ASPECTS OF DACIAN ECONOMY AND HIGHLAND ZONE EXPLOITATION*

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INTRODUCTION AND ACKNOWLEDGEMENTS

This paper presents new palaeoethnobotanical data derived from the first use of a Flotation Machine in Romania, to recover carbonised plant remains from Dacian Iron Age contexts. It results from collaboration in 1973 and 1974 between the Institute of Archaeology of London University and the corresponding organisations in Romania, and facilitated by the Cultural Exchange Agreement between Britain and Romania. The fieldwork covered a wide range of other activities, and I recognise gratefully the efforts of many archaeologists of the Institute of Archaeology in Bucharest, and especially of its Director Professor D.M. Pippidi, to promote them. I am most particularly indebted to Hadrian Daicoviciu, Director of Muzeul de Istorie al Transilvaniei in Cluj-Napoca for the opportunity to take part in his excavations at Terasa cu Grîu and for all his help towards achieving the results. The fieldwork was supported by the British Academy, by the Institute of Archaeology through the Gordon Childe Fund and the provision of facilities and transport, and by the Central Research Fund of London University which made provision for Flotation and boring equipment. Grateful acknowledgement is made to all these bodies. The generosity of the British Council must also be recognised here in giving a clear early indication that they would make funds available for the exchange visits of Romanian scholars to this country, which duly took place on a basis of reciprocity with the Consiliul Culturii şi Educaţiei Socialiste in Bucharest.

THE FLOTATION SAMPLES

THE EXCAVATION OF TERASA CU GRÎU ("THE TERRACE WITH WHEAT") AT GRĂDIŞTEA MUNCELULUI

The following account of the excavation of one of the terraces to the west of the sanctuaries at Dealul Grădiştei during July 1974 is intended to make clear the context of the flotation samples. The excavation was directed by Prof. Hadrian Daicoviciu, and the site supervisor was Eugen Iaroslavschi. I am indebted to them for the opportunity to describe the circumstances in which the samples were found, since without this contextual information analyses of plant remains lose much of their value. The full identification of all samples is AR 8366/followed by the sample number referred to here: e.g. AR 8366/26 is referred to simply as sample 26.

The site lies on one of the numerous small platforms levelled into the south-facing upper slope of a steep ridge to the west and south of the sanctuaries and hill fort on Dealul Grădiştei, a quarter of an hour's walk away. In the highly dissected areas of Dacian upland settlement it is typical to find sites on hill tops, since the sun lights these far longer than it does the narrow valley floors. The ridge falls steeply on either side, to the stream of Valea Albă on the north, and the main valley of Valea Godeanului to the south. It is formed of micaceous schists, which provide some of the foundation blocks found during the excavation, but which also make for difficult climbing on the steep paths, especially in wet or icy weather. For this reason it has been proposed elsewhere (Nandris 1976; 734) that the iron crampons found in Dacian contexts

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may have been used in such circumstances, and there are ethnographic parallels from Romania for this. The terraces are partly artificial, and are scattered in a dense but dispersed pattern of settlement throughout the region. Across the Valea Albă there are important excavated examples at Fețele Albe, elaborated with stone revetments. The whole ridge between the two valleys may be referred to as Dealul Grădiștei, and the terraces on it are the sites of individual Dacian domestic houses and outbuildings. Their destruction can be dated to the Roman suppression of the region during the campaigns of 101—102 A.D. and 105—106 A.D. Building did go on between these dates. At Fețele Albe for example a round house can be dated to between 102 and 106 A.D. (Daicoviciu, H., Glodariu, I. and Piso, I., 1973). Abundant archaeological remains are found in the destroyed houses, which have yielded important data on the Dacian period.

THE EXCAVATION AND FLOTATION SAMPLES

The samples were taken mainly from Suprafața 1(=Area, 1, or *Sp* 1) and Trench Sp 1 adjacent to it, both cutting across the terrace towards the hill slope to the north. Features subsequently excavated outside these areas are shown on the plan to make the total relationships clearer. Sp 1 was 8 m × 5 m, with a 50 cm baulk between it and *Trench Sp* 1, which was 2 m wide and 15 m long. Sp 1 was divided by a 1 metre baulk into northern and southern portions, Sp 1 North and South. The remains of a rectangular Dacian house are apparent, resting on roughly-shaped blocks of mica schist and limestone, as was the usual arrangement. What is described here as limestone was more in the nature of a loosely cemented sandstone, which weathers and looks like limestone. Beams were normally laid across these blocks, and the remains of Dacian planking were found scattered over the central part of Sp 1 in brown soil just below the surface, 10 cm down, together with large lumps of charcoal (Sample 26). Another regular feature was found, numerous structural iron nails, as well as burnt pisé (clay daub mixed with tempering), and the abundant carbonised grain which was evident to the eye and gave the terrace its name. Burnt mica schist was also present. The black remains marking the house with its foundation blocks and occasional trampled surfaces preserved were c. 40 cm thick, below which there was a yellow stratum comprising the fill and levelling of the man-made terrace, of varying thickness but averaging about 70 cm. Below this was the surface of the terrace cut in the local mica schist. This is highly micaceous, with a sandy loam texture when a fresh section is cut. The profile appears to be a simple A/C, the upper darker horizon containing many roots and the occupation level. Where there appears to be no occupation layer, an A/B/C horizon is evident, with a thin B horizon. The natural (C) horizon is gleyed with Fe/Ca mottling, probably the result of ground water rather than surface water variations. There are several large root disturbances, going into the natural, and translocation has occurred along root channels so that in these areas archaeological deposits have been disturbed both by tree growth and root removal. Pit-like features can be seen indicating the removal of large rooted trees which had influenced the development of the upper humic horizon to lower depths.

SAMPLE 20

As excavation progressed, the surfaces of Sp 1 were first shaved to about 20 cm depth, revealing a grey-black deposit in the north-east corner, with a massive concentration of carbonised grain which was sampled and sieved. This is Flotation sample 20, from a depth of 20 cm, 130 cm south and 30 cm west of the N.E. corner of Sp 1, comprising 11 litres of earth. The area became defined as a surface of trample spreading southwards from a pit 60 cm in diameter and 90 cm deep with a burnt base, containing burnt grain and pisé as well as the remains of a wooden lid together with its metal ring handle. The trampled surface to the south (in Roumanian excavation terminology referred to as a 'Vatra', meaning surface, which should not be confused with 'Vatra de foc' meaning hearth) was clearly a thin spread, as opposed to the pit, and overlay a hard clay surface. Thin deposits of natural were to be found overlying the hardened clay, with pottery associations around the edges. The whole area was sub-circular and the context appeared to be a courtyard with red, black and yellow burnt areas, trample and irregularly positioned stones. It continued south of the baulk through a redder area, and the whole courtyard lay between the well-defined house to the west of Sp 1 and what may have been another less well-defined structure to the east, with two limestone bases, a spear head and an axe of metal.

SAMPLE 21

The north-west corner of Sp 1 showed an area of yellowish-brown earth some 2 metres square, extending south towards the central baulk. From this was taken Flotation sample 21, comprising 11 litres from 15—20 cm depth. In considering the full spectrum of plant remains produced by sample 21 it is worth noting that this brown earth was not apparently very full of carbonised plant remains to the naked eye during excavation, unlike the area of the Vatra. During flotation it became apparent that it contained much *Vicia faba.* In the brown earth were many of the iron nails used in Dacian structures, c. 4 cm long with heads c. 1.5—2 cm in diameter. Sample 21 included 92 seeds of *Camelina sativa* and fused lumps of the same.

SAMPLE 25

Adjacent to the brown earth but separated from it by about 20 cm was a lens of pottery tumble extending N.E.—S.W., and occupying the centre of Sp 1 North. Among abundant pottery this contained iron nails and clamps, and the basal ferrule of a spear, conceivably that belonging to the spear head found 3.5—4 metres away outside the area of Sp 1, to the east of the Vatra, as well as a copper fibula, and burnt mica schist. The tumblo lay at the same level as the Vatra and extended down to a depth of c. 40 cm. It ended 80 cm south of the northern edge of Sp 1. After cleaning and drawing it was lifted, and inscribed or stamped sherds with a triskele-like sign were provisionally identified among the pottery. Burnt earth and yellow terrace soil appeared underneath, so that this was clearly a sherd tumble, and not the top of a pit. The pottery included fine wheel-made vessels, and there was also a micaceous sandstone whetstone, a socketed iron tool, an iron ring, and a clamp or staple. A Flotation sample of 11 litres was taken from the sherd tumble selected from careful sieving-out with large mesh of the sherd material and pisé (Sample 25). It included *Camelina sativa* and remains of small apples, *Pyrus malus.*

SAMPLE 22

South of the Vatra, and extending through the central baulk of Sp 1 into Sp 1 South, was a large area of reddish burning and variegated trample. It contained substantial black lumps of burnt earth, and of red noticeably purple clay, together with areas of yellow terrace earth, brown earth and fragments of sherds and mica schist. This concentration centred some 2 metres south of the Vatra but was continuous with it, and passed southwards into variegated tumble of pisé fragments in Sp 1 South. Beside the central baulk in Sp 1 South lay Stone 1, one metre from the eastern side of Sp, with a deep groove across its surface. To the west of this stone lay an area of lumps of the yellow terrace fill. Between this and the sherd tumble in Sp 1 North, contained in the baulk, were found subsequently a curved Dacian sword, a dagger, and the umbo of a shield. Flotation Sample 22 was taken from a depth of 20 cm at the level of the base of Stone 1 to the east of it, and consisted of 8 litres of earth from the variegated trample. The jetsam included small quartz chips. The southern portion of Sp 1 was taken down some 10 cm and was fairly clean in the south-western corner except for one reddish area. The deposit appeared to deepen towards the east along the south of Sp 1 South, with a higher incidence of pottery and an iron nail. This was subsequently confirmed by the discovery of a big deposit of Dacian painted pottery outside the area of Sp 1 to the east. Sample 22 included 21% by weight of seeds of *Camelina sativa.*

SAMPLE 17

The 50 cm baulk between Sp 1 South and Trench Sp 1 contained three of the stone supports of the western house, and a vessel base with an incised sign, resembling a circle with rays radiating externally. Trench Sp 1 crossed three more of the stone support blocks, the central one of which (Stone 3) had been moved during previous excavations and had a large fragment lying at a slope above it. It thus lay in the 50 cm baulk west of Trench Sp 1. Between it and Stone 4 to the north lay a square stone 22 × 22 cm described as an anvil. Sample 17 was taken as a hand sample, during the course of the Romanian excavation before flotation was begun, from the area beside this anvil.

