector 8, H16.

The skeleton belongs to a child aged 1 1/2 years.

The cranium is represented only by its frontal bone. The forehead is broad (a value that relatively diminishes, during growth), with the fronto-parietal fontanelle (*fonticulus anterior*) widely opened (leaving access to the frontal portion).

The frontal is bipartite, showing a widely opened and complete frontal suture (*sutura metopica*) - a very rare feature. Great, round orbits, characteristic for little children, can be distinguished on the facial cranium.

The nasal aperture (*apertura piriformis nasi*) is ellipsoidal, another characteristic for children.

The mandible is very gracile, with the mental protuberance not yet formed.

The two dental arches show some lacteal teeth and numerous dental buds.

The postcranial skeleton is well represented in all his components.

The length of humerus is 97 mm, for radius - 75 mm -, for cubitus - 84 mm - and for the femur - 122 mm -, values that correspond to the presumed age of the individual.

Also characteristic for the age of 1 1/2 years are: no synostosis of the apophyses with the vertebral body and no synostosis of the three hip bone components (ilium, pubis and ischium).

GRAVE M XV (plate 43) - Sa, sector 8, H5.

The skeleton belongs to an 8 year old individual and is almost complete.

A slight fragmentation of the facial cranium and of the mandible was noticed. A certain massivity of the mandible and of the totality of the bones suggests that the individual was a male.

The neurocranium shows an ovoid shape in *norma verticalis*. In *norma occipitalis* the occipital bone appears very swollen out while the cranial relief is slight. Unhappily, the facial massif could not be completely reconstructed. Some cranial dimensions will, however, be pointed out:

- the cephalic index (70,9) indicates a dolichocephalic cranium;

- the longitudinal porio-bregmatic index (58,7) is characteristic of the orthocranial category;

- the transversal porio-bregmatic index (82,7) is characteristic for the metriocranial type.

The length of the long bones (150 mm for humerus, 202 mm for the femur and 155 mm for tibia), as well as the teeth development and the synostosis of the endocranial sutures give informations concerning the age of the individual.

Some long bones, mainly the femur and tibia, present interesting morphofunctional disposals encountered at the ancient populations. So are the flattened outlines of femur and tibia, correlated to the muscular development, as well as another particular feature of tibia, called "the oriental facet", known mainly from populations accustomed to rest in squat position.

The anthropological analysis of this skeleton allowed the identification of a mediterranoïd component, which is characterised by a dolichocephalic neurocranium of medium height, with a fairly rounded occipital and a slight cranial relief (even more emphasised because the subject is a child), and a narrow, low and gracile mandible. Therefore one can admit that the child in M XV certainly included a mediterranoïd component. Another present typologie component could be protoeuropoid (from his stature which is a little taller for his age).

Human remainders were found in a pit (S α , 16, -2,70 m): the left tibia, left radius and left cubitus, unfortunately deprived of any cranial fragment.

The particularity of these bones lies in the fact that, while they are very small and too gracile for an adult female, all epiphyses are fused, ageing her about 20 years. Tibia length - 173 mm - corresponds to an age of 8 years, whereas radius (165 mm) and cubitus (65 mm) correspond to an age of 12-13 years.

This situation of very small sized bones belonging to an adult individual, is a very difficult pathological case of nanism, the first of such importance in the whole speciality's bibliography - Necrasov²⁴ also describes a case of dissendocriny troubles on human remainders discovered at Traian (Neamț), in a Cucuteni-Arșud context.

GRAVE M XVI (plate 44) - S α , sector 3, □G1.

The bones belong to a child aged about 3-4 years. They are fragmentary and were not found in anatomical connection.

The cranium is represented by neurocranium, mandible and maxilla fragments.

The forehead is strongly swollen and the fronto-parietal fontanelle is widely open.

Neurocranium is spheroidal in *norma verticalis*, with a cephalic index of 90.3, characteristic for brachycephaly.

The mandible is gracile, with a faint mental protuberance, some lacteal teeth and numerous dental buds characteristic for this age.

The postcranial skeleton is well represented by gracile bone pieces. Vertebrae components (apophyses and bodies), as well as hip bone components (ilium, pubis and ischium) are not fused. Humerus length is 124 mm, while that of tibia is 128 mm.

GRAVE M XVII (plate 45) - Sα, sector 8, □ I6.

The remainders belong to a 7 years old child.

The neurocranium is represented only by the right parietal bone and some fragments of the left one. The features of the parietal bone seem to indicate an antero-posteriorly lengthened neurocranium, that suggests the existence of a mediterranean component.

The humerus measures 164 mm in length and the radius 136 mm.

The vertebral bodies and apophyses are not fused.

Disparate human remainders were also found:

- Sα, □ H6, SU 1225, -2,70 m.

Three fragments from one young individual's (18-20 years) hand, as well as one metacarpal and two phalanges I and II. Their gracility suggests that they belonged to a woman;

- Sα, □ H6

Tibia fragment belonging to a 5-6 year old individual. The tibia has a platynemic aspect ("sword" aspect), well known for the ancient populations;

- Sα, □ J4

Great bone fragments, with missing distal end, from the left forearm of a 14-17 year old individual (possibly a woman considering the gracility and the flat muscular relief).

3.6. ARCHAEOZOOLOGY

3.6.1. PISCES

Valehtin Radu

Archaeoichthyology - the study of fish remains from archaeological sites - is, in Romania, a new research direction as part of the pluridisciplinary research carried out in archaeological sites. The main cause for the accumulation of fish remains in these sites are man's activities:

As the tell from Bordusani-Popina is situated in Danube's vicinity, it was normal to consider that fishing was one of the main occupation of the site's inhabitants. The great amount of fish remains found during the digging of various levels emphasised the importance of ichthyologic research which had to solve problems of great interest:

- which were the captured fish species, the numbers and sizes of individuals;
- which were the methods used to capture, to process and to prepare the fish;
- which was the importance of fish in the alimentation of the site's inhabitants, in trade and generally, in the site's economy;
- was there a seasonality of capture and in which way it is reflected by the stratigraphy; this kind of observations might have significant consequences for the global interpretation of the research (biostratigraphy, biochronology, palaeoeconomy etc.)

Thorough ichthyological research was to be carried out in order to answer these questions.

Up to the present day, anatomo-specific identifications of bone pieces belonging to fish, recovered from archaeological diggings, were sparse and resulted only in some inventories (due to the imperfect recovery methods) which could not allow further, thorough analysis. These identifications were made on the Romanian archaeological sites mainly by archaeozoologists - S. Halmovici, O. Necrasov, A. Bolomey.

The sampling of the ichthyologic material during the 1993 and 1994 campaigns was not realised by proper methods, so its analysis led to a simple specific inventory for the 1993 pieces, which was completed by the size and weight estimation for the 1994 material. Nevertheless, the results of the present study are of the greatest importance by being the first of this kind for this site and because

they pointed out the necessity to improve the sampling methods in order to obtain relevant data which would reflect the most accurately possible the habitation's characteristics.

Materials and method

The fish remains are found in great amounts within the Gumelnița A2 levels and especially in the domestic waste accumulation zones. Along with the fish bones and scales, these zones contain potsherds, charcoal, ash, shells and mammal, bird and reptile bones. Let aside the domestic waste zones, the fish remains are sparse and come from former domestic waste zones that were disturbed during the successive occupation periods, and whose contents was mixed to great amounts of sediment, as is the case with the various stratigraphic disturbances (trench and pit infillings), the levellings or the destruction levels.

The bone pieces are very well preserved, in spite of the great lapse of time; severe forms of chemical alteration were not observed. The bones are seldom covered by a carbonate crust which does not interfere, however, with specific or anatomical identification. The only problem is the advanced fragmentation degree of the bones, which renders measurements (used in size reconstitutions) difficult.

During the 1993 campaign, the fish remains were collected manually from the digging, together with the mammal and bird bones, without paying a special interest to anyone of them. But after the taxonomic sorting, we noticed that a great part of the pieces pertained to fish, so that we found it necessary to retain and study them. Being manually collected, the fish remains included only the great pieces (>10 mm) and are relatively few compared to the excavated volume.

As a result, in 1994 the collecting was more accurately performed, resulting in 2779 bone pieces from a domestic waste unit, the minimum dimension being of 5 mm. The pieces were washed, dried and marked, and afterwards studied in the laboratory. Each one was identified anatomically and then, if possible, specifically, by comparing it to the skeleton reference collection. The bones which could not be identified, as well as the ones that were only anatomically identified, are considered indeterminable (IND). For the 1994 material, size and weight estimations were also performed.

Faunal composition

1993. 825 bone pieces coming from 19 stratigraphic units (SU) were studied. Due to the reduced number of pieces per SU, the material was studied as a whole the unique goal of this study consisting in the achievement of a first faunal inventory of the site - table 22 presents the identified species. It can be noticed that these are species which are frequent both in the Danube and in the ponds of its flood plain. From the 509 specifically identified pieces, the most frequent are the ones belonging to three species: wels catfish (*Silurus glanis*) - 20,48%, carp (*Cyprinus carpio*) - 20,96% and pike (*Esox lucius*) - 16,72%. The other present species hardly exceed, some of them, 1%: zander (*Stizostedion lucioperca*) - 0,84%, roach (*Rutilus rutilus*) - 0,24% and perch (*Perca fluviatilis*) - 0,12%.

Taking into account the rather inaccurate modality of bone collecting, we considered that MNI (minimum number of individuals) and size estimates were not suitable.

1994. Two domestic waste zones (SU 1182 and 1368) were the subjects of the study (table 23). 1106 (40%) out of the 2779 fish bone pieces yielded by SU 1182 were specifically identified, whereas in the case of SU 1368 there are 244 (56%) specifically identified pieces out of 431. These are very good percentages, considering that unidentifiable pieces included many bones which can very seldom be specifically identified, such as ribs, pterygiophores, fin spines, vertebral apophyses etc.

These samples contain, too, species which are common in the Danube. In addition to the species encountered in the 1993 samples, new species, were found, which come to enrich the *Cyprinidae* family - *Leuciscus idus* (ide), *Aspius aspius* (asp) and *Tinca tinca* (table 2). As is the case with the 1993 material, *Cyprinus carpio* (carp), *Silurus glanis* (wels catfish) and *Esox lucius* (pike) predominate both by number of pieces and MNI, confirming the 1993 observations. Cranial bones are more frequent compared to the post-cranial skeleton pieces (24,23% in US 1182 and 23,77% in US 1368). Among the post-cranial pieces only vertebrae, which are better preserved and also constitute a taxonomic criterion, were taken into account.

One of the possible explanations of the reduced number of vertebrae can be the consumption of conserved fish (by drying, smoking or even salting). The motive is that for conservation purposes the spine is removed, only the cranial skeleton

remaining²⁵. Removal of the spine was probably performed at the capture site or at the foot of the tell; no distinct preparation zone (with abundant fish vertebrae) was evidenced so far.

