The Analysis of Materials from Papiškės IV Site Using Computer Databases

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Our knowledge of the Lithuanian stone age is in many cases based on data recovered from very large sites. The areas excavated sometimes extend over several thousand square meters and some assemblages contain more than 100 thousand artefacts. As a rule, most of the large sites contain more or less mixed materials from different periods. Nevertheless, these archaeological monuments remain very significant for prehistory studies, because they can provide unique and sufficiently reliable information about the past. The development of methods and techniques to work with materials from these mixed sites is a very important goal.

Large bodies of archaeological data provide the potential to address particular questions using quantitative methods. The problem is, that large amounts of data require enormous numbers of calculations and considerably slows the progress of the investigations. The volume of data has especially increased in Lithuania in recent years since the introduction of the method of exact point recording. This method improved the quality of documentation, but time expenditures for spatial distribution analysis became very significant. The only way to make research proceed more quickly and effectively was to employ computerized databases using personal computers.

The site of Papiškės IV, located in the Vilnius district, was excavated in 1989-1991 and was chosen for this case study. The site contains materials from at least three periods: Mesolithic, Middle Neolithic and Early Bronze Age, and might be referred to as mixed (Brazaitis 1992). The main goal of the investigations was to characterize the features of the assemblages from each period using computer databases. Since a standardized system for the recording of archaeological materials from the Stone Age has never been established in Lithuania, another, and probably the most important goal of the study was to find a suitable form to record and store the data in electronic memory and to find appropriate methods for further analysis that would be useful for working with multi-component sites containing large amount of data.

Papiškės IV is situated along the upper reaches of the Vokė river, approximately 20 km south west of Vilnius. The site occupies a small sandy-gravel hill in the river valley. The cultural deposits were covered by a layer of peat which preserved organic materials such as bone and amber.

The excavations were started using a very traditional method of documentation. Artefacts were recorded according to observable stratigraphic layers and collected from 4 m^2 grid units. The exact positions of flint tools and other

major finds were indicated on the maps of the excavated area. During the second year of excavations the method of exact point recording was introduced. Almost 400 artefacts considered as important for further investigations were recorded in this way. Papiškės IV was probably the first site in Lithuania on which this method of documentation was employed.

The standard descriptions of artefacts were translated to coded sets appropriate to computerized analysis and entered into databases. An attempt was made to use a large number of attributes. Altogether four databases were created for different kinds of artefacts. The database for individual flint artefacts consists of 1872 records with point provenience data, including 377 with depth measurements. In addition to stratigraphic data, the following variables were chosen to describe flint tools:

- colour
- degree of patination
- type of flint piece taken for tool production
- type of fragment
- direction of negative flake scars on the dorsal surface
- dimensions
- three level typological classification
- presence/absence of particular technologies of flint processing
- several secondary attributes

A total of 9505 pieces of flint debris were sorted and entered into a second database according to the following attributes:

- type
- degree of patination
- presence/absence of use-wear traces
- size (ranged)

Pottery was described indicating:

- type of tempering material
- thickness of potsherds (ranged)
- diameter of rim and base
- shape of rims and bases
- type and position of decorations
- several secondary attributes

The databases for flint debitage as well as ceramics have provenience recorded only as grid data. The last database was provided for other artefacts made from stone, bone and amber. This contains point provenience data and description in terms of:

- raw material
- dimensions
- type of fragment
- three level typology

All artefact types were assigned to chronological periods using typological and some other criteria. Actually, chronological definition should be considered as derivative data, but it appeared useful to address at this stage with regard to a general intrasite spatial distribution analysis. The analysis was undertaken using a standard commercial data management software package, Microsoft FoxPro. Spatial distribution maps were generated using SURFER of Golden Software Inc.