Trench Sp 1 thus cut the eastern half of the house represented on the terrace, and this was subsequently excavated by opening up area Sp 2 to the west of Trench Sp 1, leaving a 50 cm baulk in between. This revealed the remaining three basal stones of the house, together with an iron wedge, whose butt had clearly been hammered, a bronze bell with an iron clapper, and a 35 cm long gimlet for boring in wood, which would have had a wooden transverse handle.

SAMPLE 18

This sample came from a massive deposit of burnt grain on Terrace IX, which has spilled onto the west side of the Upper Terrace (Terrace X) of the Sanctuary area. The deposit has been known for many years and eight species were listed from it without quantification among the other samples identified from Grădiştea Muncelului in *SCIV* IV 1953; 193—4. It lies behind the wall of the terrace which is here collapsed, and from the nature of the deposit it has been named 'Hambarul', or the 'Granary'.

DACIAN PLANT EXPLOITATION

The use of flotation for the first time in a Dacian context gives more control of sampling and better possibilities for quantification. However, plant identifications have long been undertaken by Romanian archaeologists, and there is now a considerable spectrum of species known to have been exploited by the Dacians. It is deliberately intended not to present this as a discussion of "the Dacian plant economy", because we do not yet know enough about the overall patterns involved. Nor should it be taken that there was such a thing as "the" Dacian economy whether of plant or animal husbandry; regional differences are certainly involved, and some indications of this can be pointed out. A perhaps even more interesting aspect of Dacian plant exploitation lies in indications of plants other than the main food plants (the wheats and legumes), hinting at the range of other uses for plants which was a consistent feature of prehistoric and traditional societies.

It is worth mentioning how both classical references and ethnographic analogy from modern Romania point to the way in which the rich plant resources of the region have been exploited, both in Dacian times and by modern Romanian peasants. Even the degraded modern environment is, in many parts of Romania, particularly rich in plant species, and a great deal of attention has traditionally been paid to plants and their uses in Romanian peasant culture. Antal and Antal (1977) have recorded for the single village of Breb in the Maramureş, in northern Romania within the Carpathians and with 1,500 inhabitants, a spectrum of at least 435 species in use for food, medicinal, veterinary, ornamental, religious, magical, and traditional purposes. Dioscorides, writing in the first century A.D. when the Dacians were an independent people, gives 44 Dacian names of plants. Pseudo Apuleius, in the second to fifth centuries, gives 36 Dacian names, of which 11 are in common with Dioscorides' list and 25 are new (Vaczy 1968, 1969 and 1971. See also Tomaschek, W. 1893—4, Part II, pp. 22—36). These lists mainly concern medicinal plants. The species list recovered archaeologically from Dacian contexts is now some 45 species, derived from carbonised remains which mainly concern edible plants, but with several species which might have other uses, comparable to those for which Dioscorides drew up his list. This is certainly true of the *Camelina sativa* recovered during flotation at Terasa cu Grîu. This is an oil-bearing crucifer, which may be a source of oil for the characteristic Dacian open lamp (Nandris 1974, fig. 1/4 and fig. 3). Oil-bearing seeds are among those treated by Dioscorides, but there are several problems in relating his nomenclature to a modern species classification, so that unfortunately it does not seem as if we could say that we knew the Dacian name for the *Camelina sativa* seeds which were so abundant on Terasa cu Grîu. They occurred however as fused lumps, clearly the result of the burning of a fully cleaned and sorted collection of seeds, and in one case were fused onto a sherd, from the interior of a wheel-turned Dacian vessel. The shiny black mass preserved the seed exteriors in great detail, and they were present in all the flotated samples from the terrace (Samples 20, 21, 22, 25). Camelina has a short growing season (Vaughan 1970; 62) and is useful if another crop fails. It is also known as false flax; linseed oil may have been used for lighting in prehistory, and *Camelina* was often found in association with flax, probably as a

weed in flax fields. It was cultivated in prehistoric times in its own right as an oil crop (Dimbleby, G.W. 1967 ; 88) and it may have a toxic effect on flax, amongst which it grows, reducing the yield. (There appear to be no remains of flax from Dacian contexts, but this cannot be taken as evidence of absence). *Camelina* was found at Aggtelek in northern Hungary, in contexts formerly accepted as neolithic (Renfrew, J. 1973 ; 168 ; Dimbleby 1967 ; 88), but which have now been re-dated to Late Bronze Age or Early Iron Age times (see Nandris : review of Hartyani and Novaki 1975, in *J Arch Sci*, 4, 1977, 295—304), so that it may be questioned whether there is now good evidence for its use early in the Neolithic. It is common enough in Scandinavian Iron Age contexts, and with the Dacian evidence this might now point towards that period as the main one for its use in Europe. Schultze-Motel (1979) comments on the increase in *Camelina* during the Iron Age in northern Europe. Only two neolithic finds are cited, one of them late neolithic.

Of the plants found at Terasa cu Grîu three species were among the stomach contents of Tollund man :

Chenopodium album; The seeds contain fat and albumen, and the plant can be used as a green vegetable and to produce a red or golden dye.

Polygonum convolvulus ; The seeds contain starch, and the plant may have been cultivated, although there is no evidence that it was here.

Camelina sativa ; This was as we can see from the Terasa cu Grîu samples, definitely collected together by the Dacians, and stored in vessels ready for use. While its use to provide oil for their lamps is highly probable, it could also have done so for cooking, or the seeds may have been used for flavouring, and the presence in Tollund man is very interesting in this context. It was also present in the stomach contents of Grauballe man. Many of the other species from Terasa cu Grîu can be used in various ways, and although there is no evidence that they were not merely growing around at the time of the burning. Poppy seeds (Papaver), and the mustards (Sinapis), are highly edible, but were present at the site in such small quantities that it is extremely unlikely that they were being collected at this point. Sinapis, Brassica, Silene or Rumex can all be used as salad plants or green vegetables. *Galium aparine* (bedstraw) may be chopped up and fed to geese, used as treatment for skin diseases, the seeds may be roasted and used as a coffee-substitute, and according to Dioscorides the leaves and stems used to strain hair out of milk. We probably know the Dacian name for one of the plants represented on the site, *Artemisia vulgaris*, a medicinal and magic herb of some repute with an attribution to Artemis ; this is 'Artemisia Monoklonos' in Dioscorides, and the Dacian name was "zuste" or "zouoste" (Vaczy 1971 ; 115).

The presence of *Agrostemma githago* in some quantity in Sample 18, which comes from the "Hambarul" or "granary" deposit at Sarmizegetusa, is of interest, since this is a highly toxic contaminant of grain, hardly acceptable in that context. One conclusion may be drawn perhaps : the contents of the Hambarul were gathered at a time of urgency and their decontamination was reserved for later on, when they were to be prepared for food.

The incompleteness of our picture of the total plant economy of the Dacians has to be stressed. Apples were certainly not the only orchard fruit used. We have iron tools which are almost certainly vine-pruning knives, but with the possible exception of Cetăţeni (see below, Daicoviciu, H. 1972, citing Mirtu, F. 1965) no seeds of Vitis have appeared yet in the palaeobotanical evidence. From the scythes which are present among the iron tools it may be possible to extrapolate to haymaking and the provision of fodder for livestock.

The regional adaptations of Dacian plant exploitation in Romania may (and indeed may not adequately) be expressed by comparing the focus at Sarmizegetusa, including Terasa cu Grîu, with Cîrlomăneşti, in the east of the country, and Zăbrani in the west. The sites certainly present a very different picture one from the other, and while this is to be expected, they still confirm that it is not yet right to make generalisations about "the Dacian economy". Zăbrani was using a very basic repertory of einkorn, emmer and millets. Cîrlomăneşti produced a spectrum which gave an emphasis on barleys. The Sarmizegetusa sites favoured bread wheats of the *Triticum aestivo-compactum* group, but with the wide range of other plants recovered from this area. Context being all-important in the assessment of plant remains, it is only from Terasa cu Grîu that the contextual evidence approaches adequacy, and that we have a full range of samples identified, quantified, weighed, and measured, thanks to the excavation by Hadrian Daicoviciu of a small Dacian domestic unit whose destruction can be dated almost to the year, and to the use of flotation.

PRESENCE/ABSENCE

Unquantified evidence for Dacian plants comes from Zăbrani, from Cetăţeni-Muşcel (H. Daicoviciu 1972 ; 175, citing F. Mîrţu 1965) and from the early identifications at Grădiştea Muncelului, close by Terasa cu Grîu, and at Tower No. 1 in the citadel of Costeşti, at the mouth of the Valea Grădiştei.