Size estimates

The size estimates were carried out using comparative data from the reference collection and from bibliography. The measuring was performed on the bones which permitted MNI estimation.

Silurus glanis (wels catfish) - is a rheophile species which enters the flood plain's ponds during reproduction. It can reach 300-400 kg in weight and 5 m in length, although most of the captured individuals usually range between 30 and 40 kg²⁶.

This is the most frequent species in the studied material. Sizes were estimated on the first pectoral fin spine - measuring points are shown in plate 46, fig. 1. These measurements were compared to the values obtained from the reference collection in order to estimate the length and weight (diagram 4) of the 21 and 9 individuals (the minimum numbers of individuals recovered from the two SU) - diagram 1.

SU 1182. The total estimated weight is of 187 kg, the individual extremes attaining 1,7 kg and 35 kg. 6 out of the 21 individuals are large sized and have weights of 15 to 35 kg. The rest of 17 do not exceed 7 kg in weight. The mean weight of one individual is, therefore, 8,9 kg.

SU 1368. Total estimated weight - 110 kg; individual weights vary between 2,5 and 35 kg. 7 individuals do not exceed 10 kg in weight, while only 2 individuals have weights of about 35 kg. Mean weight of one individual - 12,3 kg. This unit also contained the hyal bones (ceratohyal and epihyal) of a 2,4 m/150-200 kg individual.

Esox lucius (pike) - is a predatory species encountered principally in stagnant water, but also in running water. Common dimensions vary between 2-3 kg and up to 1 m; very seldom it can attain 16 kg in weight and exceed 1 m in length²⁷.

The measurements for the size estimation were made on the right dentary bone which was the most frequent. On this bone we measured the width of the symphysis with the left dentary (x) - plate 46, fig. 2 -, for which Brinkhuizen²⁸ used the following function to reconstruct the total length (T_L) of the individual: T_L =

$12,4722x + 152,9629$; afterwards, the weight (W) can be estimated: $\log W = 3,1938 \log T_L - 5,0775$.

SU 1182. The 15 individuals are middle to large-sized: 514 mm/0.892 kg to 764 mm/3.166 kg, with a mean of 1.705 kg/individual. Total weight - 25,589 kg.

SU 1368. 3 individuals of quite similar sizes (477-514 mm), with a total weight of 2.487 kg; mean weight - 0.829 kg/individual.

Stizostedion lucioperca (Zander) - is an oxyphile species which lives in the Danube and in clear stagnant waters with firm bottom; it enters the flood plain's ponds before reproduction and withdraws them at the lowering of the water level. Usually it has 40-70 cm/1-2 kg, but sometimes it can reach 12-15 kg²⁹⁾

SU 1182. The right maxilla being the best represented bone, measurements (plate 46, fig. 3) were made on the six of them, yielding weights of 0.6 to 2.6 kg. The mean weight was of 1.5 kg/individual and the total weight - 9 kg -, which mean fairly large sizes for this species.

SU 1368. The advanced fragmentation state of the cranial bones collected from this unit excluded measurements. But 2 out of the 3 vertebrae were well preserved, allowing the deduction of their position (rank) within the rachis and measurements for size estimation using the GRP (Global Rachidian Profile) method³⁰⁾. As can be seen on diagram 5, one of the two vertebrae superposes exactly the GRP of an 1010 g individual, while the other is placed near the GRP of an 2500 g individual (estimated weight 2000 g).

Family *Cyprinidae*. Five species were identified pertaining to this family. For most of them, sizes were estimated on the bones which are characteristic for this family - the pharyngeal (ceratobranchial V).

Cyprinus carpio (carp) - is a large-sized species - 2 kg/50 cm, but larger individuals (10 kg) are also encountered. The Romanian record is of 27 kg/1.3 m³¹⁾. In our material it is the second frequent species as number of bone pieces.

SU 1182. $MNI = 15$ was estimated on pharyngeals. The weights were estimated on the maximum height and width of pharyngeals (plate 46, fig. 4, 5 and diagram 6) - they range between 0.18 and 3.00 kg. Total weight - 15.30 kg, with a mean of 1.02 kg/individual.

SU 1368. The 4 carp dentary bones yielded by this unit furnished measuring points (plate 46, fig. 6). The estimated weights are comprised between 4.700 and

5,200 kg (probably the individuals were of the same age), resulting in a total weight of 19,40 kg, with a mean of 4,850 kg/individual.

Abramis brama danubii (Danube bream) - is a stagnant or slow-running water species. Length ranges from 25 to 50 cm; very seldom it can reach 70 cm/4 kg³².

SU 1182. Measuring of the pharyngeal (plate 46, fig. 7) allowed the weight estimation for 3 individuals - 0,390, 0,400 and 0,500 kg; total weight - 1,290 kg (0,430 kg/individual).

SU 1368. Weights of 0,300 kg were estimated on two right operculars (plate 46, fig. 8).

Aspius aspius (asp) - is a predatory cyprinid of 30-40 cm in length (maximum length 80 cm)³³.

SU 1182: MNI = 1 (2 pharyngeals, left and right). Estimated weight - 1,700 kg.

SU 1368. The only identified piece in the basioccipital of an individual of about 1 kg.

Leuciscus idus (ide) - is a rare species which lives in stagnant water. Its usual size is 30-45 cm/300-500 g, but it can reach 60 cm and exceed 1 kg in weight³⁴.

SU 1182. Measuring of 2 pharyngeals (see plate 46, fig. 4, 5) yielded weights of 80 and 180 g.

Rutilus rutilus carpathorossicus (roach) - prefers stagnant or slow running water. Usual dimensions are 19-24 cm/70-150 g; it can exceptionally attain 35 cm³⁵.

SU 1182. 2 identified bone pieces; the measuring of the basioccipital (plate 46, fig. 9) resulted in a weight of about 250 g.

Family Acipenseridae.

The sturgeons are represented in the Danube by 2 genus - *Huso* and *Acipenser*. Most of the sturgeon bone pieces are cephalic dermal bones and bone scutes (ganoid scales) of the 5 longitudinal rows. These are very difficult to identify specifically and therefore cannot be used in size or MNI estimations.

Conclusions

These first results obtained by the study of the 1993-1994 material are very interesting. The good state of conservation of the fish bones, as well as the existence of domestic waste zones which concentrate thousands of them, allow a complex research. The direct sampling method which provided material for this

study, has limits which reduce the possibilities of investigation of the bone material, even if maximum of information is extracted.

Out of the 4035 studied pieces, 46% were identified specifically. The identified species are common in the Danube and in its flood plain's ponds.

The 1859 specifically identified bone pieces resulted in 85 individuals (MNI) which total about 376,8 kg. Individual weights range between 80 g (*Leuciscus idus*) and 35 kg. (*Silurus glanis*) - without considering the 150-200 kg. wels catfish individual.

These results prove that fishing was an important occupation within the framework of the site's economy.

The collecting method, which omits the bones of small-sized individuals, did not permit to outline specific preferences of the neolithic fishermen.

Both the 1993 and the 1994 material emphasised the predominance of three species - *Silurus glanis* (wels catfish), *Cyprinus carpio* (carp) and *Esox lucius* (pike) - , represented by large sized individuals (table 24). The great sizes of these species, as well as the weak presence of the postcranial skeleton bones, suggest that fish were already conserved when they were eaten. In the years to come, the discovery of similar samples or of fish preparation sites will confirm and strengthen these first suppositions.

Another observed fact is the great total weight compared to the relatively small number of individuals per domestic waste zone (table 24). This could be explained by the abundance of fish in the zone, an efficient fishing technique and the conservation of fish as food reserve.

In order to clarify the sense of these observations, supplementary informations are needed, implying a pluridisciplinary approach that will point out which was the real importance of fish and fishing in the site's economy. However, the present study already confirms our initial supposition, that fish had an important role in the alimentary economy of the site's inhabitants, and emphasises methods of fish preparation which must be detailed by further research.

TAXON	No. remains	%
<i>Cyprinus carpio</i>	173	20,96
<i>Silurus glanis</i>	169	20,48
<i>Esox lucius</i>	138	16,72
<i>Stizostedion lucioperca</i>	10	1,21
<i>Abramis brama</i>	9	1,09
<i>Acipenseridae</i>	7	0,84
<i>Rutilus rutilus</i>	2	0,24
<i>Perca fluviatilis</i>	1	0,12
Total det.	509	61,70
IND.	316	38,30
Total	825	100

TABLE 22. Bordușani-Popină 1993. Identified taxons.

Taxon	1994					
	SU 1182			SU 1368		
	MNI	W.total	W.mean	MNI	W.total	W.mean
<i>Silurus glanis</i>	21	187,000	8,900	9	110,000	12,300
<i>Cyprinus carpio</i>	15	15,300	1,020	4	19,400	4,850
<i>Esox lucius</i>	15	25,589	1,705	3	2,487	0,829
<i>Stizostedion lucioperca</i>	6	9,000	1,500	2	3,000	1,500
<i>Abramis brama</i>	3	1,290	0,430	2	0,600	0,300
<i>Rutilus rutilus</i>	1	0,250	0,250	-	-	-
<i>Leuciscus leuciscus</i>	2	0,260	0,130	-	-	-
<i>Aspius aspius</i>	1	1,700	1,700	1	-	1,000
Total	64	240,389	-	21	136,487	-

TABLE 24. Bordușani-Popină 1994. Minimum numbers of individuals (MNI) and estimated weights (W) - kg.

TAXON	SU 1182				SU 1368			
	No. remains		Rachis		No. remains		Rachis	
	No.	%	No.	%	No.	%	No.	%
<i>Silurus glanis</i>	334	12,01	93	27,48	123	28,53	39	31,17
<i>Cyprinus carpio</i>	264	9,49	33	12,50	71	16,47	12	16,90
<i>Esox lucius</i>	271	9,75	44	16,23	17	3,94	2	11,76
<i>Stizostedion lucioperca</i>	78	2,80	23	29,48	7	1,62	3	42,85
<i>Abramis brama</i>	10	0,36	75	54,74	2	0,46	-	-
<i>Leuciscus idus</i>	2	0,07			-	-	-	-
<i>Rutilus rutilus</i>	2	0,07			-	-	-	-
<i>Aspius aspius</i>	4	0,14			1	0,23	-	-

<i>Tinca tinca</i>	3	0,10			-	-	-	-
<i>Cuprinidae</i>	116	4,17			14	3,24	2	14,28
<i>Acipenseridae</i>	22	0,79	-	-	9	2,08	-	-
Total det.	1106	39,79	268	24,23	244	56,61	58	23,77
IND.	1673	60,20	-	-	187	43,38	-	-
Total	2779	100,00	-	-	431	100,00	-	-

TABLE 23. Bordușani-Popină 1994. Identified taxons; number of remains and number of vertebrae.

