Importance of palaeopollinic and histologic researches at Măgura Fetelor settlement of Vădastra

(Study on Middle Neolithic Climate and Vegetation in Lower Danube Plain)

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RÉSUMÉ: Lors de la reprise, en 1946, des fouilles archéologiques de *Măgura Fetelor* à *Vădastra,* l'un des problèmes qui se posaient était celui du climat et de la végétation au temps de la formation des couches de civilisation. En plus des observations enregistrées au cours des fouilles, des investigations de laboratoire ont été effectuées régulièrement: analyses granulométriques, calcimétriques, détermination des limites de plasticité de l'argile à differents horizons; analyses palaleopolliniques, investigations histologiques et déterminations sur les charbons de bois. On a également étudié les gastéropodes et les os d'animaux - particulièrement ceux des bovins en relation avec la traction animale et l'agriculture néolithique. Les conclusions des sciences auxiliaires concordent avec les dates archéologiques.

Un climat à végétation de steppe et de sylvosteppe avait dominé au temps où se déposait le loess de la couche paléolithique (Aurignacien moyen-prolongé). Un climat à végétation similaire a existé aussi au temps de la formation de la couche intermédiaire, des périodes plus sèches et froides alternant avec d'autres plus humides et légèrement plus chaudes. Le climat qui a dominé lors de la formation des couches du Néolithique moyen, Vădastra I et Vădastra II (V[e] millénaire av. J.-C.), était un climat à végétation de sylvosteppe, avec une humidité plus grande dans la couche Vădastra II où, par suite des conditions bio-climatiques favorables, le site atteint son apogée. Ensuite, dans le Néolithique tardif, à l'époque où se déposait le loess de la couche Sălcuţa, le climat, devenu plus sec, est caractérisé par une végétation de steppe.

Les recherches multidisciplinaires effectuées sur le climat et la végétation du temps où se formaient les couches de civilisation du site de Măgura Fetelor et *Dealul Cişmelei* ont fourni aussi des contributions importantes pour les stations contemporaines du Bas-Danube.

The settlement on *Măgura Fetelor* (Maiden's Hillock) at *Vădastra* we are dealing with is placed in the south-eastern plain of Oltenia, on a fragment of medium-size terrace of the Danube, called by the natives *Dealul Cişmelei* (Drinking Fountain Hill). Dealul Cişmelei is on the right side of Obîrşia Valley, some 60-64 m above the Danube meadow level and 80-84 m above the sea level [1].

The archaeological excavations Cesar Bolliac performed at Vădastra on 'Cetate' hillock between 1871-1874 were one of the first neolithical diggings in this country [2]. In spite of the modest means and that time's escavation methods, Bolliac dealt among other things also with vegetation [3]. The excavations performed on both hillocks after more than half-a-century, in 1926 [4] and 1934 [5], paid no heed to cli-

[1] CORNELIUS N. MATEESCO: *Contribution à l'étude des fossés néolithiques du Bas-Danube: le fossé de la station de Vădastra, Actes de VII[e] Congrès International des Sciences Préhistoriques et Protohistoriques, Prague 21-27 août 1966,* Prague, 1970, 1, p. 453 and fig. 1, 2.

[2] CORNELIU N. MATEESCU: *Centenarul săpăturilor arheologice de la Vădastra,* 'Studii şi Cercetări de Istorie veche', 22, 1971, 4, p. 643; ID.: *Cesar Bolliac (1813-1881),* 'Drobeta', 1876, p. 214.

[3] CESAR BOLLIAC: *Ceramica preistorică a Daciei. Vodastra,* 'Trompetta Carpatilor', XIV, 1876, 1255, p. I.

[4] VASILE CHRISTESCU: *Les stations préhistoriques de Vădastra,* 'Dacia. Recherches et découvertes archéologiques en Roumanie', III-IV, 1927-1932, pp. 167-225.

[5] D. BERCIU: *O colecţie de antichităţi din Judeţul Romanaţi* —Gh. Georgescu-Corabia—, 'Buletinul Comisiunii Monumentelor Istorice', XXVII, 1934, 80, pp. 74-80.

mate and vegetation, the same as all the similar excavations performed in the Lower Danube plain.

In 1946, the excavations on Măgura Fetelor were started anew; but this time one of the aims was, from the very beginning, establishment of the climate conditions and vegetation that were propitious for the development of life ever since the birth of the settlement. That is why, apart from the observations carefully registered during the excavations, laboratory investigations, due Em. Protopopescu-Pake, were performed each and every year. Soil samples taken from different civilization layers, from pits and from virgin soil were submitted to various analyses: granulometry, calcimetry, clay plasticity limit[6]; besides, gasteropoda shells[7] were determined, due to Professor Al. V. Grossu, and fragments of charcoal and cereal remainders from unearthed area began to be studied. Thus, modern techniques used by other sciences helped verifying and gradually completing the deductions and conclusions derived by classical archaeological methods.