From a consideration of presence/absence in 17 samples of plant remains from all Dacian contexts (Table 2) it seems that we already have a list of about 45 species exploited by these people. A third of them were not represented in samples outside flotation methods, and a quarter are not represented in flotation samples. Flotation was successful in recovering a larger number of species (twice as many) per sample ($\bar{x} = 13.6$) than were other methods of hand sampling of identification from impressions ($\bar{x} = 7$). The constancy figures (%C = % of the total number of samples in which a species is present — without considering quantity) indicate that the most constant species are *Triticum aestivo-compactum* c. 80% C (grîu cîrnău), *Hordeum vulgare* c. 70% C (orz), and *Secale cereale* c. 70%C (secară). *Panicum miliaceum* at c. 60%C (mei) and *Triticum vulgare* at c. 40%C are also relatively constant, while emmer wheat *(T.dicoccum)* was represented at c. 30%C, from Terasa cu Grîu and at Zăbrani. Einkorn *(T. monococcum)* was represented by one grain at Terasa cu Grîu, and by relatively frequent impressions at Zăbrani. The most constant legume was *Vicia faba* (bob) at c. 40%C, but there seems to be no very great emphasis on legumes among Dacian plants. The presence of chick pea *(Cicer arietinum* — năut) at Cetăţeni is of interest among the legumes. Renfrew, J.M. (1973 ; 119) notes that this was roasted and ground up in Roman cooking and added to soup. *T. dicoccoides* (grîu păros) is also claimed from this site.

Presence analysis for Terasa cu Grîu alone (Table 1, Terasa cu Grîu %C) indicates the importance there of *T. aestivo-compactum*, Hordeum, and Secale.

Table 1

TERASA CU GRÎU : %C

Presentation of the data employing presence-absence analysis

Taxon	%C (Σ=6)
Triticum aestivum	100
T. aestivum var. aestivo-compactum	100
T. dicoccum	50
T. monococcum	16.5
Hordeum vulgare	100
Secale cereale	100
Avena sp.	16.5
Panicum miliaceum	84.5
Bromus secalinus/mollis	66
Vicia faba var minor	66
V. sativa ssp. angustifolia	16.5
Pyrus malus	16.5
Camelina sativa	66

The seven contexts from which the Grădiştea Muncelului samples were taken (SCIV 4, 1953 ; pp. 193—4) are :

I Near a cistern of Dacian and Roman date, west of Sarmizegetusa-Cetate.
II An unexcavated terrace west of the cistern along the Dealul Grădiştei ridge.
III The western gate of the Sarmizegetusa earthwork, from a hearth below the wall.
IV Terrace No. X of Sarmizegetusa, surface associated with Roman building.
V Terrace IX of Sarmizegetusa, behind the terrace wall at c. 2 metres depth and strewn over the destruction of the terrace wall.
VI Terrace IX, storerooms below the slope towards Terrace VIII.
VII Terrace VIII.

Of these context V (8 species) is probably the 'Hambarul' or 'granary' represented by Sample AR 8366/18 (13 species), which was recovered by hand sampling. A pit on one of the house terraces west of the sanctuary of Sarmizegetusa produced 20 kilograms of carbonised grain, contained in a beech-wood grain bin, studded with miniscule iron nails (SCIV, 3, 1952, pp. 306). This may recall the pit containing carbonised grain from the north-east corner of Terasa cu Grîu, which appears to have had a wooden lid, with a metal ring-handle (belciug). In both instances we have storage in a pit, associated with further containment in wood, made up with metal attachments. This is a further insight into Dacian Iron Age storage practice therefore, and should be compared with western European evidence for this important topic. British Iron Age evidence from excava-

TABLE 2

PRESENCE ANALYSIS OF PLANT SPECIES FROM 17 DACIAN IRON AGE SAMPLES

	Terasa cu grîu Sample Nos. (AR 8366/—)						Grădiștea Muncelului (SCIV 4, 1953, pp 193—1)							Costești fort (Tower No. 1)	Cetățeni	Cîrlomănești	Zăbrani	(Σ=17) %C
	17	18	FL 20	FL 21	FL 22	FL 25	Contexts: I	II	III	IV	V	VI	VII					
No. of species represented: Σ = *Gramineae*																		
Triticum aestivum	+	+	+	+	+	+										+		11
T. compactum							+	+	+	+	+	+	+					41 82
T. aestivum L., grex aestivo-compactum (Schiem)	+	+	+	+	+	+												35
T. durum																+		5
T. vulgare							+	+		+	+	+	+		+			11
T. dicoccoides															+			5
T. dicoccum Schübl	+		+	+	+												+	29
T. monococcum L.				+													+	11
Hordeum sativum									+		+	+						17
Hordeum distichum															+	+		11 70
Hordeum vulgare L. emend. Lam.	+	+	+	+	+	+		+				+			+	+		58
Secale cereale L.	+	+	+	+	+	+	+	+		+	+	+				+		70
Avena sativa		sp.													+			11
Panicum miliaceum L.		+	+	+	+	+	sp.				sp.	sp.	sp.			+	+	64
Setaria viridis														+			sp.	11
Echinocloa crus-galli (L.) P.B.						+												5
Bromus secalinus/mollis	+		+	+		+									+			29
Lolium sp.							+					+						11
Rosaceae																		
Pyrus malus L.						+												5
Liliaceae																		
Ornithogalum pyramidale								+										5
Leguminosae																		
Vicia faba L. var. minor (Peterm. emend. Harz) Beck	+			+	+	+				+		+	+					41
V. sativa L. ssp. angustifolia (L.) Gaud		+																5
Lens culinaris											+							5
Leguminosae (contd.)																		
Cicer arietinum															+			5
Pisum sp.																+		5
Cruciferae																		
Camelina sativa (L.) Crantz.			+	+	+	+												23
Brassica sp.												+						5
Sinapis alba											+							5
S. arvensis								+			+							11
S. dissecta								+										5
Chenopodiaceae																		
C. Cf. album L.				+										sp.				11
Caryophyllaceae																		
Agrostemma githago L.	+	+	+	+		+												29
Silene sp.			+															5
Compositae																		

TABLE 2 (continued)

	Terasa cu Grîu Sample Nos. (AR8366/—)						Grădiştea Muncelului (SCIV, 4, 1953 pp. 193—4)							Costeşti fort (Tower No. 1)	Cetăţeni	Cîrlomăneşti	Zăbrani	(Σ=17) %C
			FL	FL	FL	FL	Contexts:											
	17	18	20	21	22	25	I	II	III	IV	V	VI	VII					
Cf. Bellis perennis L.						+												5
Cf. Artemis vulgaris L.						+												5
Labiatae																		
Galeopsis sp.		+																5
Papaveraceae																		
Papaver somnifer um L.	+	+	+	+	+	+						sp.						35
Polygonaceae																		
P. convolvulus L.		+																5
P. Cf. persicaria L.					+	+												11
Rumex sp.i		+																
Rubiaceae																		
Galium apar ne L.		+	+	+		+												23
G. Cf. spuri um L.			+															5
G. tricorne							+											5
Urticaceae																		
Urtica urens L.						+												5
Malvaceae																		
Hibiscus sp.								+		+								11

tion and experimental archaeological indicates the feasibility of storage in unlined pits on chalk sites. Barley, upon which there is an emphasis at Cîrlomăneşti, does not store well in these conditions. The Neolithic evidence from south-east Europe indicates rather the storage of grain in large vessels perhaps, but quite commonly in special thick-walled, often rectangular, grain bins made up of pisé (daub) within the houses, or lining pits as at Nosa near Subotica. It is not clear what the container was for the massive deposit of the 'Hambarul' at Sarmizegetusa.

DACIAN PLANT REMAINS FROM ZĂBRANI

During the course of excavation at Zăbrani in western Romania in 1973, conducted by Mr. Eugen Dorner, plant remains from a Dacian context (Zăbrani II — Pruni) were identified from impressions on fired pisé. There is an epi-palaeolithic site (Zăbrani I — Dealul Viei) in the neighbourhood which was also being excavated by Mr. V. Boroneanţ. The sites both lie on the southern side of the Mureş, on spurs overlooking the area where the Mureş valley widens out into the flatter country of the Banat, between Lipova and Arad. The Mureş is now some 40 minutes walk or 4—5 kilometres distant to the north, but there are ox-bow lakes within one kilometre of the sites, at the locality of Bugeac, which indicate that at some period, which may have corresponded with one or the other site, and which would therefore affect the catchment envisaged for them, the river lay much nearer. Borings with a hiller borer and auger revealed two metres of deposits here, running out into lenses of gravel. The deposit could have been composed of quite recent vegetation and silting. A small marsh immediately below both sites also revealed two metres of deposit before gravel (locality Valea Livezilor). The stratigraphy revealed by the borings is given below, but the deposits do not appear suitable for palynological analysis (although the samples have been conserved) and are certainly of relatively recent date.

The plan impressions, identified by R.N.L.B. Hubbard, from the Dacian site at Zăbrani II (locality Pruni), comprised :

Triticum dicoccum (Schrank) Scheubl. Impression of caryopses not infrequent. (Emmer).

T. monococcum L. Glume impression quite frequent. (Einkorn).

Setaria sp., ? *italica*. Caryopses impressions. (Italian millet).

Panicum miliaceum L. Caryopses impressions frequent. (Broomcorn millet).