Diagram 5. G.R.P.- Stizostedion luciooperca

Diagram 4. Silurus glanis - first pectoral fin spine.

Diagram 6. Cyprinus carpio - ceratobranchial V.

The identification of the amphibians and reptiles' bone pieces was based on their morphology and was made by comparing them to the actual ones from the reference collection. In estimating the minimum number of individuals (MNI), we took into account the morphologic criteria and also the relative dimensions of pieces coming from differently aged individuals.

The herpetological material from Borduşani belongs to two species: *Rana esculenta* and *Emys orbicularis*. All the pieces belonged to adult individuals of different sizes (these are animals which grow continuously during their lives).

The estimated MNI of *Rana esculenta* is 4, whereas that of *Emys orbicularis* is 3. The great majority of pieces of *Rana esculenta* are fragmentary and do not differ from the actual ones. The *Emys orbicularis* pieces are also fragmentary: some of them were obviously splintered (SU1057, SU1058), while others (SU1000) show wear traces (at the proximal end of ribs).

The palaeoenvironment

The two identified species, widespread throughout Europe, are related to the aquatic biotope. They live mostly in plain regions, preferring slow running waters, marshy zones or lakes. *Emys orbicularis* is more affected by sudden changes in temperature.

Conclusions

1. The small number of individuals suggests that these two species played a secondary role in the alimentation of the community. No selective accumulation of pieces (from the posterior limbs of *Rana*, for example) was observed, as was the case with several sites from France".

2. The burning traces and the fragmentation of this pieces may suggest that these animals were, however, "accidentally" eaten.

3. The significantly great number of costal plates, as well as the wear traces observed on some of them, lead to the idea that they could have been used for domestic purposes: the two costal plate fragments, each equipped with a prominence, could have been used as earrings.

4. The general image of the Borduşani herpetofauna, as well as that of its relationships with man, need further study of the entire deposit's contents, as well as correlations with other vertebrate groups.

The excavations from Bordușani-Popină (1993-1994) picked out 69 bone pieces belonging to the limbs and the shoulder girdle, found both in the La Tène and Gumelnița levels.

Even if most of the pieces are fragmentary, we were able to identify 19 species, attributed to 7 orders and 8 families. These species are (the number of pieces and the cultural attribution in brackets):

Phalacrocorax carbo (L.) - Cormorant (5; La Tène, Gumelnița);

Phalacrocorax pygmaeus (Pallas) - Pygmy Cormorant (1; Gumelnița);

Ardea cinerea L. - Grey Heron (2; La Tène);

Ciconia ciconia (L.) - White Stork (3; Gumelnița);

Ciconia nigra (L.) - Black Stork (3; Gumelnița);

Anas platyrhynchos L. - Mallard (22; Gumelnița);

Anas querquedula L. - Garganey (1; La Tène);

Anas strepera L. - Gadwall (1; Gumelnița);

Anas acuta L. - Pintail (1; Gumelnița);

Anas sp. - Duck (1; La Tène);

Anser anser (L.) - Grey Land Goose (3; La Tène, Gumelnița);

Cygnus olor (Gmelin) - Mute Swan (1; Gumelnița);

Cygnus cygnus (L.) - Whooper Swan (5; La Tène, Gumelnița)

Haliaeetus albicilla (L.) - White-Tailed Eagle (1; Gumelnița);

Gallus gallus L. - Chicken (4; La Tène);

Fulica atra L. - Coot (2; La Tène);

Corvus corone corix L. - Hooded crow (3; La Tène);

Corvus frugilegus L. - Rook (2; Gumelnița);

Pica pica (L.) - Magpie (1; La Tène).

The analysis of the above-listed species led to the following conclusions:

1. All the identified species belong to the actual avifauna of Romania (even if some of them are endangered species);

2. The local geographical conditions explain the predominance of humid environment species - 15;

3. The elements characteristic for non-humid environments are scarce - chicken and corvidae;

4. At Bordușani there are 10 species in common with the fauna found at Hârșova, but while at Hârșova *Anser* is predominating (as number of species), at Bordușani a predominance of *Anas* has been noticed. This fact can be due to different ecological conditions or to different occupations and hunting methods of the two populations. The abundance in great rapacious birds, that was discovered at Hârșova, diminishes at Bordușani to a single taxon - *Haliaeetus* (present also at Hârșova); the explanation of this fact is given at the previous point.

The Gumelnița A2 levels of the α surface yielded 2411 mammal bone pieces during the 1993 and 1994 excavations at Bordușani-Popină. 1526 pieces were assigned to 16 species, both domestic and wild. The other 885 pieces are unidentifiable - various bone and rib fragments which have no particular significance for the species determination and MNI (minimum number of individuals) estimation.

The analysis of these pieces brought to the identification of the following species: *Bos taurus* (cow), *Ovis aries* (sheep), *Capra hircus* (goat), *Sus scrofa domesticus* (pig), *Canis familiaris* (dog), *Bos primigenius* (aurochs), *Cervus elaphus* (red deer), *Capreolus capreolus* (roe deer), *Sus scrofa attila* (wild boar), *Canis lupus* (wolf), *Vulpes vulpes* (fox), cf. *Lutra lutra* (otter), *Felis silvestris* (wild cat), *Castor fiber* (beaver) and *Lepus europaeus* (hare). The distribution of the bone pieces by species is shown in table 25; the species frequencies by bone pieces and by minimum numbers of individuals (MNI) are shown in table 26.

The osteological material represents domestic (cooking) waste, showing a series of features characteristic of this activity: fragmentation, butchery and defleshing incisions, burning traces, gnawing traces and impressions of carnivores (especially dog) teeth.

In the following pages we will present the osteological material by species, trying to outline some aspects referring to the animal economy of the neolithic inhabitants of Bordușani-Popină.

Bos taurus (cow): number of identified bone pieces (NP) = 334, MNI = 9. The analysis of the pieces proved that the cows from Bordușani-Popină belong to the *brachyceros* type, of small size, with short, curved horns and gracile limbs. The study of the dental eruption and wear and of the epiphyses fusion degree³⁷ showed that most of the individuals were mature (between 1 and 3 1/2 years old). Only one horncore, belonging to a female, was discovered. The biometry of the cow bones is shown in table 27.

Ovis aries (sheep): NP=319, MNI=15. All the pieces belong to the *palustris* type, small-sized, with short, straight horns and gracile limbs. The slaughtering ages, estimated on the basis of dental wear³⁸, are comprised, for most of the

individuals, between 6-12 months and 1 to 2 years. A noticeable fact is that sex determination on the hip bones³⁹ showed that females' frequency (MNI=5, all adult) is greater than that of males (MNI=2, one subadult and one adult). The biometry of sheep is shown in table 28.

Capra hircus (goat): NP=19, MNI=5. The goat bones also belong to the *palustris* type. We noticed the presence of two paired frontal bones which were attributed to an unhorned individual, as well as that of a horncore of the *prisca* type, belonging to a male. From the 5 estimated individuals, one was subadult while the other four were adults. The biometry of goat is shown in table 29.

Sus scrofa domesticus (pig): two forms were present at Borduşani-Popină. The form resulted from the local domestication of the wild boar⁴⁰ (NP=280, MNI = 12) is mainly represented by adult individuals aged between 1 and 3 years old, followed by subadults (8 months to 1 year old). Their biometry is shown in table 30.

The *palustris* form (NP=15, MNI=4) is small-sized and very similar to the asiatic subspecies *Sus scrofa vittatus*, from which it probably descended. Three individuals were younger than 3 years, while the fourth was aged between 1 year and 3 1/2 years. Unfortunately only one bone gave the possibility of being measured (Radius: Bp = 24 mm).

We draw attention on the fact that juvenile individuals were included in the *Suidae* category, due to the impossibility of specific differentiation between pig and wild boar for this age category.

Canis familiaris (dog): NP=296, MNI=16. The dog pieces were also assigned to the *palustris* type, small-sized and similar to the actual *spitz* race. The basal length of cranium (Brinkmann index) varies between 111,6 and 143,4 mm. Sizes estimated on the length of two radius (Koudelka and Harcourt index) are 34,45 and 42,83 cm, 35,98 and 44,24 cm respectively (see table 31). Age classes, estimated on cranial sutures⁴¹, suggest a high frequency of adult individuals.

It is noticeable that 44 of the pieces show incisions, some of them (on the labial side of the mandible, on the nasal bones and on the maxilla) obviously resulted from skinning, while the others (on the long bones, in the articulations proximity or on diaphyses) are characteristic for disjointing and flesh removal. These ascertain that dogs were used also on alimentary purposes.

Bos primigenius (aurochs): NP=18, MNI=1. The pieces were assigned to an adult individual older than 3 1/2 years (*tuber calcis* fused on calcaneum), most probably a female. The biometry is shown in table 32.

Cervus elaphus (red deer): NP=61, MNI=3. From the three individuals, one was juvenile (ilium, pubis and ischium unfused) and two were adults (1-2 years and 2-2 1/4 years old, respectively), as was estimated on dental eruption/wear⁴². Two antler fragments were also discovered, but being secondary branches we could not specify whether these belonged to the hunted individuals or are simple sheds. The biometry of red deer is shown in table 33.

Capreolus capreolus (roe deer): NP=13, MNI=2. The two individuals were adults (metatarsals fused distally). An antler fragment (anterior branch) was discovered but, in the same way as for the red deer, we cannot specify the sex of the hunted individuals. The biometry of roe deer is shown in table 34.

Sus scrofa attila (wild boar): NP=47, MNI=3. The three individuals were all adults: 2 years (tibia fused distally, but with the limit still visible), 2-2 1/4 years (metacarpal fused distally, metatarsal unfused) and 4-5 years (vertebral epiphyses fused), respectively. One of them was a male (inferior canines⁴³). The biometry of wild boar is shown in table 35.

Canis lupus (wolf): NP=26, MNI=2. Both individuals were adults. One of them has a surprisingly big size - radius: Bd=33,7 mm (see table 36).

Vulpes vulpes (fox): NP=2 (right and left ulna⁴⁴), MNI=1.

Lutra lutra (otter): NP=1, MNI=1. This whole left tibia (GL=86, Bp=19, SD=6, Bd=14)⁴⁵ shows both epiphyses fused.

Felis silvestris (wild cat): NP=1, MNI=1. This tibia (fused proximally, Bp=24,1) shows working traces at the distal end, suggesting that the diaphysis was used to make a tool.

Castor fiber (beaver): NP=22, MNI=1. Due to the lack of bibliography, it was impossible for us to estimate the age of this individual. However, we noticed that the femoral epiphyses are unfused. One right premaxilla shows the superior incisor in his socket. The biometry is shown in table 37.