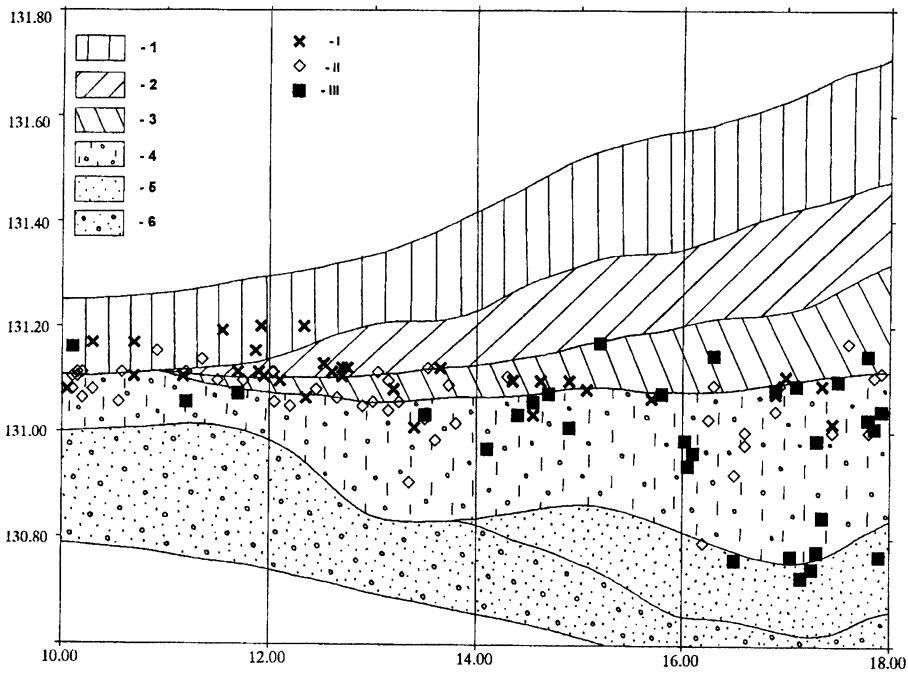

Fig. 1. Profile section of Papiškės IV. 1 – ploughed peat; 2 – black peat; 3 – brownish peat; 4 – gravel with organic content; 5 – gray sand; 6 – gravel and sand without organic content. I – Early Bronze Age artefacts; II – Middle Neolithic artefacts, III – Mesolithic artefacts

The first question was if it was it possible to confirm the typological subdivision of the material into chronological units based on the stratigraphic evidence. Figure 1 shows a profile section through the excavated area on which the positions of flint artefacts are indicated. Flint artefacts from different periods are depicted with different symbols. This section shows clearly that the material is mixed, and that the vertical distribution of the chronologically diagnostic flint artefact types do not correspond to observable layers. Nevertheless, calculations of the average depth of these show that the earliest artefacts tend to be situated deeper than the latest ones. This confirms the initial subdivision of material into three periods. Similar calculations were made for shorter sections. It appears that there was better stratigraphic resolution on the slopes of the hill. In the central part of the area tested the materials were more mixed. This is interpreted to be the result of disturbances connected with later activities and a less intensive process of accumulation of the cultural deposits on the top of hill.

The computer allows one to quickly identify each artefact, and to correct its chronological assignment if necessary. A separate group of Mesolithic flint material was revealed near the eastern border of the excavated area in the sand layer. Using lists extracted from the computer databases, Mesolithic materials were re-examined. Section A of Fig. 2 shows the major flint tools found within this group, and section B depicts flint artefacts from the upper stratums. Typological differences between the two groups are obvious and probably represent separate phases of occupation during the Mesolithic. Group A might be associated with a