The excavations started in 1946 continued with short interruptions until 1975 only on Măgura Fetelor and Dealul Cişmelei, being directed from the hillock's centre to the periphery, that is east-, west-, north- and southward. Although small surfaces were dug, the archaeological material unearthed was quite sufficient to provide knowledge about the climate and vegetation during the formation of the different civilization layers. They are included in the loess covering Măgura Fetelor and Dealul Cişmelei; today, their thickness is well-nigh 3 m, becoming thinner from the hillock's centre toward the periphery of the settlement until they gradually disappear. At the bottom, there is the *palaeolithic layer* (prolonged middle aurignacian), above it an *intermediate layer* without archaeological remainders (except those which penetrated through galleries of earth-rodents). Follows *Vădastra I and Vădastra II neolithic layers* (middle neolithic), *Sălcuţa* (late neolithic). In Sălcuţa layer there are also infiltrations from later layers (*Coţofeni* —transition from neolithic to bronze—, the *layer with remainders from the 14th, 17th and 18th centuries),* which in the course of time were ruined by rainfalls and man on Măgura Fetelor. It is the lower part of this layer[8] that was preserved on Dealul Cişmelei.

Archaeological work cannot leave aside soil and subsoil, climate, vegetation and fauna. In the course of time, changes in climate and vegetation[9] and, to a lesser extent, man's action, determined alterations in the soil —slightly levigated chernozem— of Vădastra settlement. The slightly levigated chernozem was formed in a climate with moderate humidity (450-500 mm annual rainfalls) and an annual average temperature of + 10-11°C[10]. In addition, the Vădastra settlement, the same as all the settlements of Vădastra civilization, was determined also by the presence of the swamp and of Obîrşia brook, especially of the drinking water springs. In the plain, the fertile soil and the moderate climate led the neolithic communities to an ever larger cereal plant cultivation and, at the same time, to develop animal breeding and selection, especially horned cattle used for traction, particularly in land tilling[11].

Not so long ago, the idea prevailed that both the soil and the loess deposits did not provide propitious conditions for the preservation of pollen so that it should be determined and studied. However, quite the opposite was proved by the palaeopollinic analyses of soil samples of Vădastra settlement started by Mrs. Arlette Leroi-Gourhan of the Prehistoric Research Centre, 'Musée de l'Homme', of Paris, and by Mrs. Krystyna Wasylikowa of the Botanical Institute of Kraków thanks to the Director of the Institute, Mr. A. Środoń. Based on these analyses[12] and on the palaeopollinic and histologic

[6] Em. Protopopesco-Pake, Cornélius N. Mateesco et Al., V. Grossu: *Formation des couches de civilisation de la station de Vădastra en rapport avec le sol, la faune malacologique et le climat,* 'Quartär', 20, 1969, pp. 135, 138, 150-156.

[7] *Ibidem,* pp. 156-159.

[8] Corneliu N. Mateescu: *Săpături arheologice la Vădastra (1960-1966),* Materiale şi Cercetări arheologice, IX, 1971, pp. 68-73 and pl. I-III.

[9] Em. Protopopesco-Pake, Cornélius N. Mateesco et Al., V. Grossu: *op. cit.,* pp. 149-150.

[10] *Ibidem,* p. 158.

[11] Basile Gheţie - Cornélius N. Mateesco: *Utilisation des bovins à la traction dans la phase plus récente de la civilisation Vădastra, Actes du VII^e Congrès International des Sciences Préhistoriques et Protohistoriques...,* Prague, 1971, 2, p. 1313.

[12] Arlette Leroi-Gourhan, Cornélius N. Mateesco, Em. Protopopesco-Pake: *Contribution à l'étude du climat de la station de Vădastra du Paléolithique supérieur à la fin du Néolithique,* 'Bulletin de l'Association française pour l'étude du Quaternaire', 1967, 4, pp. 274-277. For the pollinic analyses, the samples were treated with HCl, KOH, HF and acetolysis.

ones performed by Professor Ion T. Tarnavschi [13], we present a new contribution to the knowledge of the climate and vegetation of the middle neolithic at Vădastra. The conclusions reached were confirmed by those drawn from a study on the malacologic fauna of the different civilization and virgin soil layers, by the results of the analysis of the soils formed also of loess deposits belonging to different civilization layers [14], as well as by the conclusions drawn from charcoal determination and examination. Since the climatic conditions and the vegetation in the middle neolithic were similar in the area of Danube terraces, our presentation refers also to other settlements of the Lower Danube plain in the respective period.