There were also traces of some sort of binding on pisé fragments, but the nature of the fibres involved could not be ascertained. These plant remains give no sort of balanced impression of the Dacian economy locally, but taking them as they stand, there is an interesting contrast with the information from the Sarmizegetusa samples. There is none of the emphasis on *Triticum aestivo-compactum* wheats found at Grădiştea Muncelului, where Setaria is almost absent (it was found, in the form of *Setaria viridis*, at the hill fort of Costeşti further down the valley, in tower No. 1). Instead at Zăbrani the genetically simpler basic wheats, einkorn and emmer, seem to be favoured, and the local economy may have been a simpler one than at Sarmizegetusa.

STRATIGRAPHY OF THE ZĂBRANI BORINGS

ZĂBRANI MARSH (Valea Livezilor)

In low ground between Zăbrani I and II, south of Dealul Viei.
Boring to 2.10 metres, ending in fine gravels. General sequence shows:

Grey-black plastic clay and alluvium.

Gley. Greenish-blue clay and sand.

Gravels.

Samples at 10 cm:

S—27	0.10 m	grey-black alluvium
S—28	0.20 m	grey-black alluvium
S—29	0.30 m	grey-black alluvium
S—30	0.40 m	grey-black alluvium
S—31	0.50 m	grey-black alluvium
S—32	0.60 m	grey-black alluvium
S—33	0.70 m	grey-black alluvium
S—34	0.80 m	grey-black alluvium
S—35	0.90 m	grey-black alluvium
S—36	1.00 m	grey-black clay
S—37	1.10 m	grey-black clay
S—38	1.20 m	grey-black clay
S—39	1.30 m	blue grey — H_2O
S—40	1.40 m	faun, green spots, rather gritty
S—41	1.50 m	khaki, green spots, old roots, sandy
S—42	1.60 m	soft, grey, green lumps, brown, gritty
S—43	1.70 m	grey, v. fine gravel
S—44	1.80 m	grey, sandy clay, brown lumps
S—45	1.90 m	grey-yellow, sandy fine gravel
S—46	1.95 m	yellow sandy gravel
S—47	2.10 m	gravel

ZĂBRANI BUGEAC

c. 2 km. N.N.W. of Zăbrani, Dealul Viei, on western margin of ox-bow lake of former Mureş bed. Deep portion of the bend, damp but without standing water. Dense marsh vegetation of Glyceria, Typha, etc.

Boring to 2 metres revealed general sequence:

Mud and clay

Bands of sands and clays

Sands

Gravel at 2 m.
Samples at 10 cm :

S—48	0.10	fine grey alluvium, micaceous
S—49	0.20	fine grey alluvium, +brick
S—50	0.30	fine brown micaceous clay
S—51	0.40	fine brown micaceous clay
S—52	0.50	fine brown micaceous clay
S—53	0.60	blue grey micaceous clay alluvium
S—54	0.70	grey coarse silt and clay
S—55	0.80	grey coarse silt and clay
S—56	0.90	grey fine sand and clay
S—57	1.00	grey fine sand and clay
S—58	1.10	grey clay (+sand lens)
S—59	1.20	grey fine silt
S—60	1.30	grey fine sand alluvium
S—61	1.40	grey coarse silt alluvium
S—62	1.60	brown clay
S—63	1.65	black and organic
S—64	1.70	grey sand

METRICAL DATA

Quantified evidence for Dacian plant remains, as opposed to the *identifications* of species discussed above, comes only from Cîrlomăneşti and from Terasa cu Grîu. From a sample of 1,221 grains from Cîrlomăneşti, in the region of Buzău in eastern Romania, Cîrciumaru (1977) gives the following proportions :

Hordeum distichum	52%
Hordeum vulgare	39%
Triticum aestivum	4.5%
T. durum	1.3%
Secale sp.	1.9%

as well as unquantified remains of *Panicum miliaceum* and *Pisum sp.* In the preceding Bronze Age at Cîrlomăneşti, with a smaller sample of only 90 grains *T. durum* (42%), and *T.aestivum* (56%) are better represented.

The most comprehensive quantified evidence remains that from Terasa cu Grîu presented here, mainly in tabulated form. The Pre-Sieve mesh for removal of sherds, coarse lumps of pisé etc. prior to Flotation was 13 mm. The flotation collection sieves were precision sieves graded >1.0 mm and >0.2 mm and the quantity sampled was 11 litres except in the case of Sample 22 (8 litres). The sieves used for sorting and identification were >4.76 mm, >2.0 mm., >1.0 mm, and >0.24 mm. 'Sink' or 'Jetsam' indicates the residue of the Flotation sample which has sunk in the machine; this was recovered through the valve at the base, and 1/5 or 1/10 of it was subsampled and retained. The indices referred to for length (L), breadth (B), and thickness (T) are :

$L : B = \frac{100 \times L}{B}$ as an index of slenderness or plumpness, and

$T : B = \frac{100 \times T}{B}$ as an index of height.

Other abbreviations are: $\bar{x}$ = mean
s = standard deviation
FL = Flotation, or flotation sample

Quantified Data

Sarmizegetusa: Terasa cu grîu

Most frequently represented taxa, as % by weight of the total carbonised seed material

	Sample:	17	18	20	21	21 Jetsam	22	25	25 Jetsam
Bread wheats (-Grîu)	*Triticum aestivum*	69	35	47	11	25	13	12	23
	T. aestivum var. aestivo-compactum	14	60	45	29	35	51	46	48
	T. aestivum (nnderdeveloped grain)	—	1	4	1	1	1	1	4
Emmer	*T. dicoccum*	3	—	—	1	2	5	—	—
Grîu	(Total Wheat)	76	96	96	42	63	70	59	75
Orz	*Hordeum vulgare*	1	+	+	1	+	1	+	+
Secară	*Secale cereale*	8	3	3	1	6	2	7	8
Bob	*Vicia faba*	4	—	—	52	29	6	28	18
Măr	*Pyrus malus*	—	—	—	—	—	—	4	+
"Gold of pleasure"	*Camelina sativa*	—	—	+	3	+	22	+	+

Sample 17

Taxon	Number	Wt. (g.)	Taxon as % of total wt.of carbonised seed
T. aestivum L.	450	5.85	69.23
T. aestivum var aestivo-compactum (Schiem)	97	1.23	14.56
T. dicoccum (Schübl)	27	0.29	3.43
Hordeum vulgare L. emend Lam.	12	0.10	1.18
Secale cereale L.	77	0.607	7.93
Bromus secalinus	1		
Vicia faba L. var minor	2.5	0.31	3.67
Papaver somniferum L.	5		
Agrostemma githago L.	2		
Grain fragments >1mm.		2.49	

Metrical Results of the Cereals from Sample 17 (showing dimensions in mm. and the Indices)

		L	B	T	L:B	T:B
Triticum aestivum (n = 50)	min	3.97	1.87	1.73	156	71
	max	5.30	3.07	3.00	229	104
	$\bar{x}$	4.59	2.46	2.20	188	90
	s	± 0.37	± 0.27	± 0.25	± 17.5	± 8.0
T. aestivum var aestivo-compactum (n = 50)	min	3.77	2.33	1.80	118	68
	max	5.30	3.67	2.87	174	101
	$\bar{x}$	4.33	2.87	2.36	152	82
	s	± 0.32	± 0.29	± 0.26	± 14.9	± 7.0
T. dicoccum (n = 27)	min	4.27	1.50	1.50	160	68
	max	6.40	3.20	2.67	295	110
	$\bar{x}$	5.27	2.55	2.15	212	85
	s	± 0.58	± 0.48	± 0.35	± 34.8	± 9.6

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Hordeum	min	4.70	2.30	1.80	162	65
vulgare	max	6.03	3.67	2.80	235	80
(n = 11)	$\bar{x}$	5.70	3.03	2.24	191	74
	s	±0.39	±0.46	±0.35	±25.3	± 5.4
Secale	min	4.33	1.47	1.40	203	81
cereale	max	6.03	2.60	2.70	325	110
(n = 40)	$\bar{x}$	5.27	1.95	1.95	275	96
	s	±0.58	±0.26	±0.19	±36.4	± 7

Sample 18

Taxon	Number	Wt.(g.)	Taxon as % of total wt. of carbonised seed
T. aestivum L.	c. 1340	14.29	35.22
T. aestivum var aestivo-compactum (Schiem)	c. 2345	24.47	60.31
T. aestivum (underdeveloped grain)	107	0.46	1.13
Hordeum vulgare L. emend Lam.	4	0.05	0.1
Secale cereale L.	160	1.25	3.08
Bromus secalinus/mollis	19	0.06	0.1
Avena sp.	4		
Panicum miliaceum L.	5		
Vicia sativa sap. angustifolia	2		
Papaver somniferum L.			
Agrostemma githago L.	76	0.23	0.57
Calium cf. aparino L.	4		
Polygonum convolvulus	1		
Rumex sp.	3		
Caleopsis sp.	1		
>1 mm. seed fragments		15.93	

Metrical Results for the Graminese from Sample 18 (showing dimensions in mm. and the Indices)

Taxon		L	B	T	L :B	T :B
Triticum aestivum	min	3.27	2.00	1.77	146	69
(n = 50)	max	5.20	3.30	2.50	229	105
	$\bar{x}$	4.18	2.52	2.05	167	82
	s	±0.38	±0.27	±0.16	±15.4	± 8.2
T. aestivum var	min	3.06	2.40	1.70	108	64
aestivo-compactum	max	4.70	3.77	2.80	167	100
(n = 50)	$\bar{x}$	3.97	2.84	2.27	144	80
	s	±0.63	±0.31	±0.26	±13.3	± 8.5
T. aestivum S.I.	min	2.43	1.50	1.23	136	67
(underdeveloped grain)	max	3.53	2.00	1.90	199	96
(n = 20)	$\bar{x}$	3.15	1.88	1.50	168	80
	s	±0.41	±0.15	±0.20	±18.8	± 9.2
Hordeum vulgare	min	5.67	2.73	1.87	173	69
(n = 4)	max	6.07	3.10	2.53	207	82
	$\bar{x}$	5.49	2.93	2.23	187	76
	s	±0.47	±0.15	±0.28	±14.3	± 5.9
Secale cereale	min	4.53	1.47	1.50	193	74
(n = 50)	max	6.63	2.60	2.63	392	118
	$\bar{x}$	5.67	2.15	2.04	269	96
	s	±0.58	±0.33	±0.29	± 48	±10.00