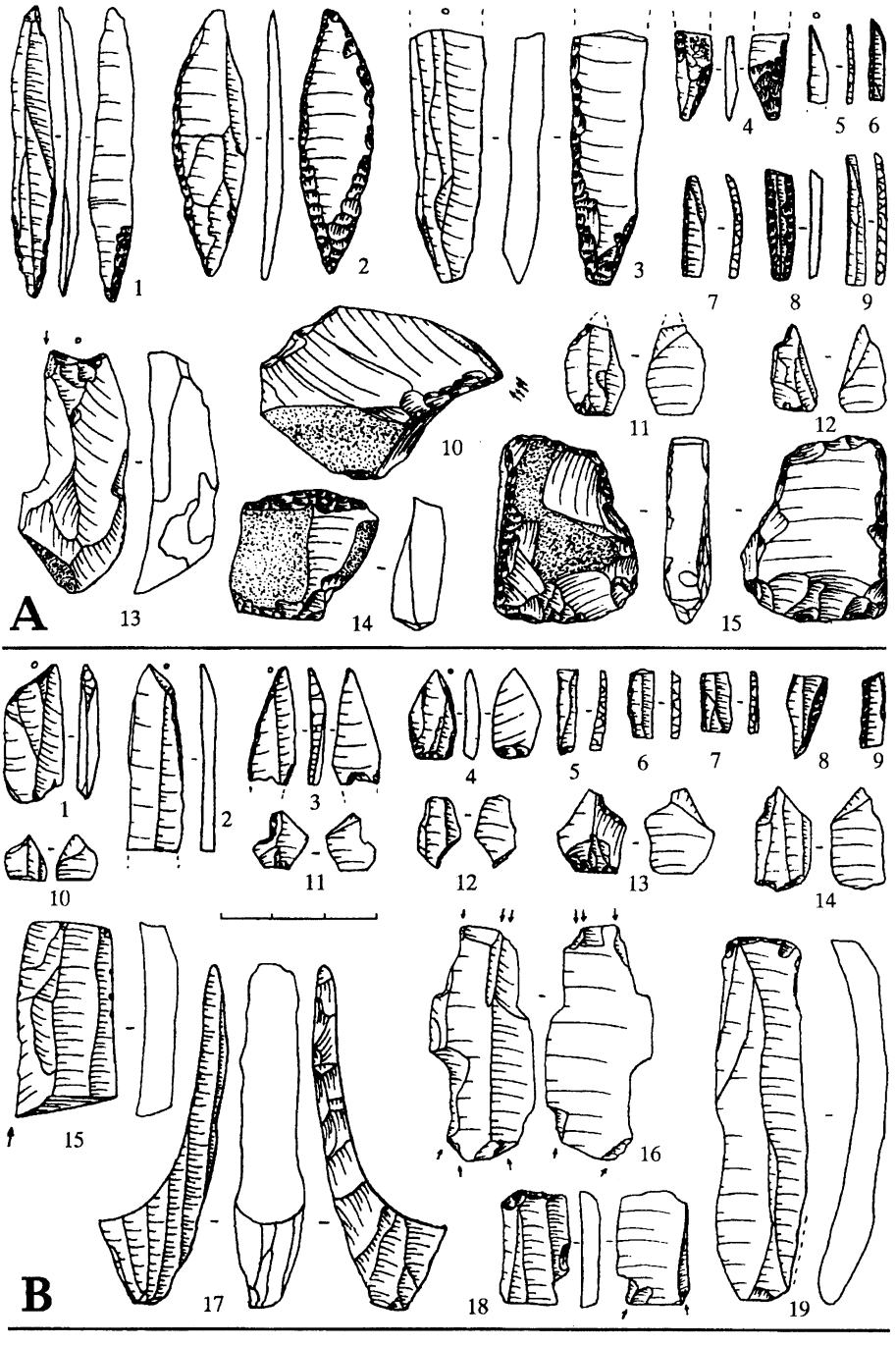

Fig. 2. Mesolithic artefacts from Papiškės IV. A – artefacts collected from gray sand layer. B – artefacts collected from upper stratums

radiocarbon date of 8770 +/- 150 BP. derived from a charcoal sample taken from the sand layer at the same depth. The types of flint artefacts recovered here, such as tanged points and burins, support the radiocarbon dating. This group is comparable to materials from the Early Mesolithic sites of Netiesai, Drąseikiai and some others in Southern and Central Lithuania (Rimantienė 1984a:60-64) and should be associated with the Swiderian archaeological culture tradition. Group B contains microlithic tools and probably represents a Late Mesolithic phase. More precise characterization of the second assemblage is problematic because the cultural deposits of this phase have been affected by later activities. A concentration of late Mesolithic flint tools was also revealed in central part of the excavated area.