Lepus europaeus (hare): NP=30, MNI=2. One of the two individuals was juvenile (all long bones unfused, including the radius, which is the earliest to fuse proximally), whereas the other was adult. In this case too, the lack of bibliography

proved that a more detailed description is impossible. The biometry is shown in table 38.

The animal economy: husbandry and hunting

The above-mentioned informations lead to the idea that the animal economy of the neolithic inhabitants from Borduşani-Popină was mainly based on domestic animals (NP=82,66%, MNI=74,38%).

The most frequent between them were ovicaprins, and especially sheep. In what regards the sheep, the surprisingly high number of slaughtered adult females proves an unusual lack of interest for the reproductive individuals. This lack of interest is also underlined by the lack of a wild stock for domestication and renewal of the flock's number (other possible explanations for this situation can, however, be figured - periods of alimentary crisis, diseases of the animals).

Suids, which are characteristic for the sedentary populations, also played an important role within the framework of animal economy. The structure of their age categories suggests that they were generally slaughtered at optimum weight ages.

Among bovids, adult and mature individuals are the most frequent; they were probably slaughtered after having brought some contribution to the community's economy (reproduction, milk, possibly draught).

Dogs rise interesting problems from the point of view of the animal economy. As was already shown, let aside the possible services (flock and dwelling guard, possible hunting companion), dogs were also used for alimentary purpose. Another noticeable observation: adult individuals are the most frequent, but the analysis of dental wear⁴⁶ proved that they were slaughtered before reaching advanced ages.

It seems that, at Borduşani, the entire progeny was preserved because it might have represented a safe and available source of fur (knowing that dogs are very prolific and whelp regularly and frequently). Meat might have also been used.

The specific diversity of wild animals proved that hunting was not neglected as a means of compensation of the carnate alimentation.

Great ungulates (red deer, wild boar, aurochs, roe deer), which furnish increased amounts of meat, were intensely hunted. The presence of their acropodii proves that these animals were brought to the settlement in all, which means that either these were hunted at short distance from the settlement, either the groups of hunters were large enough to carry them. The other wild species were hunted

occasionally, probably for the fur, their meat being also used. In the case of the wolves, their killing for protecting the flock can also be figured.

Table 25. Bordușani-Popină, 1993-1994.
The distribution of the bone pieces by species

SPECIES																	
ANATOMICAL ELEMENT	<i>Cervus elaphus</i>	<i>Capreolus capreolus</i>	<i>Bos primigenius</i>	<i>Bos taurus</i>	<i>Ovis aries</i>	<i>Capra hircus</i>	<i>Sus scrofa attila</i>	<i>Sus scrofa domesticus</i>	<i>Sus domesticus palustris</i>	<i>Suidae</i>	<i>Canis lupus</i>	<i>Canis familiaris</i>	<i>Vulpes vulpes</i>	<i>Lutra lutra</i>	<i>Felis silvestris</i>	<i>Castor fiber</i>	<i>Lepus europaeus</i>
Cornus*	2	1															
Neurocranium**	6			41	13	3		30		4	1	39				2	
Viscerocranium	6			23	19		2	23		6	1	27				1	3
Dentes sup.	2		1	14	21			7		1		6				1	1
Mandibula	6				33	2	5	25		3	1	26					1
Dentes inf.				13	15		5	17		2		8					
Hyoid				2	4												
Atlas	1			2			1	5				7					
Epistropheus				4	6			3				6					
et Vert. cv.	4		2	18	4		1	14		2	1	11					
Vert. thor.	1		5	23	4		4	25		3		18					1
Vert. lumb.			2	21	10		4	17		1		13					1
Sacrum			1	1			1	2									
Vert. caud.				4								1					
Costae***																10	5
Scapula	4	1	1	11	19	2	1	12	2	2	1	10					
Humerus	1			16	21		2	11	4	3	1	17				1	3
Radius	2	1		12	21	8	1	14	1	1	2	15				1	3
Ulna		1		7	11		3	10	1	2		22	2				2
Carpalia			1	9	3							2					
Metacarpus	4	1	1		19		4	7			7	11					
Pelvis	5	2	1	12	17		1	6	2	1	1	8				1	1
Femur	5	2		15	18			9	3	5	1	10				3	2
Patella	1							2									
Tibia	3	1		14	15	1	2	11		3	3	12		1	1		1
Fibula							2	5				6					1
Talus				3	6		1	4				2					
Calcaneus	2		1	2	3			6			1	2					1
et Tarsalia				8	2							3					
Metatarsus	1	2		20	20	3	4	7			3	10				2	3
Phalanx I			2	16	10		2	6	1	2	1	3					1

Phalanx 2	1	1		19	2		1	2	1		1							
Phalanx 3	4			4	3					1								
Os penis											1							
TOTAL	61	13	18	334	319	19	47	280	15	42	26	296	2	1	1	22	30	885
M.N.I.	3	2	1	9	15	5	3	12	4	4	2	16	1	1	1	1	2	

* = Cervidae

** = Including Cavicornes horncores (*Bos*, *Ovis*, *Capra*)

*** = Due to the fact that they do not have particular significance for the specific identification and for the M.N.I. estimates, and also to the fact that most of the ribs were very fragmented (which rendered the specific identification impossible), these anatomical elements were discussed together with the unidentifiable bone pieces (INDET), excepting the hare and beaver ribs which were included in the reference collection.

Table 26. Bordușani-Popină, 1993-1994.

The species frequencies by bone pieces and M.N.I.

N.P. = number of bone pieces; M.N.I. = minimum number of individuals.

SPECIES		N. P.	% N.P.	M.N.I.	% M.N.I.	% N.P. dom./wild	% N.M.I. dom./wild
D O M E S T I C	<i>Bos taurus</i>	334	21,89	9	11	82,66	74,38
	<i>Ovis aries</i>	319	20,9	15	18,3		
	<i>Capra hircus</i>	19	1,24	5	6,1		
	<i>Sus scrofa domesticus</i>	280	18,35	12	14,6		
	<i>Sus scrofa domesticus f. palustris</i>	15	0,98	4	4,88		
	<i>Canis familiaris</i>	296	19,3	16	19,5		
Suidae		42	2,75	4	4,88		
W I L D	<i>Bos primigenius</i>	18	1,18	1	1,22	14,59	20,74
	<i>Cervus elaphus</i>	61	4	3	3,66		
	<i>Capreolus capreolus</i>	13	0,85	2	2,44		
	<i>Sus scrofa attila</i>	47	3,08	3	3,6		
	<i>Canis lupus</i>	26	1,7	2	2,44		
	<i>Vulpes vulpes</i>	2	0,13	1	1,22		
	<i>Lutra lutra</i>	1	0,065	1	1,22		
	<i>Felis silvestris</i>	1	0,065	1	1,22		
	<i>Castor fiber</i>	22	1,44	1	1,22		
	<i>Lepus europaeus</i>	30	1,96	2	2,44		
TOTAL		1526		82			

Table 27. Bordușani-Popină. *Bos taurus* - osteometrical data

Anatomical element /measurements ^{ns}	number	extremes (mm)	mean (mm)
HORNCORE			
44	1	145	-
45	1	46	-
46	1	38,6	-
MANDIBLE			
10(L)	2	33,2; 35	-
10(B)	1	12,6	-
15a	1	69,5	-
ATLAS			
GB	1	119,5	-
BFcr	1	95	-
BFcd	1	86,5	-
GLF	1	76,5	-
AXIS			
BFcr	2	80; 90,5	-
SCAPULA			
SLC	3	44,2-50,6	47,9
GLP	2	63,4; 66,2	-
LG	3	52,5-58	54,4
BG	4	43,2-48,4	46
HUMERUS			
Bd	2	75; 79	-
BT	2	67; 70	-
RADIUS			
Bp	1	76	-
BFp	1	69,2	-
Bd	1	72,6	-
ULNA			
DPA	1	52,5	-
BPC	3	(40)-44	42,7
METACARPUS			
Bp	2	54; 54,5	-
Bd	2	35; 47	-
PHALANX 1 anterior			
Glpe	7	52-59,5	55,9
Bp	6	28,2-31	29,75
SD	7	21-27	24,75
Bd	7	26,5-31	28,2
PHALANX 2, anterior			
GL	6	35-43	38,4
Bp	5	27,3-31,3	29
SD	6	21,7-24,5	22,8
Bd	6	(23,4)-27,8	25,1
TIBIA			
Bp	1	68,3	-
Bd	1	58	-

Table 27 (continued): *Bos taurus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
ASTRAGALUS			
GLl	2	64,4; 67	-
GLm	2	60,2; 61,2	-
DI	2	37; 37,7	-
Dm	2	(37); 39	-
Bd	2	40; 43	-
METATARSUS			
Bp	3	(42,5)-44,7	43,9
Bd	2	49,4; 55,5	-
PHALANX 1 posterior			
GLpe	2	58; 58,4	-
Bp	2	26,7; 27,5	-
SD	2	22,4; 23	-
Bd	2	25,4;(26,5)	-
PHALANX 2 posterior			
GL	10	33-41	37,51
Bp	12	21,5-31,4	26,85
SD	11	19,3-24	21,65
Bd	8	(22)-25,7	23,9
PHALANX 3 posterior			
DLS	1	72,3	-
Ld	1	56,6	-
MBS	2	(22)-22,1	-

Table 28. Bordușani-Popină. *Ovis arles* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
CRANIUM			
21	1	(66)	-
22	2	(42); 44,3	-
23	2	21,2; 23,3	-
MANDIBLE			
3	1	37	-
5	1	110	-
6	1	127,4	-
7	3	66,6-79,8	73,8
8	2	(46,2);50	-
9	4	(21)-26	22,4
10(L)	2	20,6;25,8	-
10(B)	2	8; 9	-
11	1	36	-
12	2	57,6; 63	-
13	2	33; 58	-
15a	1	34	-
15b	3	20-20,6	20,3
15c	5	15-23	17,2

Table 28 (continued): *Ovis aries* - osteometrical data

Anatomical element / measurements	number	extremes (mm)	mean (mm)
AXIS			
LCDe	4	49,2-54,2	51,6
BFor	5	36-38,4	37,4
BPacd	2	29; 32	-
BPtr	1	39,6	-
SBV	4	19,5-21	20,4
BFcd	3	19,5-20,6	20,1
SCAPULA			
SLC	11	15,5-20,2	17,2
GLP	6	27,6-31,5	29,3
LG	7	22-26	23,5
BG	8	15,8-19,8	17,6
HUMERUS			
SD	4	11,3-14,3	13,1
Bd	9	25,3-28	26,9
BT	10	23,6-27,5	25,3
RADIUS			
Bp	6	25,3-29,4	27,5
BFp	6	23,8-27,7	25,6
SD	5	13,5-15,5	14,1
ULNA			
LO	2	32,5; 36	-
DPA	2	21; 24	-
SDO	2	17,5; 20	-
BPC	2	15; 16,6	-
METACARPUS			
Bp	6	20-21,7	-
SD	1	12,3	-
DD	1	9	-
Bd	1	22	-
PELVIS			
LA	7	25 - 26,2	25,6
LAR	5	21,4- 22,3	21,9
SH	4	13,8- 14,4	14
SB	4	7,6-9,2	8,3
LFo	1	31	-
FEMUR			
Bd	2	(30); (30,5)	-
TIBIA			
Bp	1	37	-
Bd	3	25- (30,5)	27 6