After withdrawal of the Danube to the south, dunes covered by loess were formed at Vădastra; one of these dunes was on the very place of Măgura Fetelor. The loess, from post-würmian to the present, is today some 3.50 m thick to the centre of the hillock and includes also different civilization layers. Loess depositing began in a droughty climate (as shown by gasteropoda shells) which gradually turned more humid. In the virgin soil sample, immediately under the paleolithic layer, Mrs. Wasylikowa detected only herbaceous pollen, mentioned in the order of frequency: *Compositae Tub., Artemisia, Compositae Lig., Chenopodiaceae, Gramineae, Umbelliferae, Filipendula* (?). The gasteropoda *Cepaea Vindobonensis* Pfeiff. (met in groves and forests), *Caracolina corcyrensis* Nass. and *Oxychilus inopinatus* Ulicný (especially under dead leaves) point also to a more humid climate propitious to the development of life [15].

In two paleolithic layer samples, Mrs. Leroi-Gourhan found polen of arborescent and herbaceous vegetation [16]. As a main tree is quoted the pine (*Pinus Silvestris*); leafy trees, with the same spreading curve (slightly above 1 % of the total amount of pollen grains) are represented by *Betula* and *Corylus,* then *Alnus* (rarely, in general) and the southern species: *Quercus, Tilia, Ulmus* and, never-failing, *Hedera.* In the sample analysed by Mrs. Wasylikowa, the arborescent vegetation is limited to *Pinus* and *Salix.*

From among the herbaceous plants, Mrs. Leroi-Gourhan detected *Anthemideae* (a large amount, over 25 %), *Cichorieae, Carduaceae (Compositae Tub.), Chenopodiaceae, Artemisia, Filicales.* The latter, appearing after the withdrawal of forests, prove the change that occurred in the climate. Finally, plants belonging to other families were found in much more reduced proportions (below 2.5 %). Generally, Mrs. Wasylikowa found pollen of the same plant genus and families among which *Compositae Tub.* prevailed.

The gasteropoda (*Helicopsis striata* Müll., *Cepaea, Oxychilus)* point to a climate with steppe and sylvosteppe vegetation, with droughty periods alternating with more humid ones.

An almost similar regimen but slightly drier and colder continued also during the formation of the intermediate layer. The pollen of two samples examined by Mrs. Leroi-Gourhan showed that there were less trees, especially leafy ones, but more herbaceous plants. In the upper part of the layer, the *Cichorieae* are predominant, the same as in the neolithic layers. The shells of *Cepaea, Oxychilus, Pomatias elegans* Müll. are indicative of more humid periods.

In step with the development of the climatic Optimum in the Lower Danube area, the communities grew in number and began to move away. In middle neolithic, toward late 6th millenium and early 5th millenium, a population engaged in cattle breeding and land tilling (also in silex, stone and bone processing and in clay modelling) settled on Măgura Fetelor and Dealul Cişmelei. To protect their possessions, they dug around the settlement a wide and deep ditch whose northern part was brought open by the excavations of 1960 (fig. 1) and the eastern one by those of 1964. All the findings (pits, archaeological material) show that the ditch was used until Vădastra II phase when, after

[13] The preparations were performed at the Institute of the Ministry of Mines, Oil and Geology. We are grateful to Mrs. Ştefana Roman for her kindness. The pollinic analyses were performed according to G. Erdtmanś method of acetolysis.

[14] Earlier analyses were completed in recent years by Engineer Gh. Gâţă with infrared and atomic absorption analyses (the first of their kind for the archaelogy of Dacia and South-East Europe), and confirmed the results obtaines the former.

[15] ARLETTE LEROI-GOURHAN, CORNĒLIUS N. MATEESCO, EM. PROTOPOPESCO-PAKE: *op. cit.*, pp. 274-275.

[16] *Ibidem,* p. 275 and pl. III.

FIG. 1. Vădastra. *The northern slope of* Dealul Cişmelei *with the excavation performed in 1960. In the background, the fitch of the neolithic settlement (F); 80 m to the South, Măgura Fetelor (*apud *Cornélius N. Mateesco,* in Actes du VII[e] Congrès International des Sciences Préhistoriques et Protohistoriques..., *Prague, 1970, 1, pl. XVII/1).*

the development of the settlement and the removal of dangers (especially beasts), it was covered [17].

The lower part of Vădastra I layer is more compact, and slightly rust coloured, while the upper part is more spongy due, perhaps, to climate difference. The gasteropoda shells of this layer (*Caracolina corcyrensis, Oxychilus inopinatus, Cepaea Vindobonensis, Pomatias elegans)* are indicative of a climate with sylvosteppe vegetation, with more humidity during the formation of the more compact part, as shown also by the larger size of *Euomphalia strigella* Drap. [18].

The pollen of a sample examined by Mrs. Leroi-Gourhan showed an increase in arborescent vegetation - both pine and the already known leafy trees. Mrs. Wasylikowa mentions also *Fraxinus* pollen. A high percent (some 30 %) of *Cichorieae (Comp. Lig.* and *Tub.)* and *Gramineae.* The specimen analysed by Mrs. Wasylikowa included also seeds of *Amaranthus* sp., *Chenopodium* sp., *Portulaca oleraceea* [19].