Avena sp.	min	4.30	1.50	1.27 •	266	71
(n = 4)	max	4.93	1.9	1.50	306	87
	$\bar{x}$	4.77	1.72	1.36	279	80
	s	± 0.43	± 0.18	± 0.10	± 23.8	± 8.2
Bromus secalinus/mollis	min	4.30	1.53	1.1	222	64
(n = 9)*	max	6.27	2.27	1.67	325	79
	$\bar{x}$	4.98	1.86	1.32	271	73
	s	± 0.61	± 0.25	± 0.20	± 35.2	± 6.6
* Plus one underdeveloped seed measuring :		4.83	1.13	1.03	427	91
Panicum miliaceum	min	1.53	1.43	1.2	104	82
	max	2.13	1.57	1.47	136	94
	$\bar{x}$	1.75	1.49	1.31	118	88
	s	± 0.26	0.06	± 0.11	± 13.5	± 50

Sample 20

Taxon	Number	Wt.(g.)	Taxon as % of total wt.of carbonised seed
T. aestivum	c. 2266	23.68	47.2
T. aestivum var aestivo-compactum (Schiem)	c. 1955	22.34	45.2
T, aestivum sl. (underdeveloped grain)	363	2.03	4.0
Secale cereale L.	205	1.47	3.0
Bromus secalinus/mollis	6	0.02	c. 0.44
Hordeum vulgare L. emend Lam.	8	0.08	c. 0.2
Panicum miliaceum L.	4		
Camelina sativa (L.) Crantz	37		
Agrostemma githago L.	2		
Papaver somniferum L.	12		
Silene sp.	1		
Galium cf. apartne/spurium	6		
Unidentified seeds	10		
Varia >1 mm. fragments		17.32	

Dimensions (in mm) and Indices for the Cereals from Sample 20

Taxon		L	B	T	L :B	T :B
T. aestivum	min	3.6	1.96	1.51	140	65
(n = 50)	max	5.43	3.34	2.85	225	98
	$\bar{x}$	4.36	2.69	2.37	166	79
	s	± 0.37	± 0.35	± 0.33	± 19	± 6.8
T. aestivum var	min	3.51	2.63	1.87	111	65
aestivo-compactum	max	4.72	3.69	2.71	151	86
(n = 50)	$\bar{x}$	4.08	3.08	2.32	132	75
	s	± 0.30	± 0.24	± 0.22	± 9.3	± 5.2
Hordeum vulgare	min	4.27	2.50	2.07	149	75
(n = 7)	max	5.90	2.83	2.60	211	95
	$\bar{x}$	4.86	2.66	2.26	182	85
	s	± 0.66	± 0.13	± 0.18	± 19	± 6.8
Secale cereale	min	3.46	1.53	1.40	185	79
	max	6.47	2.67	2.37	313	112
	$\bar{x}$	5.07	2.07	1.93	251	94
	s	± 0.74	± 0.27	± 0.22	± 33.2	± 6.7

Sample 21

Taxon	Number	Wt.(g.)	Taxon as % of total wt. of carbonised seed
Vicia faba. L. var minor	c. 50	5.76	52.54
Triticum aestivum L.	132	1.25	11.4
T. aestipum var aestivo-compactum (Schlem)	366	3.19	29.1
T. aestivum (underdeveloped grain)	18	0.11	1.0
T. dicoccum Schübl	13	0.16	1.46
T. monococcum L.	1		
Hordeum vulgare L. emend Lam.	8	0.08	0.73
Secale cereale L.	8	0.07	0.64
Bromus secalinus/mollis	1		
Panicum miliaceum L.	10	0.02	0.09
Camelina sativa (L.) Crantz	92		
Camelina sativa 'lumps'	+	0.33	3.01
Chenopodium cf. album L.	2		
Papaver somniferum L.	15		
Galium cf. aparine L.	1		
Compositae	2		
Gramineae	1		
>1 mm fragments of seed		1.1	

Metrical Results for the Cereals from Sample 21 (showing dimensions in mm and the indices)

Taxon		L	B	T	L:B	T:B
Triticum aestivum	min	3.67	2.00	1.67	151	67
(n = 50)	max	5.67	3.30	2.87	230	100
	$\bar{x}$	4.73	2.78	2.34	170	85
	s	± 0.38	± 0.29	± 0.24	± 22.4	± 7.5
T. aestivum aestivo-compactum	min	3.40	2.30	1.90	109	71
(n = 50)	max	5.20	3.70	3.10	162	98
	$\bar{x}$	4.23	3.01	2.51	141	82
	s	± 0.4	± 0.32	± 0.28	±119	± 12.6
T. dicoccum	min	4.73	2.07	1.70	186	73
(n = 43)	max	7.60	3.40	2.83	233	103
	$\bar{x}$	5.66	2.74	2.36	220	91
	s	± 0.80	± 0.35	± 0.35	±22.4	± 6.2
Hordeum vulgare	min	4.67	2.47	1.90	146	77
(n = 7)	max	6.33	3.60	2.87	245	90
	$\bar{x}$	5.41	2.86	2.36	188	83
	s	0.65	0.45	± 0.37	± 28	± 4
Secale cereale	min	2.9	1.33	1.30	180	80
(n = 8)	max	7.5	3.07	2.47	251	97
	$\bar{x}$	4.74	2.13	1.91	220	91
	s	±1.3	± 0.48	±0.34	±22.4	± 6.2
Panicum miliaceum	min	1.77	1.67	1.47	106	74
(n = 10) *	max	2.30	2.07	1.93	122	100
	$\bar{x}$	2.05	1.89	1.65	109	89
	s	± 0.16	± 0.13	± 0.15	± 10.9	± 10.5
* (plus 1 *Panicum* which was noticeably underdeveloped):		2.0	1.17	0.9	171	77

Dimensions in mm of Vicia faba var. minor from the float and sink of Sample 21

Sample	L		B		T		% of total by weight
float (n = 25)	7.72 ± 0.85	(6.7–9.7)	6.27±0.58	(5.2–7.8)	6.13±0.54	(4.7–7.0)	52.54
sink (n = 20)	7.54 ± 1.0	(5.0–8.9)	6.26 ±0.79	(4.6–7.5)	5.92±0.95	(4.0–7.0)	28.8

Dimensions (in mm) of Camelina and Papaver seeds from Sample 21

Taxon		L	B	T
Camelina sativa	min	1.40	0.77	0.50
(n = 30)	max	1.73	1.07	1.00
	$\bar{x}$	1.53	0.96	0.72
	s	±0.10	±0.11	±0.11
Papaver somniferum	min	0.87	0.67	0.4
(n = 12)	max	1.07	0.97	0.8
	$\bar{x}$	1.03	0.81	0.64
	s	±0.09	±0.09	±0.10

Terasa cu Grîu, Sample 21, Jetsam

Taxon	Number	Wt.(g.)	Taxon as % of total wt. of carbonised seed
Vicia faba L. var minor	c. 44	4.21	28.8
Triticum aestivum L.	300	3.68	25.16
T. aestivum var aestivo-compactum (Schlem)	460	5.18	35.44
T. aestivum (underdeveloped grain)	35	0.20	1.38
T. dicoccum Schübl	25	0.29	1.99
Hordeum vulgare L. emend Lam.	6	0.08	0.55
Secale cereale L.	102	0.85	5.82
Panicum miliaceum L.	15	0.03	0.21
Camelina sativa (L.) Crantz		0.01	
'lumps'		0.07	0.48
Agrostemma githago L.	8	0.02	0.13
1 mm seed fragments			

Metrical Results for the Cereals from Sample 21, Jetsam (showing dimensions in mm and the indices)

Taxon		L	B	T	L :B	T :B
Triticum dicoccum	min	4.00	1.97	1.77	165	83
(n = 25)	max	6.20	3.33	(3.46*)	240	(128*)
				2.97		106
	$\bar{x}$	5.39	2.58	2.45	209	93
	s	±0.49	±0.32	±0.34	±19.5	±17.5

The figures in parentheses indicate that these values were obtained for single-seeded emmer which were included in the analysis.

Secale cereale	min	3.83	1.50	1.47	185	76
(n = 50)	max	6.67	2.57	2.37	357	111
	$\bar{x}$	5.00	2.01	1.95	252	97
	s	±0.60	±0.22	±0.22	±30.1	± 7.4
Panicum miliaceum	min	1.57	1.33	1.23	(79)	71
(n = 15)	max	2.40	2.00	1.80	145	(111)
	$\bar{x}$	1.93	1.66	1.42	118	86
	s	±0.28	±0.17	±0.19	±18.7	± 13.3

The figures in parentheses indicate that these values were obtained from millet which was very puffed, causing expansion of the width or thickness (section 2.4).