ASTRAGALUS			
GLI	6	23,7-28	26,1
GLm	6	22,6-26	24,9
DI	6	13,4-15,5	14,4
Bd	5	15-18	16,5
shoulder height (Teichert index)	6	537,5-635	592

Table 29. Bordușani-Popină. *Capra hircus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
HORNCORE			
40	1	87	-
41	1	(32)	-
42	1	22,5	-
RADIUS			
GL	1	139	-
Bp	3	28 - 32	30
BFp	3	26-29,2	27,4
SD			
Bd	2	14,2; 15	-
BFd	2	26,4; 27	-
shoulder height	2	22; 23,4	-
(Schramm index)	1	553,2	-
TIBIA			
Bd	1	24,6	-

Table 30. Bordușani-Popină. *Sus scrofa domesticus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
MANDIBLE			
9	1	54	-
9a	2	37; 37,5	-
11	2	37; 37	-
12	1	63	-
ATLAS			
GL	1	49,3	-
BFcr	2	59,1; 60	-
BFcd	2	49,4; 50,5	-
SCAPULA			
SIC	2	18,5; 23,2	-
GLP	2	30,2; 36,8	-
LG	2	27,2; 31,8	-
BG	2	20; 23,8	-
HUMERUS			
SD	1	15,7	-
Bd	2	37,3; 39,6	-
BT	1	29,2	-

RADIUS			
GL	1	152,5	-
Bp	1	29,5	-
SD	1	16,5	-
Bd	1	34,2	-
shoulder height (Teichert index)	1	789,1	-

Table 30 (continued): *Sus scrofa domesticus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
ULNA			
DPA	2	38,4; 40	-
SDO	2	27; 32,1	-
BPC	2	22,1; 24,6	-
PATELLA			
GL	1	38,5	-
GB	1	24,5	-
TIBIA			
SD	1	18	-
CD	1	53	-
Bd	1	26,7	-
ASTRAGALUS			
GLl	3	37,3-38,5	37,8
GLm	3	34-34,7	34,4
shoulder height (Teichert index)	3	690,7- -712,1	700,2
CALCANEUS			
GL	1	77,4	-
GB	1	(23)	-
shoulder height (Teichert index)	1	749,4	-
PHALANX 1			
GLpe	4	28,7-41,9	36,6
Bp	4	14,8-20,3	17,4
SD	4	11,1-15,6	13,5
Bd	4	12,5-18,2	15,4
PHALANX 2			
GL	2	22,5; 23,3	-
Bp	2	15; 17,1	-
SD	2	12,4; 14,4	-
Bd	2	11,7; 16,3	-
PHALANX 3			
DLS	1	(36,1)	-
Ld	1	34,5	-
MBS	1	15,1	-

Table 31. Bordușani-Popină. *Canis familiaris* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
CRANIUM			
4	1	34	-
7	1	67	-
11	1	60,5	-
14	1	21,4	-
15	8	43,8-59,8	51,9
16	14	12,7-17	14,6
17	10	35-45,6	39,9
18	14	13-17	15,4
19	14	12,2-17	15
20(L)	12	8,4-11,3	10
20(B)	12	9,6-13	11,6
21(L)	11	5-6,7	5,7
21(B)	11	7-8,7	7,5
22	7	17,8-22,4	19,1
23	1	46	-
24	1	45,5	-
25	2	26; 29,3	-
27	2	14,4; 15	-
28	2	13; 13,3	-
31	1	33	-
32	1	39	-
33	1	25,4	-
34	1	44	-
37	2	24,5; 25	-
38	1	37,6	-
40	1	31,3	-
MANDIBLE			
1	12	93,2-117	105,9
2	12	93-(117,4)	106,6
3	12	91-(112,4)	101,9
4	14	78-104,3	90,9
5	14	72-99,6	86,8
6	13	79,6-104	92,8
7	9	52-67,7	62,2
8	9	50-64	59,3
9	10	46,7-59,5	53,1
10	13	(25)-30	28,2
11	15	26-35,2	32
12	12	22-30,5	27,3
13(L)	9	17,5-19,6	18,7
13(B)	9	6,7-8	7,2
14	17	17-19,2	18,4
15(L)	4	7-7,4	7,3
15(B)	4	5,4-5,6	5,5
17	16	8,5-10,4	9,3
18	13	35,5-45,5	40,8
19	17	15,8-20,3	17,8

20	13	(10)-16	14,2
25	11	111,6-143,4	128,8
26	9	101-141,6	127,9

Table 31 (continued): *Canis familiaris* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
ATLAS			
GB	6	45,2-63,7	58,1
GL	4	23-33	29,8
BFcr	7	29,6-34,6	32,8
BFcd	7	22,3-27,3	25
GLF	7	21-26,4	24,9
LAd	7	10-14,4	13
AXIS			
LCDe	1	40,5	-
LAPa	1	(41)	-
BFcr	1	26	-
BFcd	1	14,3	-
SCAPULA			
SLC	5	15-18,2	16
GLP	5	19-22	20,2
LG	5	17-20,3	18,9
BG	5	10,4-13,4	11,7
HUMERUS			
SD	1	8	-
Bd	2	20,3; 23,3	-
RADIUS			
GL	2	107;133	-
Bp	5	11,6-15	13,3
SD	5	8-10,4	9
Bd	2	16; 18,4	-
shoulder height:			
- Koudelka index	2	344,5; 428,3	-
- Harcourt index	2	359,8; 442,4	-
ULNA			
DPA	8	16-20,3	18,2
SDO	7	14-16,6	15,3
BPC	8	12-13,7	12,8
PELVIS			
GL	1	(117)	-
LA	7	16,4-21	18,2
LAR	4	14,5-15,6	14,9
SH	5	11-14	12,1
SB	5	4,6-7,2	5,9
FEMUR			
Bp	1	23,6	-
DC	1	(10,6)	-
Bd	1	9	-

TIBIA Bd	1	15,3	-
ASTRAGALUS GL	2	18,5; 19	-
CALCANEUS GL	2	28,9; 33,4	-
GB	2	11,3; 13,3	-

Table 32. Bordușani-Popină. *Bos primigenius* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
SCAPULA			
SLC	1	65,5	-
GLP	1	85	-
LG	1	70,5	-
BG	1	58	-
METACARPUS			
Bd	1	75	-
PELVIS			
LA	2	80; 81	-
LAR	1	69	-
CALCANEUS			
GL	1	150	-
PHALANX 1 posterior			
Glpe	1	57,9	-
Bp	1	35,6	-
SD	1	30,6	-

Table 33. Bordușani-Popină. *Cervus elaphus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
MANDIBLE			
10(L)	1	32	-
10(B)	1	11,5	-
15a	1	47,6	-
SCAPULA			
SLC	1	50,5	-
RADIUS			
Bp	1	76,3	-
BFp	1	70	-
Bd	1	47	-
BFd	1	40,6	-
METACARPUS			
Bp	1	43	-
Bd	1	45,7	-
TIBIA			
Bd	1	57,7	-

PHALANX 2			
GLpe	1	42,3	-
Bp	1	21	-
SD	1	17	-
Bd	1	18,5	-
PHALANX 3			
DLS	1	63,6	-
Ld	1	50	-
MBS	1	20,3	-

Table 34. Bordușani-Popină. *Capreolus capreolus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
METACARPUS			
Bp	1	24,3	-
PELVIS			
LA	1	29	-
SH	1	20	-
METATARSUS			
Bp	1	21,5	-
SD	1	13	-
DD	2	12; 13	-
Bd	2	25,3; 27	-

Table 35. Bordușani-Popină. *Sus scrofa attila* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
MANDIBLE			
10(L)	1	44,4	-
10(B)	1	20	-
12	1	(89)	-
ATLAS			
GB	1	98,5	-
GL	1	54,4	-
BFor	1	68	-
BFcd	1	66	-
METACARPUS IV			
GL	1	85,4	-
LeP	1	79,16	-
Bp			
B	1	18,66	-
Bd	1	13	-
shoulder height	1	(16,7)	-
(Teichert index)	1	869,8	-
TIBIA			
Bd	1	38,6	-

ASTRAGALUS			
GLl	1	50,7	-
GLm	1	45	-
shoulder height (Teichert index)	1	930,5	-
METATARSUS III			
GL	1	(102,9)	-
LeP	1	98,2	-
Bd	1	20,6	-
shoulder height (Teichert index)	1	(966,6)	-
PHALANX I			
GLpe	1	47,4	-
Bp	1	22	-
SD	1	17	-
Bd	1	19,2	-

Table 36. Bordușani-Popină. *Canis lupus* - osteometrical data.

Anatomical element /measurements	number	extremes (mm)	mean (mm)
CRANIUM			
15	1	55	-
16	1	12	-
17	1	42,5	-
18	1	15,7	-
18a	1	8,5	-
19	1	15	-
37	1	26,3	-
MANDIBLE			
4	1	128	-
5	1	119	-
6	1	130,5	-
7	1	81	-
8	1	74	-
9	1	70	-
10	1	36	-
11	1	38,5	-
12	1	35	-
13(L)	1	22,5	-
13(B)	1	8,7	-
14	1	21,2	-
15(L)	1	10	-
15(B)	1	7	-
17	1	12,7	-
18	1	59	-
19	1	25	-
20	1	19	-
26	1	170,6	-

SCAPULA			
SLC	1	24,6	-
GLP	1	30	-
LG	1	27	-
BG	1	18	-
HUMERUS			
Bd	1	33,3	-
RADIUS			
Bd	2	25; 33,7	-
TIBIA			
Bp	1	26,4	-
SD	1	10,7	-
Bd	1	23	-
CALCANEUS			
GL	1	45	-
GB	1	18,4	-

Table 37. Bordușani-Popină. *Castor fiber* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
HUMERUS			
Bd	1	34,4	-
RADIUS			
GL	1	102,4	-
BP	1	14	-
SD	1	7,4	-
Bd	1	14	-
PELVIS			
LA	1	25	-
LAR	1	21,1	-
SH	1	16,5	-
SB	1	16,1	-
LFo	1	63,2	-
FEMUR			
Bd	1	41,8	-
METATARSUS II			
GL	1	44,3	-
Bd	1	10	-

Table 38. Bordușani-Popină. *Lepus europæus* - osteometrical data

Anatomical element /measurements	number	extremes (mm)	mean (mm)
CRANIUM			
9	2	18; 18	-
16	1	47	-
HUMERUS			
Bd	2	13,2; 13,3	-

RADIUS			
Bp	1	9,3	-
SD	1	5,3	-
PELVIS			
LA	1	14,4	-
SH	1	12,7	-
CALCANEUS			
GL	1	36	-

The 1993 sampling was aimed to test the spore-pollinic potential and the conservation stage of pollen in various stratigraphic units (SU), in order to establish a strategy for systematic sampling in 1994.