In two samples analysed recently, Professor Tarnavschi detected a large amount of *Compositae* pollen; in one of these samples, alongside the abun-

[17] CORNÉLIUS N. MATEESCO: *Contribution à l'étude des fossés néolithiques du Bas-Danube: le fossé de la station de Vădastra, Actes de VII[e] Congrès International des Sciences Préhistoriques et Protohistoriques...,* Prague, 1970, 1, p. 456.

[18] C. N. MATEESCOU: *La plus ancienne phase de la civilisation de Vădastra, Vădastra I, à la lumière des nouvelles fouilles de Vădastra, Bericht über den V. Internationalen Kongress für Vor- und Frühgeschichte, Hamburg 1958,* Berlin, 1961, p. 530.

[19] ARLETTE LEROI-GOURHAN, CORNÉLIUS N. MATEESCO, EM. PROTOPOPESCO-PAKE: *op. cit.,* pp. 275-276 and pl. III.

dant amount of *Chenopodiaceae* pollen, he found also Bryophyta spores (*Hepaticae*).

Vădastra I layer contained also pollen of *Plantago lanceolata* and *Cerealia* (7 %), that is indicative of man's action. Moreover, the remainders of cereal plants, the grinders and bones of animals that were used for traction, stand as the most convincing proofs for the practicing of agriculture[20].

During the formation of Vădastra II layer —much thicker than Vădastra I— the bio-climatic conditions (revealed also by the gasteropoda association, grove or forest species) were propitious to the development of a less precarious life. This was reflected also by the inhabitants' main occupations: selective animal breeding, extensive agriculture (bumper crops) as well as by the large number and variety of household implements and by the way they built spacious and hygienic dwellings[21]. Clay modelling and ceramics ornamentation were matchless throughout the neolithic in the Lower Danube area. The ceramics of Vădastra and, generally, of all the settlements of this civilization, have an entirely particular ornamental effect due to the limy-white and red colours, as well as to the polishing of portions that are not part of the decoration proper[22] (fig. 2). Such a prosperous life required the establishment and maintenance of relations of exchanges even with distant populations. From the south Danube regions and from the Banat mountains, the inhabitants of Vădastra brought silex and various hard rocks to produce implements; from upstream the Danube they got copper, turtles (*Testudo Hermanni* Cimel) for the preparation of remedies, good quality obsidian for medical tools, etc.[23].

In the Vădastra II layer there was a large number of pollen grains whose determination was easier also because they were better preserved than in the earlier layers. Unlike in the Vădastra I layer, leafy trees were more numerous than pine trees, the latter being represented by *Pinus* pollen. According to Mrs. Leroi-Gourhan there were more important increases in the number of such trees as *Betula, Tilia, Corylus, Ulmus.* There were smaller percentages (below 1 %) of *Alnus, Quercus,* and *Buxus.* Mrs. Wasylikowa mentions only the species of the *Corylus, Alnus* and *Tilia* genus.

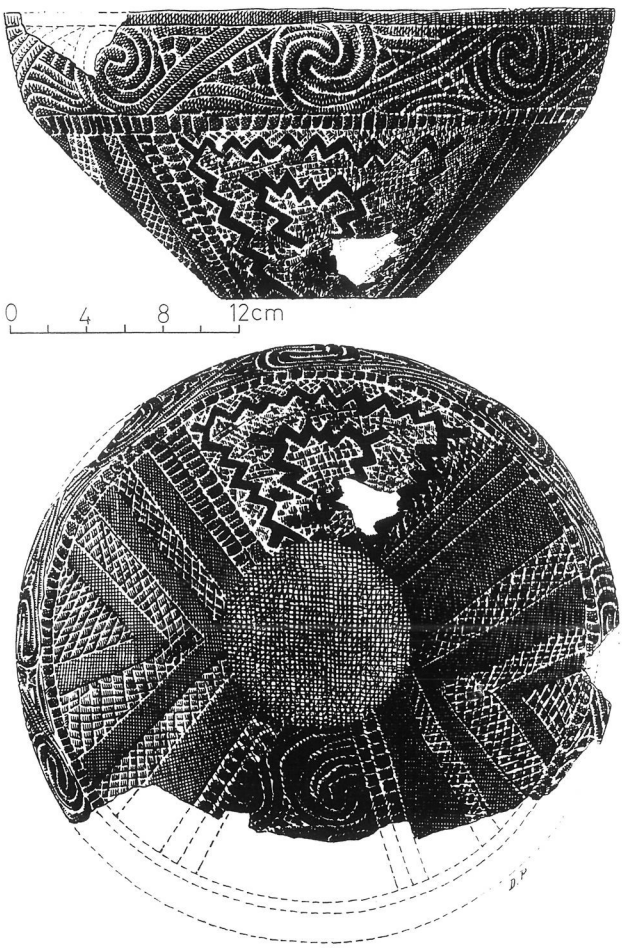

FIG. 2. Vădastra. *Clay jar with ornamental motifs made by notch and inlay with white* (apud *Corneliu N. Mateescu*, in Atti del VI Congresso Internazionale delle Scienze Preistoriche e Protostoriche..., *Roma, 1965, II, pl. XLIII/2).*