Sample 22

Taxon	Number	Wt.(g.)	Taxon as % of total wt. of carbonised seed
Vicia faba L. var minor	10	0.77	6.19
Triticum aestivum	146	1.63	13.09
T. aestivum var aestivo-compactum (Schiem)	490	6.33	50.9
T. dicoccum Schübl	50	0.68	5.46
Hordeum vulgare L. emend Lam.	6	0.12	1.00
Secale cereale L.	24	0.22	1.77
Panicum miliaceum L.	1		
Camelina sativa (L.) Crantz	100	0.04	0.32
'lumps'		2.66	21.37
Polygonum cf. persicaria			
Papaver somniferum	4		
Unidentifiable seed	2		
1 mm seed fragments		7.09	

Metrical Results for the Cereals Grains from Sample 22 (showing the dimensions in mm and the indices)

Taxon		L	B	T	L :B	T :B
Triticum aestivum	min	3.46	2.13	2.03	151	71
(n = 30)	max	5.67	3.33	2.67	232	105
	$\bar{x}$	4.84	2.83	2.36	173	84.2
	s	± 0.4	± 0.31	0.21	± 18.9	± 7.4
Triticum aestivum	min	3.80	2.60	2.10	118	63
var aestivo-	max	5.47	4.13	3.33	164	96
compactum	$\bar{x}$	4.59	3.20	2.57	141	78
(n = 60)	s	± 0.41	0.65	± 0.27	± 12	± 63
T. dicoccum	min	4.23	2.0	1.90	163	67
(n = 50)	max	6.67	3.67	3.23	258	116
	$\bar{x}$	5.48	2.77	2.58	201	92
	s	± 0.52	± 0.32	± 0.47	± 23.9	± 10.9
Hordeum vulgare	min	4.67	2.47	1.93	159	77
(n = 10)	max	5.60	3.13	2.50	207	91
	$\bar{x}$	5.06	2.73	2.24	184	82.4
	s	± 0.4	± 0.3	± 0.26	± 18.3	± 4.9
Secale cereale	min	4.45	1.70	1.60	215	82
(n = 17)	max	6.13	2.67	2.47	300	105
	$\bar{x}$	5.67	2.32	2.26	246	95
	s	±0.27	±0.27	±0.29	±21	± 7.3

Dimensions (in mm) of Camelina and Papaver seeds from Sample 22

Taxon		L	B	T
Camelina sativa	min	1.33	0.70	0.6
(n = 30)	max	1.87	1.23	1.07
	$\bar{x}$	1.57	0.98	0.87
	s	± 0.14	± 0.12	± 0.14
Papaver somniferum	min	1.0	0.8	0.6
(n = 4)	max	1.13	0.97	0.87
	$\bar{x}$	1.1	0.9	0.75

Sample 25

Taxon	Number	Wt. (g.)	Taxon as % of total wt. of carbonised seed
Vicia faba L. var minor	e. 114	8.33	28.23
T. aestivum L.	c. 432	3.84	13.02
T. aestivum L. var aestivo-compactum (Schlem)	c. 1680	13.52	45.81
T. aestivum, (underdeveloped)	125	0.36	1.22
Hordeum vulgare L. emend. Lam.	8	0.07	0.23
Secale cereale L.	426	2.09	7.08
Bromus secalinus L.	17	0.04	0.14
Panicum miliaceum L.	6		
Echinochlos crus-galli L.	1		
Camelina sativa (L.) Crantz	65		
Papaver somniferus L.	19		
Agrostemma githago L.	17		
Chenopodiaceae	6		
Polygonum of persicaria	1		
Urtica urens L.	1		
cf. *Bellis perennis L.*	1		
cf. *Artemisia vulgare L.*	1		
Galium cf. aparine	1		
Pyrus malus L.	1—2	1.25	4.24
1 mm seed fragments		2.4	

Metrical Results of the Cereals from Sample 25

Taxon		L	B	T	L :B	T :B
Triticum aestivum	min	3.67	2.07	1.93	140	75
(n = 40)	max	5.67	3.47	2.73	196	99
	$\bar{x}$	4.44	2.79	2.39	164	87
	s	± 0.77	± 0.31	± 0.20	± 12.1	± 6.7
Triticum aestivum	min	3.07	2.60	2.00	109	70
var aestivo-compactum	max	5.03	4.00	3.27	145	97
(n = 50)	$\bar{x}$	4.26	3.30	2.70	129	82
	s	± 0.47	± 0.38	± 0.28	± 9.2	± 6.7
T. aestivum	min	2.40	1.43	1.20	142	69
(underdeveloped)	max	3.63	1.79	1.54	201	98
(n = 50)	$\bar{x}$	3.17	1.97	1.90	169	83
	s	± 0.45	± 0.19	± 0.22	± 20	± 9
Hordeum vulgare	min	3.83	2.07	1.53	166	69
(n = 8)	max	5.67	3.33	3.07	200	92
	$\bar{x}$	4.99	2.88	2.38	175	83
	s	± 0.68	± 0.48	± 0.51	± 11.9	± 9.6
Secale cereale	min	3.80	1.69	1.20	178	64
(n = 50)	max	6.98	2.76	2.58	317	132
	$\bar{x}$	4.84	2.04	1.83	227	89
	s	± 0.69	± 0.28	± 0.30	± 44.5	± 13.2

Terasa cu Grîu, Sample 25, Jetsam

Taxon	Number	Wt.(g.)	Taxon as % of total wt. of carbonised seed
Vicia faba L. var minor	c. 48	3.49	17.57
Triticum aestivum	c. 465	4.5	22.64
T. aestivum var aestivo-compactum (Schlem)	c. 930	9.51	47.86

T. aestivum (underdeveloped)	173	0.8	4.03
Hordeum vulgare L. emend Lam.	1		
Secale cereale L.	208	1.57	8.01
Panicum miliaceum L.	3		
Camelina sativa (L.) Crantz	14		
Agrostemma githago L.	6		
Galium aparine L.	1		
Papaver somniferum L.	5		
Chenopodiaceae	3		
>1 mm seed fragments		2.38	

Comparison of the Dimensions and Indices of wheat from the Flotated and Sink Portions of Sample 25

Taxon		L	B	T	L :B	T :B
T. aestivum (Sink)	min	3.47	2.10	1.73	154	70
(n = 50)	max	5.70	3.40	2.70	203	97
	$\bar{x}$	4.59	2.67	2.16	1.74	83
	s	±0.49	±0.35	±0.43	± 26.7	± 5.9
T. aestivum (Flot)	min	3.67	2.07	1.93	140	75
(n = 50)	max	5.67	3.47	2.73	197	99
	$\bar{x}$	4.4	2.79	2.39	164	87
	s	±0.77	±0.31	±0.20	± 12.1	± 6.7
T. aestivum var	min	3.47	2.47	1.80	105	68
aestivo-compactum	max	4.77	3.67	3.00	150	100
(Sink) (n = 50)	$\bar{x}$	4.01	3.01	2.42	134	81
	s	±0.28	±0.28	±0.26	± 11.8	6.7
T. aestivum var	min	3.07	2.60	2.00	109	70
aestivo-compactum	max	5.03	4.00	3.27	146	97
(Flot) (n = 50)	$\bar{x}$	4.26	3.30	2.70	129	82
	s	±0.47	±0.38	0.28	9.2	± 6.7

THE EXPLOITATION OF ANIMALS

The exploitation of animal resources by the Dacians is complementary to consideration of the plants which they used. There are not yet enough data to make it possible to synthesise regional and chronological variation, or to talk about the economy as a whole. Some generalisations are offered here as a prelude to observations on the relationship of upland pastoralism to other aspects of Dacian society, and to the ethnohistory of the region, with reference again to the region of Sarmizegetusa.

The sites are few and little quantified evidence is available. The following brief summary is based largely on the work of Haimovici (1973), who refers to the following sites :

Stinceşti 5th—3rd B.C. In northern Moldavia near Botoşani.
Zimnicea 4th—1st B.C. On the Danube. (Hen and cat present)
Zimnicea Cemetery 4th—2nd B.C. (Ritual horse burials)
Răcătău 2nd—1st B.C. S. Moldavia, south of Bacău on the Siret.
Bradu 2nd—1st B.C. S. Moldavia, south of Roman on the Siret. (Hen and elk)
Pecica 1st B.C. — 1st A.D. On the Mureş below Arad. (Hen present).

Animal rearing was important to the Dacians, and the presence of exotic animals such as the hen and cat, both derived from classical sources long before Roman conquest, is of interest. So too is the presence of five or six individuals of elk at Bradu, for this animal was conventionally thought to have retreated well into northern Europe before Neothermal times. In fact there is a concentration of toponyms derived from the elk in Romania today, concentrated on the northern Carpathians around the valleys of the Bistriţa and Moldova, and in Moldavia itself. In Bukovina there is a similar dense concentration of toponyms based on the aurochs (Filipaşcu, 1969). This is another indication of the faunal richness of Moldavia, which is apparent from the records of fauna at late Glacial sites, through to the accounts given by Dimitri Cantemir, ruler of Moldavia, in the 18th century A.D. This was the last region in the world where the aurochs *(Bos primigenius)*, which is consistently present among Dacian hunted species, survived in the wild. It formed the principal element in the arms of Stephen the Great of Moldavia (1457—1504) and its appearance and behaviour are described by Cantemir. The last animal, an aurochs cow, died in captivity

in the forest part of Jaktorowka, 55 km west of Warsaw, in 1627, only 46 years before Cantemir was born. It is also apparent that such species as bear or deer, which are now thought of as mountain animals, were much more widely distributed in Dacian times, into the foothills and even lowlands of Transylvania and Moldavia, as indeed was the forest itself.