Seven samples were analysed, as follows:

a) *Gumelnița* context:

- a destruction level made of daub, with frequent vegetal impressions and fragments of straw - sample P7/SU 82;

- an exterior occupation level of domestic waste containing ash, charcoal, potsherds - sample P2/SU25;

- another daub destruction level containing frequent straw impressions - sample P1/SU26;

b) *La Tène* context: a discontinuous occupation level containing potsherds, bones, shells - sample P3/SU2;

c) In the *transition sequence*, from *Gumelnița* to *La Tène*, in an almost archaeologically sterile level of light brown (at the bottom) turning progressively into dark brown (at the top) colour:

- one sample from the bottom side, light brown deposits - P6/SU11;

- one sample from the top side, dark brown deposits - P4/SU3;

- another sample between the previous two samples - P5/SU10.

Samples were processed at the *Centre National de Préhistoire* (Périgueux, France) for pollen and spore concentration and extraction.

Informations obtained during processing - calcium carbonate contents (CaCO_3), soluble organic matter contents (SOM) and figured organic matter contents (OM) -, as well as spore-pollinic contents of samples are presented in the appendix. They show that sediments are very rich in carbonate. SOM and OM diminish with the sample depth (z) - the more ancient the sample, the organic matter is more degraded and transformed towards inorganic material.

As regards the pollen and spores, the deepest samples (P1 and P7) are totally deprived of them, whereas the five others contain pollen in great enough amounts to permit statistic analysis, but the pollen is intensely corroded. Apart from the

fenestrate *Asteraceae* pollen which, by his very characteristic features, can still be identified (at family level only), the rest cannot be identified any longer.

A discussion on pollen corrosion is needed here. In the present case, corrosion could not be due to processing, because further samples, processed with the same method, yielded great amounts of well preserved pollen. The coating of pollen and spores is made of, or contains sporopollenine, which was shown⁴⁷ to be autoxidizable, that is to say affected by oxidation under natural aerobic conditions. According to Havinga⁴⁸, oxidation is more severe in a dry environment, which is the case at Bordușani, a site with very hot and dry summers and where sediment porosity enables pollen exposure to aerobic conditions. Oxidation favours attack of pollen by bacteria. Besides, Heinen⁴⁹ found that enzymatic destruction of cutine (which is chemically related to sporopollenine) begins with oxidation, while Havinga⁵⁰ points out that increasing susceptibility to corrosion parallels the diminution of sporopollenine contents and that through oxidation of pollen, the resulting material becomes soluble in dilute alkali.

On the other hand, Weinstein-Evron⁵¹ notices that pollen assemblages found in sites with warm, dry summers, usually contain high *Asteraceae*, especially *Liguliflorae*, pollen. This might result from selective corrosion, because it is known that pollen susceptibility to corrosion differs from one species to another and, as shown by Bottema⁵², *Asteraceae* - *Liguliflorae* pollen is among the most resistant to corrosion.

And, in order to close this argumentation, Havinga⁵³ considers that under dry and warm conditions, apart from the most resistant pollen types, the rest are not preserved for more than two or three years.

Nevertheless, given the results of the 1993 pollen analysis at Hârșova-tell, a quite similar site where pollen has been found in coprolites and in a sample collected under a grinding stone, the sampling in 1994 at Bordușani was oriented towards deposits of this type.

In Gumelnița context - Sα -, 61 samples were collected (out of which 55 in coprolites, 2 in closed *Unio* shells, 2 under potsherds and 2 in other situations), whereas in La Tène context - Sβ -, 2 samples came from the infilling of a pot and one from a light brown sediment containing daub fragments and charcoal.

Unfortunately, only two of these samples were processed until the present - P19 (the contents of a closed *Unio* shell) from SU 1186 and P23 (a coprolite

containing vegetal remainders) from SU 1182. They show a medium (P19) or high (P23) contents of calcium carbonate, very low (P19) or low (P 23) contents of SOM, and quite low contents of OM. Microscope observation shows rare, corroded pollen, unidentifiable excepting some *Asteraceae* - *Liguliflorae* pollen. The palynofacies of these two samples contains frequent vegetal debris, very corroded and broken, and rare brown (ligneous) debris, medium-sized, angular to rounded, occasionally showing pits.

These results strengthen the hypothesis supporting the importance of environmental conditions in the destruction of pollen grains at Borduşani.

Concluding, for the years to come, the analysis of a core seems essential. The sediments sampled through this core must be accumulated in a limnic or telmatic environment, of fine texture and rich in organic matter - conditions which permit pollen concentration and preservation, far from direct anthropic influences, but still in the proximity of the site. The correlation of the sporo-pollinic record from this core to the results from the pollen analysis of the site deposits, will probably enlighten the evolution of the vegetation in the surroundings of the site and the image of the economy of the populations that inhabited the Borduşani-Popină tell during the last millennia.

APPENDIX. Results of sample processing and pollen contents tests.

Cultural context	Sample	SU	z(m)	CaCO ₃	SOM	OM (μl/g)	Sporo-pollinic contents
La Tène	P3	2	0.48	rich	**	19,30	12 very corroded
?	P4	3	0.61	rich	***	6,25	31 very corroded
?	P5	10	0.89	rich	**	3,50	47 very corroded
?	P6	11	1.13	rich	**	2,25	29 very corroded
Gumelnita	P2	25	2.17	rich	*	0,90	23 very corroded
Gumelnita	P1	26	2.38	rich	0	0,75	0
Gumelnita	P7	82	2.60	medium	0	0,50	0

The CaCO₃ contents has been estimated through the effervescence of the sample with 40% hydrochloric acid (HCl).

The SOM contents has been characterised by the colour of the supernatant resulted after the first centrifugation which followed the 10% potassium hydroxide (KOH) digestion.

* - very low contents

** - low contents

*** - medium contents

The OM contents has been measured with a Gilson Pipetman micropipette, in microlitres per gram of dry processed sediment.

The sporo-pollinic contents was tested by examining one vertical line (at X250 magnification) on one slide for each sample. The OM solution of glycerine had the same concentration in all samples:

Because during the current period the surface geological context of the Bordușani tell and of its environment includes only unconsolidated sedimentary rocks, and because, most probably, the situation was the same at the time of the eneolithic and La Tène occupation, a fact which is quite normal given the marshy, flood plain area of the site and its disposal on a large alluvial bar, the study of all the lithic material (artifacts, but also simple rock fragments), was evaluated as being of interest in order to attempt the identification of its sources of origin.

The macroscopic petrographical analysis of the lithic material found at Bordușani-Popină during the 1993-1994 excavations emphasised two genetic rock categories:

- sedimentary rocks: limestone, sandstone/microconglomerate and silicolites;
- metamorphic rocks: greenschists and quartzite.

For the distribution of artefacts and lithic fragments by rock types see the appendix.

The majority of **limestone** pieces originate in a very fine textured type, massive and compact, beige of colour, including fine impregnations of iron and manganese oxides. The microscopic analysis⁵⁴ pointed out that this micritic limestone is in course of dolomitisation, containing rare foraminifera skeletons. This dolomitisation process is quite characteristic for the jurassic limestones from Dobrogea.

A few pieces are made of fine textured limestone, red or greyish, which is sometimes marly.

Three polished chisels were obtained from hard, very fine textured limestone. The microscopic analysis pointed out that this fine, parallel lamination limestone contains pellets made of or impregnated by iron hydroxide (from which its hardness), relied by microsparite. The concentric structure of the pieces is obviously due to further alteration.

The microscopic study of another limestone fragment underlined micritic lithoclasts, rare feldspar grains, polycrystalline quartz fragments and foraminifera, dispersed in a secondary sparite (microsparite) mass, proving a littoral facies.

Occurrence - limestones outcrop within the Jurassic - Romanian sequence, along almost all the valleys of Southern and Central Dobrogea, along the dobrogean bank of the Danube and in mesozoic deposits from Northern Dobrogea. Therefore, it is impossible to find, without extensive studies, the origin sources of the limestone material from Borduşani.

As regards the clastic sedimentary rocks, the Borduşani **sandstones**, are fine grained, calcareous, slightly micaceous, beige or grey of colour. One of the fragments shows brown alterations, while another one contains a centimetric level of yellowish calcilutite.

The only **microconglomerate** fragment is red, with local siliceous cement and hematitic pellicular cement. Grains are made of volcanic rocks (dacite, trachyte), filonian quartz, micaceous quartzite, detritic muscovite and biotite, feldspar. Because some of the grains come from Palaeozoic rocks, the age of this microconglomerate is postpalaeozoic.

Occurrence - calcareous sandstones outcrop within upper cretaceous deposits along almost all the valleys of Southern Dobrogea and in the Nalbant Beds (Norian) from Northern Dobrogea; conglomerates are found in Jurassic, cretaceous and eocene deposits throughout Dobrogea, as well as in the Triassic of Northern Dobrogea.

Without extensive research, neither in this case, sources of origin cannot be identified.

The **silicolites** found at Borduşani have various colours - pale grey, beige, yellowish brown, dark grey, black. They show homogenous or inhomogenous (concentric, granular) structures, with submillimetric to centimetric white, reddish or blackish inclusions, or ferruginous, thin layered impregnations. Certain pieces preserve cortex zones.

The microscopic analysis proved that they are *cherts* - diagenetic products on calcareous or siliceous rocks: silica, a very mobile material coming from radiolarian or sponge spicule opal, diffuses in colloidal solutions through the rock and accumulates in particular zones, replacing the initial rock. The mass of the cherts is made of microquartz and can include carbonate relics of the initial rock, sponge spicules, echinid radioles, foraminifera skeletons or other bioclasts, replaced by chalcedony, fine fissures with chalcedony recrystallizations, quartz grains or

organic debris. Submicronic impurities (iron and manganese oxides, etc.) are dispersed in various manners throughout the rock.

A study, which is only at the beginning, shows that two great categories can be distinguished - the one presenting very frequent and large enough chalcedony recrystallization zones and the other having a very homogenous structure, with sparse and little chalcedony zones. The former shows macroscopically a fine-grained texture, whereas the latter appears vitreous. Within these two categories, distinctions can be made by the disposal and grouping of impurities.

Further microscopic research will try to define very clearly the chert classes and to apply them in the study of outcropping silicolites, in order to identify the sources of origin of the material found during the excavations.