Analysis of the horizontal distribution of the materials may be employed as another line of evidence. This was used to distinguish materials from Middle Neolithic and Early Bronze age. The basic presumption was that during each occupation phase different areas of the site were used for activities and waste dumping, and that this might be observable on the distribution maps of artefacts.

The distribution of microlithic points illustrated in Fig. 3 shows the concentration in the southern portion of the investigated area. Almost the same situation was observed in the distribution map for microburins. These are considered to be waste material from the manufacture of microlithic points. The distribution of bifacially flaked points (Fig. 4) contrasts dramatically with the previous figure. Bifacial points were recovered from the whole area. A concentration of irregularly shaped points with denticulate edges was observed in southern portion, while precisely made heart shaped bifacially flaked points were situated in the northern part of area. Based on traditional criteria, these typological differences are understood to have

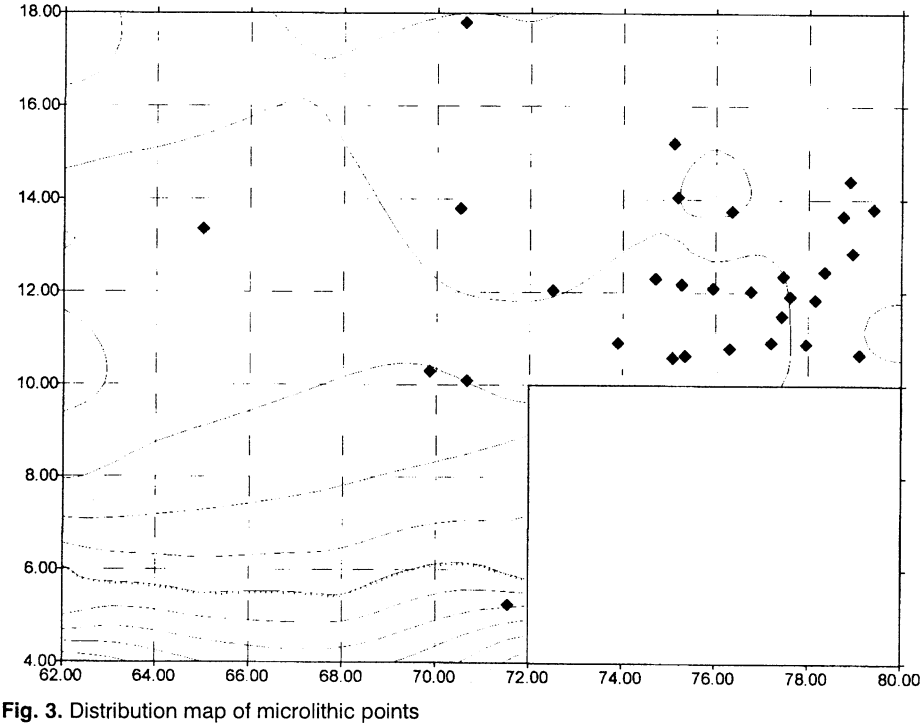

Fig. 3. Distribution map of microlithic points

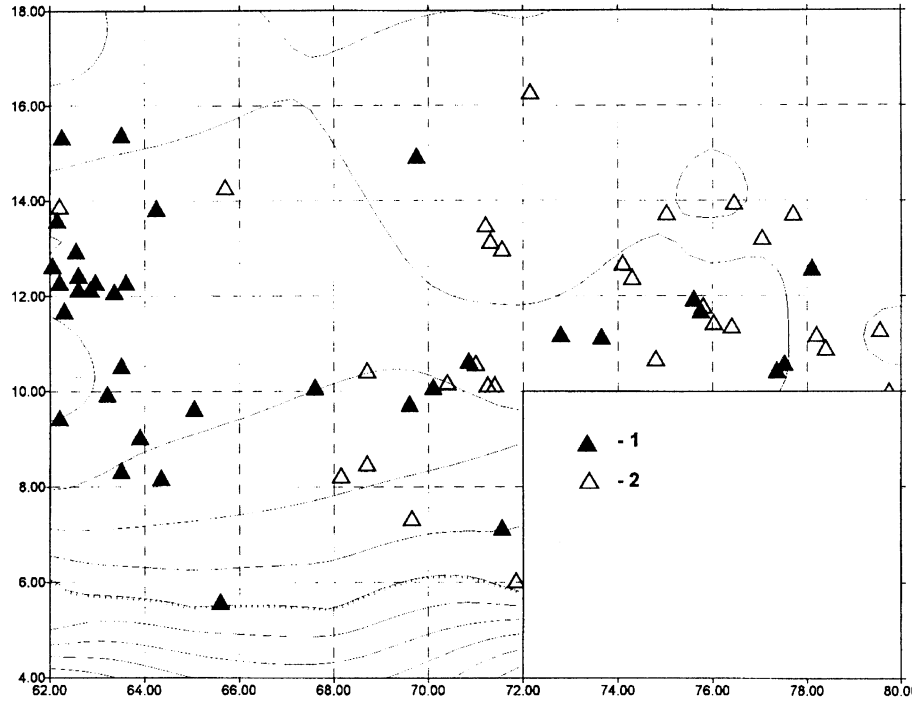

Fig. 4. Distribution map of bifacially flaked points. 1 – Early Bronze Age points; 2 – Middle Neolithic points

chronological significance, the microlithic points dating to the Middle Neolithic and the bifacial points to the Early Bronze distribution analysis thus indicates Early Neolithic activity to have been concentrated mostly in the south of the excavated area, while some Early Bronze Age activity took place over the whole area but mostly in the north. This deduction was taken as a basis or further analysis.

In an attempt to distinguish the overall materials from these periods their average position along the south-north axis of the excavated area was calculated. Selected results of this analysis are presented in Table 1. The column "X average" represents the mean position along the north-south axis of all artefacts of the type indicated in the column "Characteristic". The column "Quantity" indicates the number of artefacts of each type. The column "Index" is presented to aid in the evaluation of the results. Here the median south-north value (70.80) is subtracted from the X average such that the Index more clearly reflects where the artefacts were concentrated. Those predominantly from the northern part of the excavated area have negative values (Early Bronze Age association), while those predominantly from the south have positive values (Middle Neolithic association).

These calculations allow one to distinguish the probable phase of occupation of the artefact groups (column Characteristic) based on the Index, independent of their traditional chronological associations. For example, small and narrow tools (1 and 3) are observed to have positive Indexes and thus should be related to the Middle Neolithic while large and wide tools (2 and 4) have negative Indexes and should relate to the Early Bronze Age. This is consistent with what is generally understood to be the case for tools from these periods. Similarly, general tools

Table 1. *Selected results of artefacts distribution along south-north direction*