[20] B. GHEŢIE - C. N. MATEESCO: *L'Utilisation des bovins à la traction dans le Néolithique moyen (d'après les nouvelles observations ostéologiques faites dans les sites de Vădastra et de Cruşovu, Roumanie), Actes du VIII^e Congrès International des Sciences Préhistoriques et Protohistoriques, Beograd 9-15 Septembre 1971,* Beograd, 1973, II, p. 460.

[21] CORNELIU N. MATEESCU: *Contribution to the Study of neolithic Dwellings in Romania: a Dwellings of the second Phase of the Vădastra Culture (Middle Neolithic),* 'Dacia. Revue d'Archéologie et d'Histoire ancienne', N. S., XXII, 1978, pp. 65-71.

[22] CORNELIU N. MATEESCU: *Contribution à l'étude de la civilisation de Vădastra: Phase Vădastra II (d'après les nouvelles fouilles de Vădastra), Atti del VI Congresso Internazionale delle Scienze Preistoriche e Protostoriche Roma 1962,* Roma, 1965, II, p. 261 and pl. XLIII/2, CXIX.

[23] *Ibidem,* p. 263.

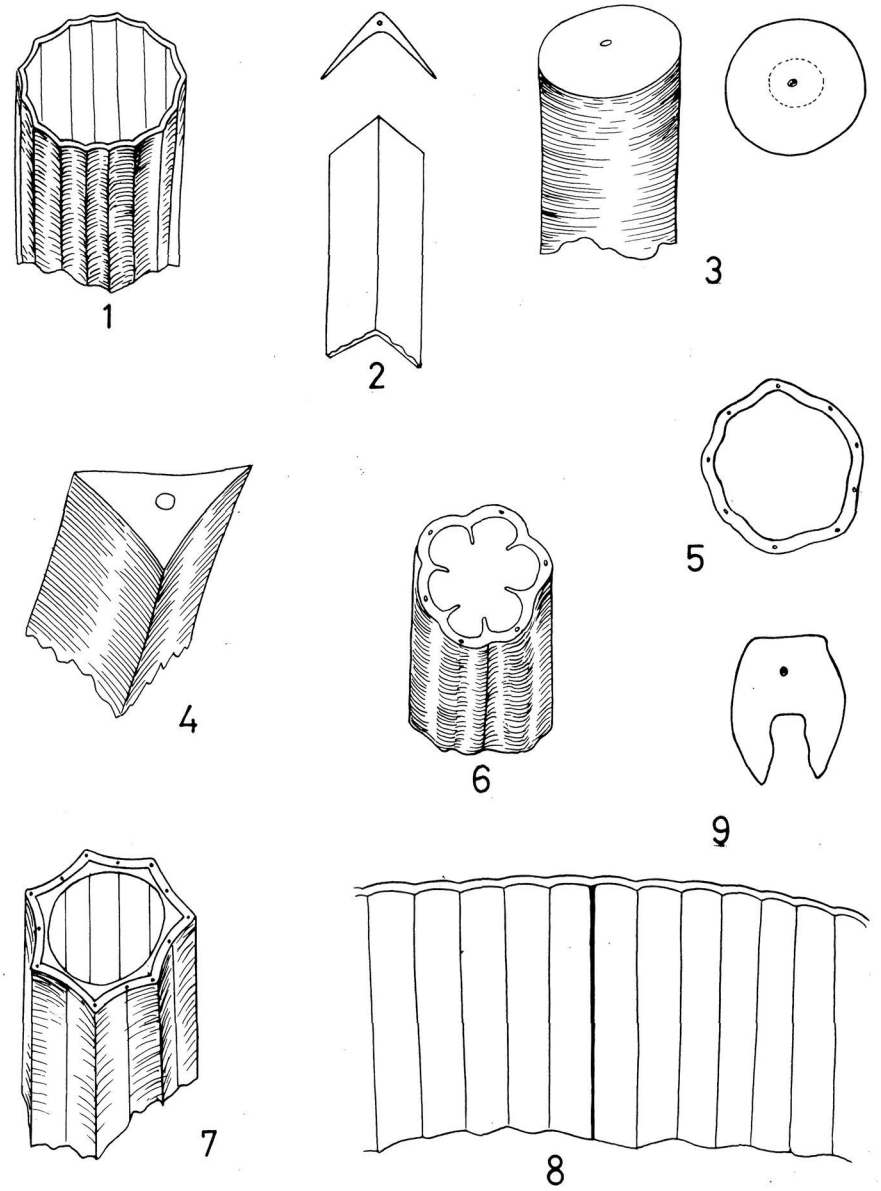

FIG. 3. Vădastra. *Fragments of stems and leaves: 1 stem of* Carex *sp.* (Cyperaceae), *seen in section and entirely; 2 leaf of* Carex *sp. (or another* Cyperaceae*) seen in cross section; 3 stem of* Scirpus *sp. (cf.* lacustris) front and sectional view; 4 le af of Scirpus *sp.* (Cyperaceae) *clearly triangular; 5-6 stem of* Triticum *sp. (or* Hordeum *sp., or* Festuca *sp.)* (Gramineae) *seen in cross section and entirely; 7 central part of a stem of* Equisetum *cf.* hiemale *or* palustre (Equisetaceae), *triangular section and front view; 8 leaf of* Monocotyledoneae, *probably* Triticum *sp.; 9 cross section view of a leaf of* Festuca *sp.*, pseudovina *group* (Gramineae) *(about 6 x).*