Occurrence - silicolites are found as:

- *flint* ("silex"), in Upper Cretaceous (Campanian-Maastrichtian) chalk from Southern and Central Dobrogea and in Paleogene (Lutetian) bioclastic (lumachelic) limestone from Southern Dobrogea;

- "*chaille*", in Upper Jurassic and Cretaceous (Turonian) limestone from Central Dobrogea, and in Triassic (Carnian) and Cretaceous (Senonian) limestone from Northern Dobrogea;

- *jasp* and *silica schist*, in the Upper Devonian Silicolitic Complex from Northern Dobrogea.

Greenschists are very low grade epimetamorphic rocks which conserve the texture and structure of the sedimentary rocks from which they originate. They display siltic, arenitic or microconglomeratic textures and massive to slightly foliated structures. They are green or reddish (due to oxidation).

Occurrence - the Upper Proterozoic greenschists outcrop throughout Central Dobrogea. Their nearest locations are at about 20 km. distance from Borduşani, the one at 5 km. ENE of Dunărea and the other at 5 km. NE of Topalu.

The **quartzite** fragments found at Borduşani show fine to medium-grained granoblastic textures. They are white or beige; one of the pieces presents fine ferruginous impregnations. Two of the pieces come from gravel deposits.

Occurrence - gravel fragments may come from alluvial deposits of the valleys which cross Southern and Central Dobrogea or from the Danube's terraces.

Quartzites also outcrop within the Ceamurlia Series (Upper Proterozoic) from Central Dobrogea, the Orliga Series (Upper Proterozoic), the Boclugea Series (Upper Proterozoic - Lower Palaeozoic) and the Lower Devonian from Northern Dobrogea.

APPENDIX

The distribution of artifacts and lithic fragments by rock types:

Limestone:	fragments - 26 chopping debris - 7 strickers - 1 polished chisels - 3 grinding stone fragments - 1 necklace beads - 1
Sandstone:	grooved abraders - 2 grinding stone fragments - 1
Microconglomerate:	grinding stone fragments - 1
Silicolites:	chopping debris - 95 nucleus - 2 axes - 1 sickle pieces - 3 arrow points - 3 (fragmentary) blades - 76 scrapers - 25
Greenschist:	fragments - 4 chisels - 1 grinding stone fragments - 9 (out of which 6 from the same grinding stone)
Quartzite:	fragments - 3

NOTES

- ¹ The same text appears in *Marele dicționar geografic al României (The great geographic dictionary of Romania)*, vol. 1, 1906.
- ² I.Barnea, *Revista Muzeelor*, III, 1962, 2, p. 157.
- ³ The osteological analysis was performed by the late Mrs. Alexandra Bolomey.
- ⁴ G.Trohani, *Ensevelissements sous l'habitation chez les gëto-daces*, Actes du XII^e Congrès International des Sciences Préhistoriques et Protohistoriques, 3, Bratislava, 1993, p. 281-282.
- ⁵ G.Trohani, *Cultură și Civilizație la Dunărea de Jos*, I, Călărași, 1985, p. 51-54; S.Sanie, *Arheologia Moldovei*, XII, 1988, pl. V/6.
- ⁶ A.Buzilă, *Memoria Antiquitatis*, 4-5, 1972-1973, 1976, p. 93-113.
- ⁷ V.Căpitanu, *Carpica*, 18-19, 1987, p. 103-149, fig. 64.
- ⁸ S.Sanie, *Arheologia Moldovei*, XII, 1988, p. 66-101, pl. I-XXVII.
- ⁹ V.Ursachi, *Thraco-Dacica*, VIII, 1987, p. 100-126.
- ¹⁰ R. and Ec.Vulpe, *Dacica*, III - IV, 1927-1933, p. 253-351; R.Vulpe et colab., *SCIV*, III, 1952, 1, p. 191-230
- ¹¹ M.Udrescu, *Considerații arheologice privind creșterea animalelor și vânătoarea la geto-dacii din Câmpia Română*, *Cultură și civilizație la Dunărea de Jos*, I, Călărași, 1985, p. 59-64.
- ¹² Fr.Audoin-Rouzeau, *La taille du mouton en Europe, de l'Antiquité aux temps modernes*, Fiches d'osteologie animale pour l'archéologie, no. 3, CNRS, Editions APDCA, Juan-les-Pins, 1991.
- ¹³ M.Udrescu, *Les chiens de l'habitat civil romain de Stolniceni-Vâlcea; données zooarchéologiques*, *Annuaire roumain d'anthropologie*, 27, Bucarest, 1990, p. 3-8.
- ¹⁴ M.Udrescu, *La chasse chez les Gëto-daces (II^e - I^{er} siècles av. J.-C.) du sud-est de la Roumanie*, *Exploitation des animaux sauvages à travers le temps*, Editions APDCA, Juan-les-Pins, 1993, p. 405-410.
- ¹⁵ H.Camps-Fabrer, *Le role de l'os dans la vie quotidienne des hommes préhistoriques*, Commission 33 Travaux du L.A.P.M.O., 1986.
- ¹⁶ H.Todorova, *Kamenno-mednata epoha v Bălgaria*, Sofia, 1968, fig. 77, p. 154; I.Nestor, A.Langsdorff, *Nachfragzu Cernavoda*, fig. 9, p. 223; an unpublished piece was found at Hârșova, 1992, SB, in the Gumelnița A2 level, at 3,60 m of depth.

¹⁷ Vl. Dumitrescu, *Arta preistorică în România*, Ed. Meridiane, 1974, p. 245 (the piece belongs to the IIIrd type, variant I).

¹⁸ A similar piece was found at Hârșova (unpublished).

¹⁹ Al.Bolomey, S.Marinescu-Bâlcu, *Industria osului în așezarea cucuteniană de la Drăgușeni - Ostrov*, SCIVA, 39, 4, 1988, p. 335.

²⁰ M.-A.Courty, P.Goldberg, R.Macphail, *Soils and micromorphology in archaeology*, Cambridge University Press, 1989.

²¹ We are indebted to Ms.Daniela Răducu and to Ms.Ioana Carcea for their suggestions and for the access to the microscopes, as well as to Mr.Marius Popa for the processing of the thin sections.

²² M.-A.Courty *et al.*, Op.cit.(note 20) and M.-A.Courty, *Soil micromorphology in archaeology*, in Proceedings of the British Academy, 77, London, 1992.

²³ We wish to mention that this study is directed by Ms.M.A.Courty, within the framework of the romanian-french collaboration programme on the site of Hârșova-tell.

²⁴ O.Nécrasov, *Etude anthropologique des restes osseux néolithiques appartenant à la culture Cucuteni-Arăușd. découverts à Doboseni*, Ann. d'anthropologie, 1, 1964, p. 15-17.

²⁵ J.Desse, N.Desse Berset, *Pêches locales, côtières ou lointaines: le poisson ou menu des parisiens du Grand Louvre, du XIV^e au XVIII^e siècle*, Anthropozoologica, 1992, p. 119-126.

²⁶ P.Bănărescu, *Fauna R.P.R., Pisces - Osteichthyes*, vol. 13, Ed. Academiei R.S.R., București, 1964.

²⁷ *Ibidem*.

²⁸ D.C.Brinkhuizen, *Ichthio-Archeologisch onderzoek: methoden en toepassing aan de hand van romens vismateriaal uit Velsen (Nederland)*, Ph.D., Rijksuniversiteit Groningen, 1989.

²⁹ P.Bănărescu, Op.cit.(note 23).

³⁰ J.Desse, N.Desse-Berset, M.Rocheteau., *Les profils rachidiens globaux. Reconstitution de la taille des poissons et appréciation du nombre minimal d'individus à partir des pièces rachidiennes*, Revue de Paléobiologie 8/1, Genève, 1989, p. 89-94.

³¹ P.Bănărescu, Op.cit.(note 23).

³² *Ibidem*.

³³ *Ibidem.*

³⁴ *Ibidem.*

³⁵ *Ibidem.*

³⁶ S.Bailon, *Quelques exemples de la consommation d'amphibiens à travers le temps*, in *Exploitation des animaux sauvages à travers le temps*, XIII^{èmes} Rencontres Internationales d'Archéologie et d'Histoire d'Antibes IV^{ème} Colloque International de l'Homme et de l'Animal, APDCA, Juan-les-Pins, 1993, p. 319-326; J.-C.Rage, *Les batraciens du niveau V*, in *Les sites littoraux néolithiques de Clairvaux-les-Lacs (Jura)*, t. II. *Le Néolithique moyen*, Édit. de la Maison des sciences de l'homme, 1989, p. 405.

³⁷ I.A.Silver, *The ageing of domestic animals*, in D.R.Brothwell, E.Higgs, *Science in Archaeology, a survey of progress and research*, Thames Hudson ed., 1969, p. 25-268.

³⁸ S.Payne, *Kill-off patterns in sheep and goats: the mandibles from Aşvan Kale*, Anatolian studies. Journal of the British Institute of Archaeology at Ankara, vol. XXIII, 1973. and S.Payne, *Morphological Distinctions between the mandibular Teeth of Young Sheep, Ovis and Goats, Capra*, Journal of Archaeological Science, 12, 1985, p. 139-147.

³⁹ W.Prummel, H.-J.Frisch, *A guide for the Distinction of Species, Sex and Body Side in Bones Sheep and Goat*, Journal of Archaeological Science 13, Academic Press Inc., London, 1986, p. 567-577.

⁴⁰ It is possible that some individuals resulted from hybridisation between pig and wild boar are present. It is known that, even nowadays, this species is less dependent on man than bovids and ovicaprines. It seems that during the prehistory, this situation was even more marked due to the fact that domestic pigs lived in a semi-wildness state, the existence of mixed populations with the wild boar (within which hybrids and individuals returned to the wild state were very frequent) being not excluded.

⁴¹ T.Poulain, *L'étude des ossements animaux et son apport à l'archéologie*, Centre de Recherches sur les techniques Greco-Romaines, Faculté des Sciences Humaines, Dijon, 1976.

⁴² E.Varin, *Evaluation de l'âge d'après les dents*, in *Chevreuil, Cerf, Sanglier*, Editions de l'Orée, Bordeaux, 1980, p. 249-257.

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⁴⁶ E.Chatelain, *Derits. Diagnose de l'age des animaux domestiques*, Laboratoire d'Anatomie de l' E.N.V.L. Lyon, 1992.

⁴⁷ F.Zetsche, O.Kalin, *Untersuchungen über die Membran der Sporen und Pollen V. 4. Zur Autooxydation der Sporopollenine*, *Helv. Chim. Acta*, XIV, 1931, p. 517-519.

⁴⁸ A.J.Havinga, *Investigation into the differential corrosion susceptibility of pollen and spores*, *Pollen et Spores*, VI, 2, 1964, p. 621-635.