The fact that the decline in forest species was not yet felt also relates to the question of when mountain vegetation was cleared for pasture. In Bulgarian pollen diagrams (Filipovich, 1978) it is in the Bronze Age that the first traces of such clearance appear in the Stara Planina. Near Sarmizegetusa we shall see below important evidence for pasturage, and thus circumstantially for clearance, at 1,400 metres during Dacian times. The Dacians had dogs, of variable morphology but all of large size, comparable to the mastiffs still used to guard sheep in south-east Europe, which themselves have clear relationships with descriptions of sheep guard-dogs from Roman times, mainly in southern regions (such as the 'Molossian hounds'). There is no direct evidence for the association of Dacian dogs with sheep-rearing in the uplands, but they would certainly have been needed for protection from several of the forest fauna just mentioned, especially wolves and bears, so that it is worth pointing out that they were available to the Dacians. Sheep in the Romanian Bronze Age and Iron Age are larger than those of the Neolithic of Romania, and Haimovici considers that they may have had a different wild ancestry. Dacian goats are also relatively large, and there are no *Capra aegagrus*, only *C. priscus* being represented. Both bovids (perhaps the most important Dacian domesticates on the sites analysed) and pigs (a primitive animal with a long snout) were more numerous than ovicaprids in the bone remains. At Pecica pigs dominate, just as they were of importance in the Banat in modern times. As with plant remains there is thus already evidence for regional variety in Dacian economic practice. One of the points to be made here is that this operated not merely regionally but also in terms of altitude. Horse was important to the Dacians, although numerically the remains come after pigs and ovicaprids. There were two breeds or varieties, a taller one of up to 140 cm (13.2 hands) for riding and stockier animals for pack work. Haimovici feels that horse was sometimes eaten, but some individuals of advanced age are also known. One of the riding horses was found in the rich burial of Agighiol. The presence of the pack animal has a bearing on the nature of economic practice which is quite far-reaching; the effect of its absence is seldom taken into account in considering neolithic economies in south-east Europe, nor is the precise time and the impact of its emergence. Deer, boar, aurochs, bear, wolf, beaver and other forest animals were also hunted by the Dacians. At the site of Cîrlomăneşti, lying at c 200 metres in the Buzău region, ovicaprids predominated in the Dacian levels (second century BC to mid first century BC) taken as a whole, although the representation varied between different samples (Udrescu, 1977). The species represented as a percentage of the Minimum Number of Individuals are as follows:

	%
Bos taurus	19.3
Ovis-capra	33.9
Sus domesticus	21.5
Equus caballus	6.1
Canis fam.	2.6
Cervus elaphus	6.1
Sus scrofa	4.4
Capreolus capreolus	3.0
Lepus europaeus	0.8
Ursus arctos	0.8
Meles meles	0.4
Castor fiber	0.8

SARMIZEGETUSA AND THE 'STÎNE'

Highland zone exploitation is often of a seasonal nature, with impermanent settlement forms, and utilising a wood-based technology in the service of an economy which exploits other organic resources such as leather and wool, bone, bark, cheese and other milk products. The nature of the evidence has ensured that highland zone exploitation throughout prehistory has to some extent been underestimated, although we know of the presence of man at high altitudes in the Italian Alps (Colbricon, at 2,200 metres/7,200 feet) and in the Carpathians in Romania (Ceahlău, at 1,300 metres/4,200 feet) at least as early as the sixth millenium. These were probably hunting sites. Some of the best archaeological evidence from Europe for early exploitation of the highland zone comes from Romania and from a Dacian context. It is also an early indication of the pastoral exploi-

tation which has remained so appropriate and characteristic a feature of the Romanian mountain zone throughout history. The evidence comes from excavations by Hadrian Daicoviciu (1972; 153 sqq. e.g.) of sites some of which may be described as Dacian '*stîne*', and is worth summarising briefly for English readers. The *stîna* (pl. *stîne*) is the complex of sheepfolds and shelters, with various forms and purposes, around which upland pastoral activities in Romania revolve. It is not necessary to suppose that all upland sites are *stîne*, and the Dacian examples comprise a wide range of activities.

The two main sites of Meleia and Rudele lie at 1,300—1,400 m/4,300—4,600 feet in the Sebeş mountains of the southern Carpathians, on the watershed immediately south of the Dacian capital and its sanctuaries at Sarmizegetusa. The ridge of Dealul Grădiştei, together with Terasa cu Grîu, is already at about 1,100 metres/3,600 feet. Similar sites exist on the nearby mountain of Tîmpul, at 1,495 metres/4,905 feet (Materiale, 8, 1962, p. 474).

At Meleia and Rudele 15 low mounds some 10—20 metres in diameter were excavated by Hadrian Daicoviciu, leaving several more as controls. They proved to contain hut remains within circular arrangements of stones, sometimes in concentric rings. The huts are in general circular, one or two are rectangular, and several are D-shaped, apsidal rectangles with one curved end, within an outer ring of stones. They evidently functioned as sites for summer occupation, since they were made without the use of pisé daub in the crevices of the walls. This is clear since a third of them were burnt. There is abundant pottery but little metal compared with what is normal from a Dacian house. Little use is made of the iron nails, tiles and other sophisticated structural elements which are standard on the Dacian domestic sites lower down, at Feţele Albe or Dealul Grădiştei. Although rare, the iron objects do include such things as door-hinges, knives, swords, spears, keys, hammers, axes, nails with broad heads as used in Dacian houses, and spurs. The pottery includes many large storage vessels, and specific forms; one in particular has a collar and no base, so that by tying on a piece of fabric and resting it inside another vessel it can be used as a strainer, indicating the processing of milk products. There are also flints, perhaps used for fire-lighting, and whetstones. The roofing may have been of shingles, and carbonised pine was found, whereas the pastures are today surrounded only by beech forest. The sites were visited in 1980; their location is consistent with summer pastoral interpretation, having access to areas of the gentle gradient which is an important factor in defining areas of upland pasture. One of the natural advantages of the southern Carpathians in general is the existence at high altitudes of vast extents of flat pasture land running for great distances along the mountains. These are known to Romanian geologists, concerned with the reasons for their formation, as *Boresco surfaces*, and they have conferred notable advantages on the evolution of pastoralism in Romania.

We may summarise some main examples from Rudele and Meleia, on the basis of Daicoviciu's reports in volumes of *Materiale şi Cercetări Arheologice* (abbreviated as Materiale).

Rudele, Mound 3 (Materiale, 5, 1959, p. 386) covered a buried soil and consisted of two rings of stones forming an annular torus round an enclosure which contained an apsidal D-shaped hut. The torus was some 20 cms. lower that the hut enclosure, and probably functioned as a sheep fold. The enclosure floor was of light yellow clay with admixture of much sand and spread over fine gravel. There was a hearth in front of the hut slightly to one side of the flat face, and another one within it. The pottery includes wheel-turned lid shapes which could be turned upside down and used as bowls. A Dacian lamp with a ring foot was also found. Daicoviciu sectioned a stretch of an ancient road in the vicinity.

Rudele, Mounds 1, 4 and 5 (Materiale, 6, 1961, p. 341). Mound 4 had a rectangular hut in an oval enclosure. A cabin of logs laid horizontally on the stone foundation is postulated. Mound 1 had a poorly preserved oval or possibly apsidal hut, with two hearths. Mound 5 contained an oval hut, which significantly was overlain by a nineteenth century stîna.

At *Meleia* sites were found on terraces on the hillside. Terrace I had an apsidal hut within two stone enclosures, again with hearths both before and within the hut. This arrangement is repeated in the more fragmentary remains of Terrace VIa, and in the stîna on the plateau at Meleia (Materiale, 6, 1961, pp. 311—4). At Stîna 3, as well as a rectangular hut, there was the remains of a circular shelter for sheep: a *Cerdac*, which consists of a roof without walls, supported by uprights resting on stones. This type of shelter, a common part of modern pastoral practice, seems to be attested both by the form and by the way in which the structure burned from the roof down (Materiale, 8, 1962, p. 469). It contained such objects as nails from the structure, spurs, iron slag, and carbonised grain and millet.

The interpretation of these sites is facilitated by the rich ethnohistorical material available in Romania. This type of evidence is most valuable when it derives from within the regions involved. Daicoviciu (1972; p. 161) has already drawn attention to the description by Vulcănescu (1965)

of Romanian stîne with analogous arrangements of sheep pens surrounding the hut. Vulcănescu's examples come from the region of Mehedinţi, within a hundred kilometres of Sarmizegetusa. The remains at Rudele and Meleia give certain indications about the organisation of the *stîne*. The relatively large quantities of pottery indicate that these are not transhumant sites distant from a locus of settlement, but are close enough to the village to make support practicable. This was possibly on a rota system, for which there are modern analogies. Food could be brought in quite easily, over and above the milk products which would have been available in the spring and early summer, especially with the pack animals available to the Dacians. The spurs from Stîna 3 at Melcia attest to the fact that horses were ridden up to the site. This then, rather than Daicoviciu's suggestion that not all the huts were abandoned over the winter, would account for the quantity of pottery. In any case, as he points out, we are dealing with large and well-organised probably pastoral establishments. Although there are modern analogues for temporary agriculture up at modern stîne it is not necessary to suppose that the carbonised grain and millet attest to local cultivation. Nor, in the absence of grains, does the presence of querns on such sites necessarily indicate either agriculture or the use of cereals, for in Romania simple querns and rubbers are used by the shepherds to grind up rock salt for feeding to the sheep. In the fact that it is necessary to give sheep salt when on the high pastures, every eight or ten days, Romania has another advantage in being abundantly provided with rock salt, and there are Dacian sites adjacent to the salt deposits. The earliest evidence for briquettage from Europe comes from a First Temperate Neolithic context c. 5000 b.c. in Romania, at Solca in Moldavia, a Criş site at 650 metres/2, 100 feet (Ursulescu 1977). The Criş site of Valea Răii lies on a saline stream. Briquettage indicates transport and exchange of this essential commodity over a distance.