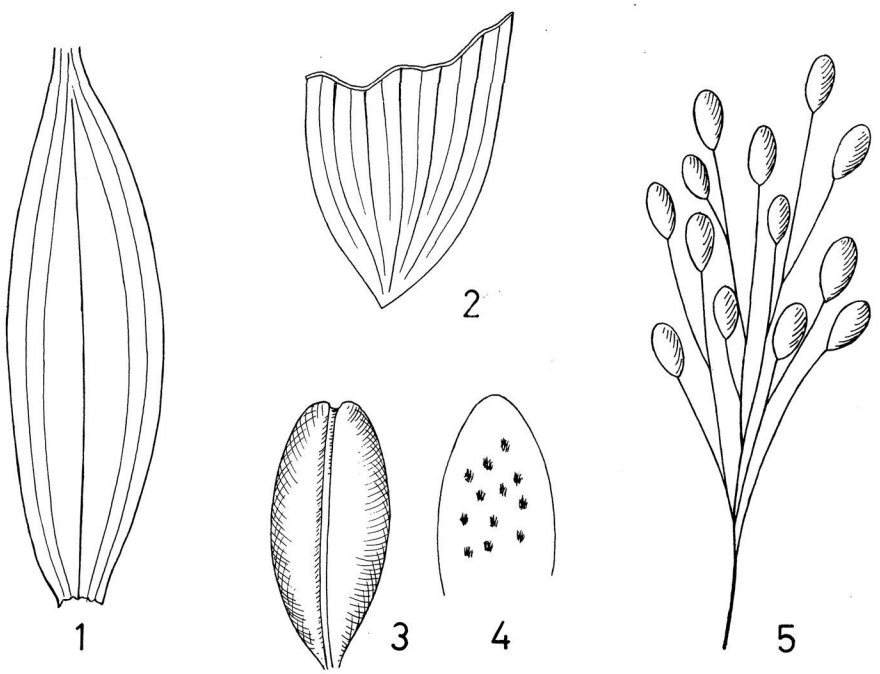

FIG. 4. Vădastra. *Cereals cultivated in Vădastra II phase: 1-2* Hordeum *sp.; 3-4* Triticum *sp. (probably* monococum*); 5* Panicum *sp. (about 6 x).*

Many charcoal fragments were found in the layer, in pits and in dwellings. The morphologic elements can be very crearly seen in the well-preserved samples. From among the hard wood trees, engineer Vladimir Platon determined *Quercus, Ulmus, Fraxinus, Carpinus betulus, Acer Pseudo-platanus* or *Acer campestris L., Cerasus,* and from soft wood trees: *Salix, Tilia, Populus*[24]. The same as the pollen, the charcoals confirm the existence of mixed forests in the middle neolithic in the Lower Danube area.

The herbaceous plants are numerous and, generally, those found in the earlier layer; particularly developed were *Cichorieae* and, according to Mrs. Wasylikowa, also *Artemisia,* Mrs. Wasylikowa identified also seeds of *Amaranthus* sp., *Chenopodium album, Rubus* sp., etc. In addition, based on an analysed sample, Professor Tarnavschi mentions pollen of *Hepaticae* and *Pteridium,* while in several samples taken from the wall cob of a dwelling of late Vădastra II stage[25], pollen of *Juglans* sp. (namely, *Hepatica* sp. *transsilvanica*) and *Curcubita* (namely, *Malva*). In these samples, fragments of stems and leaves of *Carex* and *Scirpus* sp. (cf. *lacustris*), *Equisetum* (cf. *Palustris*), *Juglans* sp. were also found together with roots, stems and leaves of Monocotyledoneae and Dicotyledoneae (fig. 3/1-9), grains of *Hordeum* sp., *Triticum* (probably *Monococum*) and *Panicum* sp. (fig. 4/1-5), as well as chaff fragments (fig. 3/1-7).