⁴⁹ W.Heinen, *Ueber den enzymatischen Cutin-Abbau I.Mitt.: Nachweis eines Cutinase-Systems*, *Acta bot.neerl.*, 9, 1960, p. 167-190.

⁵⁰ A.J.Havinga, *Op.cit.(nota 44)*

⁵¹ M.Weinstein-Evron, *Pollen spectra from the Acheulean site of Mitzpeh Yiron, Israel: a cautionary tale*, *Pollen et Spores*, XXVIII, 2, 1986, p. 157-165.

⁵² S.Bottema, *The interpretation of pollen spectra from prehistoric settlements (with special attention to Liguliflorae)*, *Palaeohistoria*, XVII, 1975, p.17-35.

⁵³ A.J.Havinga, *A 20-year experimental investigation into the differential corrosion susceptibility of pollen and spores in various soil types*, *Pollen et Spores*, XXVI, 3-4, 1984, p. 541-557.

⁵⁴ We are indebted to Dr. Albert Baltreş and to Dr. Antoneta-Seghedi (Geologic Institute of Romania) for the assistance in microscopic analysis and for the valuable suggestions, as well as to Mrs. Denisa Saru (Faculty of Geology and Geophysics, Bucharest University), for the use of her laboratory facilities.

⁵⁵ Codes from A.von den Driesch, *A guide to the measurement of animal bones from archaeological sites*, Peabody Museum Bull. 1, Harvard University, 1976.

Plate 1. The position of the tell from Bordușani Popină, Ialomița county.

Plate 2. Bordușani Popină. The parting of the investigated surfaces in sectors (st.) and squares.

Plate 5. A. Child grave from dwelling no. 2; B. Hearth from dwelling no. 4

Plate 6. Inventory of dwelling no. 2

Plate 7. Inventory of dwelling no. 2

Plate 8. Inventory of dwelling no. 2

Plate 10. Inventory of dwellings no. 2 (A) and 4 (B).

Plate 11. Inventory of dwelling no. 3.

Plate 12. Inventory of dwelling no. 4

Plate 13. Inventory of dwelling no. 4

Plate 14. Inventory of dwelling no. 4

Plate 16. Inventory of dwelling no. 4

Plate 17. Inventory of dwelling no. 5

Plate 18. Inventory of dwelling no. 5

Plate 20. Inventory of dwellings no. 8 (A) and 9 (B)

Plate 23. Borduşani Popină. S α . 1. Construction units (floors); 2. construction units (walls); 3. hearth; 4. pits and foundation trenches; 5. pits for posts/stakes; 6. destruction units; 7. ash; 8. burrows.

Plate 25. Vessels from the pottery complex no. 1

Plate 26. Vessels from the pottery complex no. 1

Plate 28. Bordsani Popina, Sß. Profiles of potsherds from the pottery complex no. 1.

Plate 29. Profiles of potsherds found in dwelling no. 12.

Plate 30. Bordușani Poptna. Profiles of potsherds found in dwelling no. 16.

Plate 31. Bordușani Popină. Profiles of potsherds found in dwelling no. 19, phase II.

Plate 32. Țorțușari Popină. Profiles of potsherds found in dwelling no. 19, phase III.

1

2

Plate 33. Bordușani Popină. 1 - lid from the pottery complex no. 1: 2 - graphite painted lid.

Plate 34. Borduşani Popină. Gumelniţa potstards.

Plate 35. Bordsuani Popina. 1, 2 awls; 3 chised; 4, 5 handles.

Plate 36. Borduşani Popină. 1, 2, 3 harpoons; 4, 5, 6 varia; 7 awl.

Plate 37. Borduşani Poplnă. 1 varia; 2 compound piece; 3, 6 figurines; 4 dentalium beads; 5 pendant; 7 ceramic figurine.

A

B

Plate 38. Bordușani Popină.

Muzeul National de Istorie

A

B

Plate 39. Bordușani Popină.

A

B

Plate 40. Bordușani Popină.

A

B

Plate 41. Bordușani Popină.

Plate 43. Bordușani Popină. Grave no. XV, S α , sector 8, □ H5.

Plate 44. Bordușani Popină. Grave no. XVI, S α , sector 3, □ G1

Plate 45. Bordușani Popină. Grave no. XVII, S α , sector 8, □ 16, SU 1225.

Fig 1

Fig 2

Fig 3

Fig 4

Fig 6

Fig 5

Fig 7

Fig 8

Fig 9

Plate 46. Bordușani Popină. Anatomical elements and measuring points used to estimate sizes

1. *Silurus glanis* - first pectoral fin spine; 2. *Esox lucius* - dentary; 3. *Stizostedion lucioperca* - maxilla;
- 4, 5. *Cyprinus carpio* - ceratobranchial V; 6. *Cyprinus carpio* - dentary; 7. *Cyprinidae* - ceratobranchial V;
8. *Abramis brama* - occipital; 9. *Rutilus rutilus* - basioccipital.

Plate 1. The position of the tell from Borduşani Popină, Ialomiţa county.

Plate 2. Borduşani Popină. The parting of the investigated surfaces in sectors (st.) and squares.

Plate 3. Borduşani Popină. S α and S β . The dwellings (Loc) of the superior La Tène occupation level.

Plate 4. Borduşani Popină. S α and S β . The dwellings of the inferior La Tène occupation level.

Plate 5. Borduşani Popină A. Child grave from dwelling no. 2; B. Hearth from dwelling no. 4

Plate 6. Borduşani Popină. Inventory of dwelling no. 2

Plate 7. Borduşani Popină. Inventory of dwelling no. 2

Plate 8. Borduşani Popină. Inventory of dwelling no. 2

Plate 9. Borduşani Popină. Inventory of dwelling no. 2.

Plate 10. Borduşani Popină. Inventory of dwellings no. 2 (A) and 4 (B).

Plate 11. Borduşani Popină. Inventory of dwelling no. 3.

Plate 12. Borduşani Popină. Inventory of dwelling no. 4

Plate 13. Borduşani Popină. Inventory of dwelling no. 4

Plate 14. Borduşani Popină. Inventory of dwelling no. 4

Plate 15. Borduşani Popină. Inventory of dwelling no. 4

Plate 16. Borduşani Popină. Inventory of dwelling no. 4

Plate 17. Borduşani Popină. Inventory of dwelling no. 5

Plate 18. Borduşani Popină. Inventory of dwelling no. 5

Plate 19. Borduşani Popină. Inventory of dwellings no. 5 (A) and 8 (B)

Plate 20. Borduşani Popină. Inventory of dwellings no. 8 (A) and 9 (B)

Plate 21. Borduşani Popină. S α main section.

Plate 22. Borduşani Popină. S β East section.

Plate 23. Borduşani Popină. S α .

1. Construction units (floors); 2. construction units (walls); 3. hearth; 4. pits and foundation trenches;

5. pits for posts/stakes; 6. destruction units; 7. ash; 8. burrows.

Plate 24. Borduşani - Popină, 1993. The pottery complex no. 1, S β , sector 37.

- Plate 25. Bordușani Popină. Vessels from the pottery complex no. 1
- Plate 26. Bordușani Popină. Vessels from the pottery complex no. 1
- Plate 27. Bordușani Popină. Profiles of potsherds from the pottery complex no. 1.
- Plate 28. Bordușani Popină, S β. Profiles of potsherds from the pottery complex no. 1.
- Plate 29. Bordușani Popină. Profiles of potsherds found in dwelling no. 12.
- Plate 30. Bordușani Popină. Profiles of potsherds found in dwelling no. 16.
- Plate 31. Bordușani Popină. Profiles of potsherds found in dwelling no. 19, phase II.
- Plate 32. Bordușani Popină. Profiles of potsherds found in dwelling no. 19, phase III.
- Plate 33. Bordușani Popină. 1 - lid from the pottery complex no. 1; 2 - graphite painted lid.
- Plate 34. Bordușani Popină. Gumelnița potstards.
- Plate 35. Bordușani Popină. 1, 2 awls; 3 chised; 4, 5 handles.
- Plate 36. Bordușani Popină. 1, 2, 3 harpoons; 4, 5, 6 varia; 7 awl.
- Plate 37. Bordușani Popină. 1 varia; 2 compound piece; 3, 6 figurines; 4 dentalium beads; 5 pendant; 7 ceramic figurine.
- Plate 38. A. Bordușani Popină 1994, L19, SU 1258; N||, x10.
1. Constructed floor made of raw sediment.
 2. Vegetal mat.
- B. Bordușani Popină 1994, L19, SU 1315 - 1318; N||, x10.
1. Constructed floor made of a carefully prepared mixture with straw binder.
 2. Occupational unit containing fine and rare anthropogenic components.
 3. Fitting out plastering made of raw sediment.
- Plate 39. A. Bordușani Popină 1994, complex 69 (C69), SU 1428; N||, x10.
1. Wall plastering made of a carefully prepared mixture with straw binder.
 2. Interior plastering of the wall, made of a carefully prepared mixture with chaff binder.
- B. Bordușani Popină 1994, SU 1335 - 1338; N||, x10.
1. Constructed floor made of a carefully prepared mixture with fine straw binder.

2. Fitting out plastering made of a carefully prepared mixture with chaff binder.

3. Constructed floor made of raw sediment.

Plate 40. A. Bordușani Popină 1993, Section 1, SU 83; N||, x10.

1. Constructed floor made of a carefully prepared mixture with fine straw binder.

2. Fine occupational unit of ochre accumulated *in situ*.

3. Fitting out plastering made of a carefully prepared mixture with fine straw binder.

B. Bordușani Popină 1994, L19, SU 1318; N||, x10.

Fine occupational unit containing fine anthropogenic components: charcoal (1) and fish bones (2).

Plate 41. A. Bordușani Popină 1994, grave M XIV; N||, x10.

1. Plastering made of raw sediment.

2. Vegetal mat.

B. Bordușani Popină 1994, grave M XIV; N||, x80.

1. Decayed vegetal fragments in the vegetal mat unit.

2. Humic material accumulated *in situ*.

Plate 42. Bordușani Popină. Grave no. XIV, S α sector 8, □I6

Plate 43. Bordușani Popină. Grave no. XV, S α , sector 8, □H5.

Plate 44. Bordușani Popină. Grave no. XVI, S α , sector 3, □G1

Plate 45. Bordușani Popină. Grave no. XVII, S α , sector 8, □I6, SU 1225.

Plate 46. Bordușani Popină. Anatomical elements and measuring points used to estimate sizes. 1. *Silurus glanis* - first pectoral fin spine; 2. *Esox lucius* - dentary; 3. *Stizostedion lucioperca* - maxilla; 4, 5. *Cyprinus carpio* - ceratobranchial V; 6. *Cyprinus carpio* - dentary; 7. *Cyprinidae* - ceratobranchial V; 8. *Abramis brama* - occipital; 9. *Rutilus rutilus* - basioccipital.