No.	Characteristic	X average	Quantity	Index
1	flint tools < 3.5 cm long	71.06	200	0.26
2	flint tools >3.5 cm long	68.71	110	-2.09
3	flint tools < 2 cm wide	71.22	140	0.42
4	flint tools > 2 cm wide	69.18	162	-1.62
5	flint tools made from blades	71.87	193	1.07
6	flint tools made from flakes	69.25	395	-1.55
7	blade end scrapers	72.11	9	1.31
8	flake end scrapers	69.83	61	-0.97
9	microlithic points	75.33	30	4.53
10	microburins	77.93	23	7.13
11	points with denticulate edges	73.34	17	2.54
12	heard shaped bifacial points	65.52	15	-5.28
13	flake end scrapers with point	69.20	8	-1.60
14	flake end scrapers with wide edges	68.09	11	-2.71
15	knives	68.44	118	-2.36
16	pointed knives	67.47	23	-3.33
17	polished flints	65.48	60	-5.32
18	tools with surface retouch	68.60	300	-2.20
19	tools with bifacial retouch	69.15	123	-1.65
20	potsherds with mineral temper	70.71	178	-0.09
21	rimsherds with mineral temper	73.00	10	2.20
22	potsherds with organic temper	68.22	953	-2.58
23	rimsherds with organic temper	64.33	15	-6.47
24	amber	77.57	4	6.77
25	bone - antler tools	65.50	7	-5.30

made from blades (5) and end of blade scrapers in particular (7) have positive Indexes and should be Early Neolithic, while tools made from flakes (6) and flake end scrapers (8) have negative Indexes and should be Early Bronze Age. These conclusions as well are consistent with the knowledge that blades were used for tool manufacture in the Middle Neolithic, but not in the Early Bronze Age. Furthermore, the groups pointed flake scrapers, flake scrapers with wide edges, knives and pointed knives (14 to 16) all have negative Index values indicating an Early Bronze Age association. This too is consistent with the traditional chronological associations of these tool types. Finally, categories reflecting types of flint processing technologies, such as polished flint, tools with surface retouch and tools with bifacial retouch, have negative Index values and should thus be Early Bronze Age – and it is known that these technologies are most common for Bronze Age artefacts.

The pottery materials from the site are poorly preserved and are very fragmentary. Two types of clay mass were observed: that tempered with organic admixtures and that tempered with mineral admixtures such as sand and crushed

granite. The stratigraphic data (recorded according to observable layers) was inadequate to address questions concerning chronological association of these types. The Indexes in Table 1 (20 to 23) indicate that ceramics with organic temper tend to be found together with Bronze age artefacts. The late age of this pottery is confirmed by such features as flat bases and cord impression decoration. This conclusion is very important for the cultural context in South East Lithuania. According R. Rimantienė this region was occupied by inhabitants of Nemunas culture during middle Neolithic and by Corded Ware Pottery culture in Late Neolithic (Rimantienė 1984a, fig. 99, 106). The pottery of both cultures contains mineral temper, so the shift to organic temper in pottery manufacture technology during Early Bronze age does not fit with this sequence. Ceramics with organic admixtures are comparable to Late Neolithic and Bronze age materials of the Late Narva culture in North East Lithuania (Girininkas 1994:178-190). The appearance of this kind of pottery in Papiškes should be considered as a result of expansion of the Late Narva culture to the south, something that has never been observed before. The presence of ceramics with organic temper is recorded also in some other South Lithuanian sites such as Barzdžio Miškas (Rimantienė 1984b).

It is difficult to judge the chronology of the amber ornaments from the site using typological criteria. Neither was the site stratigraphy adequate to address their chronological association, so only the evidence of their horizontal distribution allows us consider them as Middle Neolithic artefacts. The opposite situation is the case with bone-antler implements and with the osteological materials. The preservation of organic materials is highly dependent upon micro-environmental conditions. Most likely, bone artefacts should be represented only from the latest phase of occupation. This was confirmed also by the horizontal distribution analysis.

Analyses of the same artefacts categories using vertical stratigraphy data have partly confirmed the horizontal distribution analysis presented. However, these are not reliable enough due to the low numbers of artefacts with depth measurements. Nonetheless, this type of intrasite analysis using a combination of horizontal and vertical distributions is considered here to have a great potential for investigating mixed multi-component sites, but it requires very detailed recording and might be applied to only a very few sites that have been investigated in Lithuania to date.