As results from the large amount of cereal ash found in the layer and in pits, and from the big number of bones of bovines that were used for traction, at Vădastra (the same as in other settlements in the Lower Danube region at that time[26]) cereals

[24] Thanks to Engineer N. Ghelmeziu of the Research and Design Institute for Timber Industry - Bucharest, these determinations were performed by Engineer Vladimir Platon.

[25] The last centuries of the 5th millenium - according to the charcoals C-14 analysis performed at the NIAS Institute of the Netherlands, thanks to Professor Marijy Gimbutas.

[26] CORNELIU N. MATEESCU: *Remarks on cattle Breeding and Agriculture in the middle and late Neolithic on the Lower Danube,* 'Dacia...', N. S., XIX, 1975, pp. 17-18 and pl. 4-5.

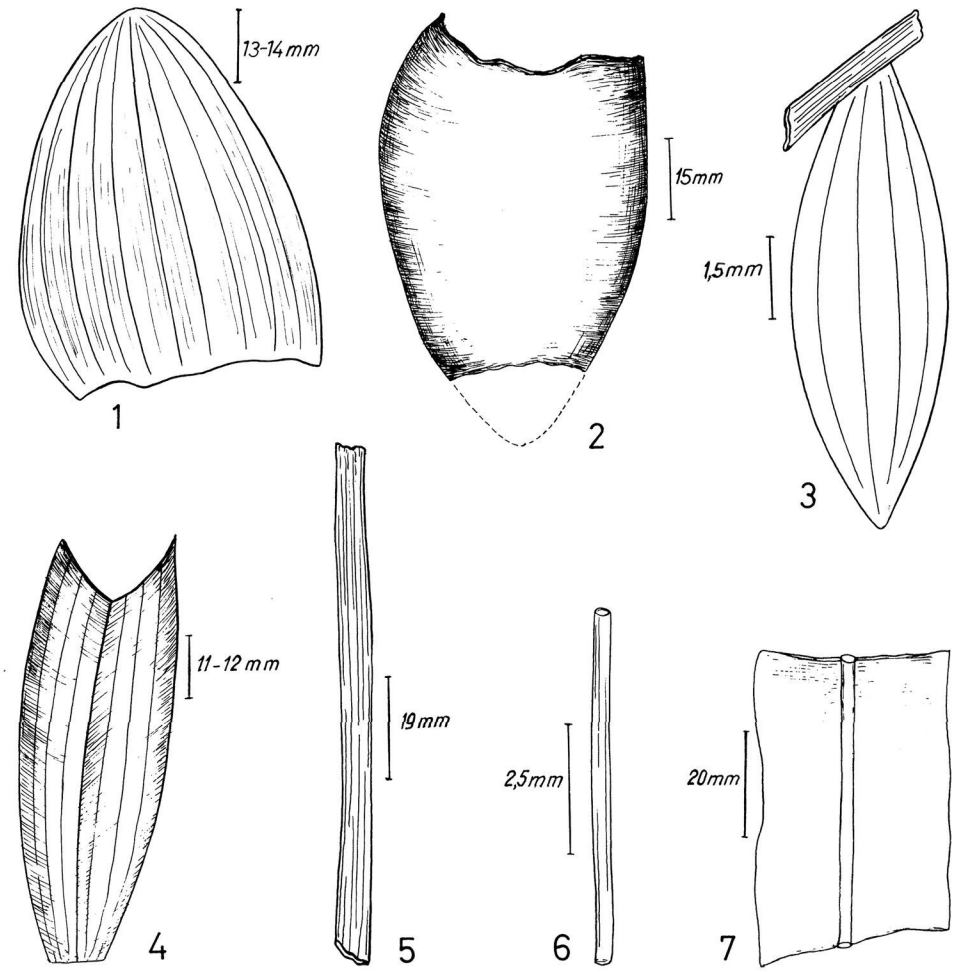

FIG. 5. Vădastra. *Remainders of plants: 1-2 chaff fragments; 3 fragment of inflorescence leaf of* Triticum *sp.; 4 folded chaff remainder (moulding); 5-6 inflorescence stems of* Panicum miliaceum; *7 inflorescence leaf fragment of* Triticum *sp.*

were largely cultivated and preserved in grain pits (genuine underground barns)[27] (fig. 6); the slightly levigated chernozem has always been an excellent soil for agriculture.

By the end of middle neolithic, the settlement of Măgura Fetelor and Dealul Cişmelei was abandoned; in late neolithic, the sttlement was inhabited by people of Sălcuţa civilization who lived also on the 'Cetate' hillock. During the formation of Sălcuţa layer, a slight modification in the climate and vegetation occurred, that is the climate became drier and colder.