The finds of spindle whorls (e.g., at Stîna 5 at Meleia) almost certainly attests the presence of women on the sites. Especially among shepherds in Romania men do practise spinning, but much more usually with another weighted device, the *tocălie* or *crivala*, which operates without either distaff or spindle whorls (see e.g., R. Vuia 1958). The presence of women is an important factor when trying to assess the organisational structure and type of seasonality which is in question at any given site. Women were, is some Romanian models of pastoralism, absolutely forbidden access to the stîne. Other kinds of activity are indicated by the iron objects already listed, and by the presence of iron slag. Further work on the neighbouring sites of the microregion is necessary before we can be certain what was going on as a whole and what was the full range of Dacian activities in this highland area.

While in some respects less rich that the Dacian domestic sites these *stîne* are more informative than any other archaeological evidence of prehistoric highland zone exploitation or pastoralism from the whole Carpathian chain. They emphasise the early development of patterns of behaviour recogniseable even today, precisely because so well adapted to the niche in question. They show that evidence for economic behaviour does not derive solely from the testimony of plant and animal remains, certainly not from the literal relationships between the frequencies at which these survive on a site. The difficulty we seem to find in refining on the interpretation of such organic remains, beyond a certain point of identification and quantification, arises precisely from treating them without reference to other archaeological evidence for practice, such as is provided for example by the *stîne*. As we now realise, quantification in economic matters is meaningless without reference to human behaviour, and this behaviour has parameters which extend far beyond the economic field.

For example it seems inescapable that, as Glodariu (1976) has emphasised, the architecture of the religious and ceremonial centre at Grădiştea Muncelului is a formalised reflection of Dacian domestic architecture. The plan of the great circular monument 90 feet in diameter at Sarmizegetusa is a faithful copy in dressed andesite of a plan such as that of Meleia Stîna II (fig. 1, 2, 3), with a D-shaped central hut. The position of a fireplace in front of the hut, and even the compass orientation of the hut, are the same; and this is repeated at Feţele Albe and at Rudele. It is interesting therefore that it was this plan, among a number of Dacian domestic house plans, which was chosen for the most important and striking of the circular sanctuaries, as a symbolic representation of the ways in which different spheres of the complex of human material and spiritual culture are integrated. Bearing in mind that at Terasa cu Grîu another type of Dacian domestic plan is represented, in which limestone blocks disposed on a rectangular grid held horizontal sleeper beams for a house, it is possible that the rectangular sanctuaries at Grădiştea and other sites reflect this alternative kind of construction. At the small rectangular sanctuary on the same terrace as the great round sanctuary there are traces of what

seems to have been a staircase leading up from outside to a level which could have been that of a floor above the column bases. This stair passes over the top of the andesite marker pillars of the rectangular sanctuary, which both in this case and that of the circular sanctuary can be seen to represent the enclosure around the house, by analogy with sites such as Meleia, and not part of the house itself.

Fig. 1. Grădiştea Muncelului. Lump of fused seeds of *Camelina sativa* from the burnt Dacian house on Terasa cu Grîu

Fig. 2. Grădiştea Muncelului. Surface detail of fused *Camelina sativa* seeds from Terasa cu Grîu. Surface patterning of the seed coats is clearly preserved. Dimensions are given in the analyses (eg., Sample 21), with average lengths being c.1.5 mm.

Sites such as Meleia, Rudele and Tîmpul are ideally placed to be *stîne*, but it does not seem that this was their sole function. If they were *stîne* the role of the *stîna* and the range of activities carried out there must not be assumed automatically to equate with those found at the modern Romanian *stîne*. Nor does the presence of iron slag make them into industrial sites. This they clearly were not, for it is too sporadic and is evidence of casual rather than large-scale iron-working. It is hoped that future studies of the micro-region will carry forward our knowledge of this highland zone exploitation, and allow it to be integrated with the wider picture we already have of this complex Iron Age society on Romanian soil. Whether they include *stîne — sensu stricto* or not, the importance of these sites lies in their confirmation and amplification of the testimony of Classical sources, that the Dacians exploited the mountain zone.

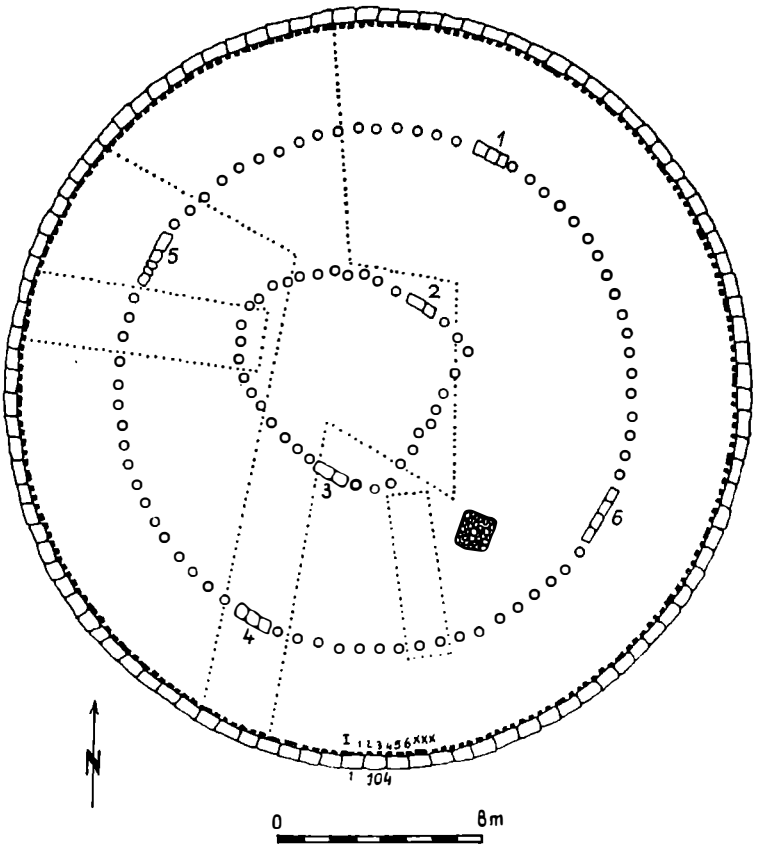
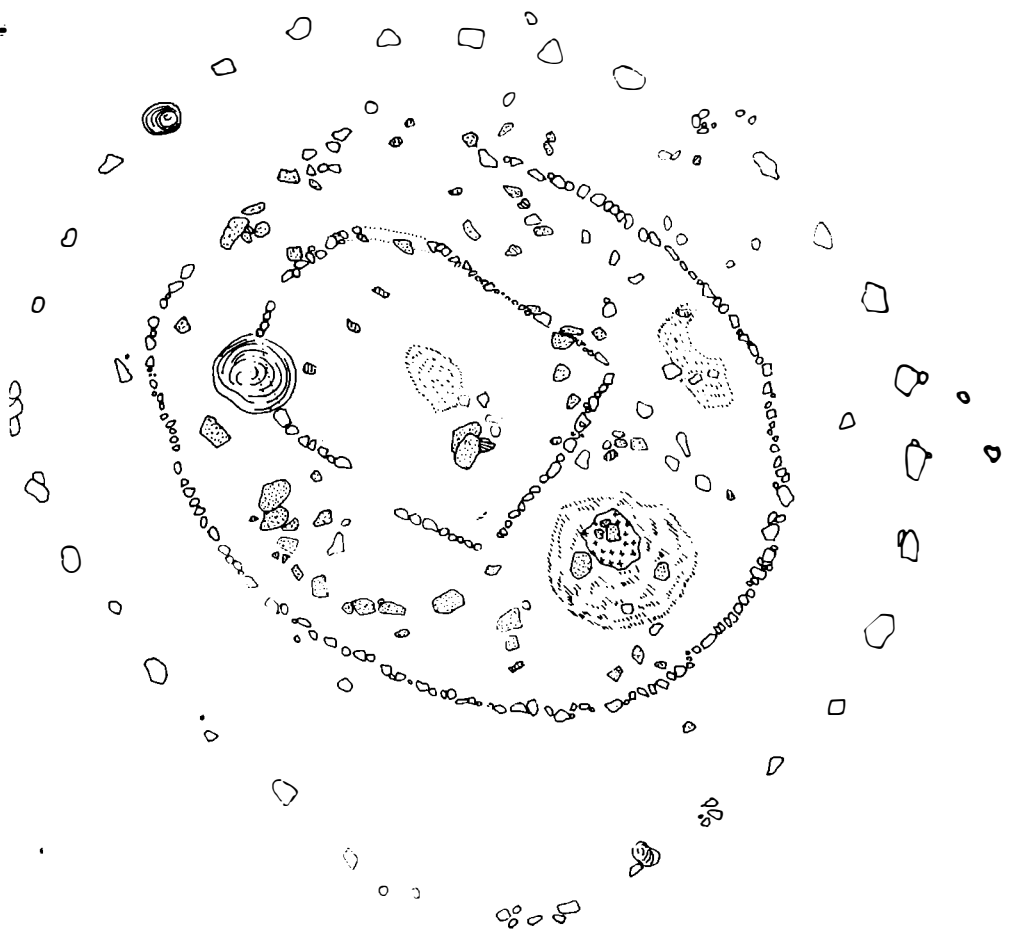


Fig. 3. Grădiștea Muncelului. Plan.



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