In Sălcuţa layer, ligneous vegetation is represented, according to Mrs. Wasylikowa, by few pollen grains of *Pinus, Corylus* and by a still lower percentage of *Picea vel Abies, Hippophaë, Quercus, Fraxinus* (1.2 %). Comparatively, the herbaceous pollen was found in larger quantities; *Compositae Lig., Chenopodiaceae* and *Compositae Tub.* represent one of the highest percentages. Mentioned in a de-

[27] SYLVIU COMĂNESCU and CORNELIU N. MATEESCU: *Measurement and presentation of archaeological features excavated below ground: principles and practice, Mathematics in the Archaeological and Historical Sciences, Proceedings of the Anglo-Romanian Conference Mamaia 1970,* Edinburgh, 1971, p. 419, fig. 3.

creased frequency order are *Gramineae, Cerealia, Plantago lanceolata,* etc. It was now that rye *(Secale)* (1.2 %) appeared. Apart from seeds of *Gramineae,* Mrs. Wasylikowa detected also seeds of *Amaranthus* sp., *Chenopodium album, Chenopodium* sp., *Papaver* sp., *Portulacaceae, Polygonum convolvulus*[28].

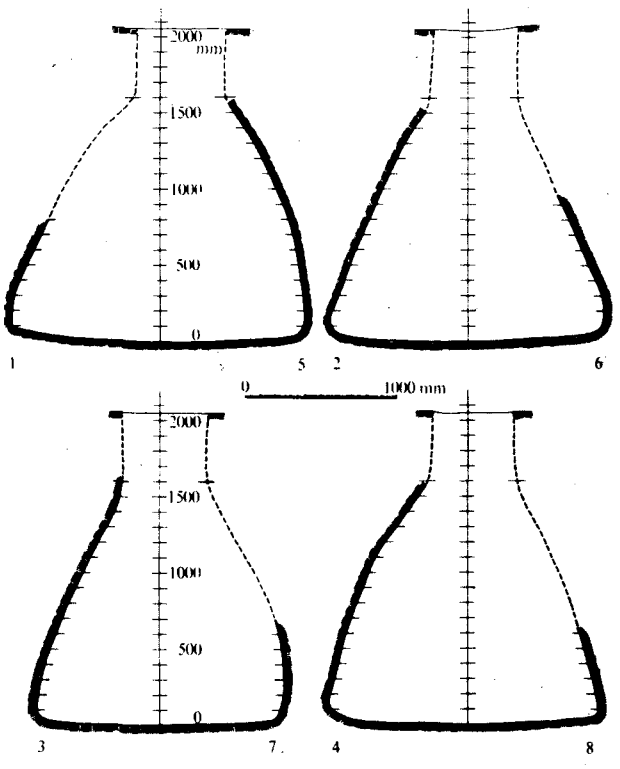

FIG. 6. Vădastra. *Grain pit (Vădastra II phase) in which some 1,600 kg wheat could be stored* (apud *Sylviu Comănescu and Corneliu N. Mateescu, in* Mathematics in the Archaeological and Historical Sciences..., *Edinburgh, 1971, p. 419-420 and. fig. 3).*

From a recently analysed sample, Professor Tarnavschi added also pollen of *Polipodiaceae, Dipsacaceae, Rubiaceae.*

All throughout the layer, steppe gasteropoda shells (especially *Helicopsis striata*) were prevailing; appearing now was also *Pupa muscorum* L., typical for steppe, which was never found on Dealul Cişmelei, either before or afterwards.

CONCLUSIONS

For all the doubt or reserve it may arouse, the use of palaeopollinic and especially of morphopollinic analyses is fully justified here.

The concordance between the conclusions deriving from the palynologic investigation and those from the study of gasteropoda both supported by soil determinations and compared with the conclusions reached by histologic investigation of vegetation remainders give a quite clear-cut image of the climate and vegetation in middle neolithic at Vădastra and, generally, in the Lower Danube plain.

The palaeopollinic analysis of the soil samples and the study of the vegetation remainders point to the following conclusions:

— during the formation of the paleolithic layer (prolonged middle aurignacian) a climate with steppe and sylvosteppe vegetation prevailed;

— during the depositing of the loess of the intermediate layer a drier and colder climate prevailed; drier and colder periods alternated with more humid and warmer ones;

— the loess of Vădastra I and Vădastra II layers (middle neolithic) was deposited in a climate with sylvosteppe vegetation; the climate was more humid during the formation of Vădastra II layer when, owing to the favourable bio-geographical conditions, the settlement reached its highest development and flourishing;

— afterwards, as an effect of a slight change in the climate, the Sălcuţa layer (late neolithic) was formed in a drier and colder climate, with steppe vegetation.

[28] ARLETTE LEROI-GOURHAN, CORNELIUS N. MATEESCO, EM. PROTOPOPESCO-PAKE: *op. cit.*, p. 276.