The calculation of average position along one axis is a rather simplified technique of spatial distribution analysis. Obviously, more open and complicated sites will require more sophisticated techniques. Nevertheless, this approach appeared successful in the Papiškės IV case in spite of the small size of the site. On the other hand, the assemblages from the Middle Neolithic and Bronze age periods have significant typological differences, which allow them to be more easily observed as groups in the distribution maps.

Probably the main weakness of this approach is the possibility that different areas may have been used not only in different periods, but that they may also have been used in the same period. That is to say, the horizontal patterns observed may reflect chronologically distinct activities and/or contemporary or nearly contemporary activities. The best way to avoid the misinterpretation is to compare the distributions of typologically different artefact groups devoted to the same purposes. In this case, for example, the comparison of the distribution of flint projectile points, ceramics and some other artefacts in Papiškės IV site obviously reflect chronological patterns.

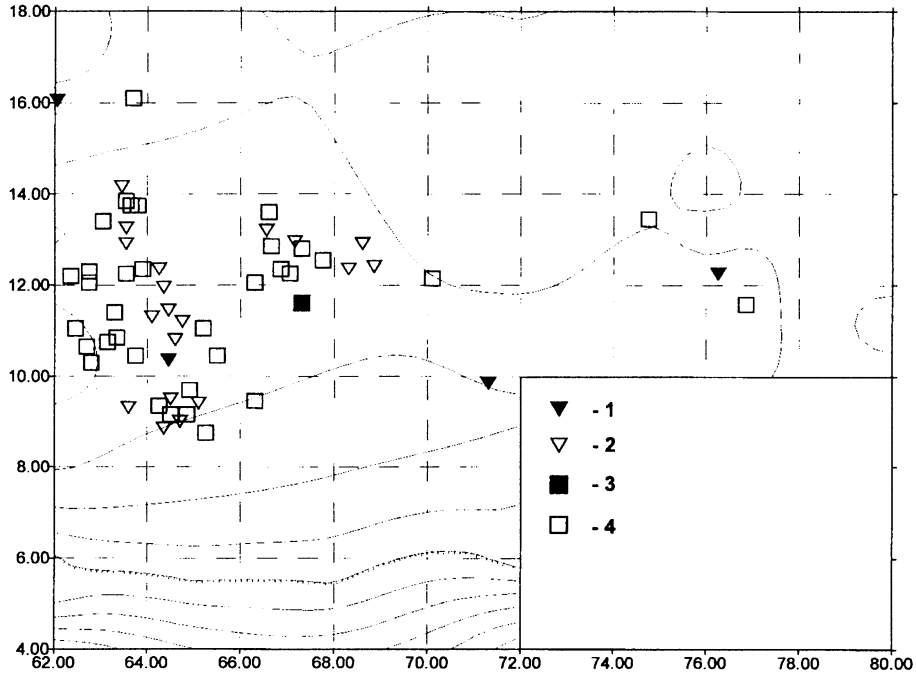

Fig. 5. Distribution map of artefacts with polished surfaces. 1 – polished axes; 2 – polished flakes with remians of axe edges; 3 – polished ax reused as core; 4 – polished flakes

A very limited number of features were observed on the site. The absence of postholes, hearths and other features restrict the possibilities to identify areas devoted to dwelling and/or other activities. Those gaps might be partly recovered through the analysis of distribution maps. Fig. 5 shows the distribution of flint artefacts with polished surfaces. Polished flakes with remains of axe edges (open triangle) indicate an area where polished axes were used. Accepting the presumption that axes were used for building dwellings, we can identify the places were dwelling construction was undertaken. In addition to the axe edge fragments, a polished axe with an exhausted edge was found (filled triangle). The open rectangles indicate flakes with polished surfaces without the remains of axe edges. The origin of these flakes might be either: damage during use of the axe, or recycling of the axes. One polished axe reused as a core (filled rectangle) was found near the accumulation of polished flakes. Both activities (usage of axes and axe repair) were observed in the same area in the northern (Early Bronze Age) part of the excavation. It is thus here that dwellings were likely placed.

Another distribution map (Fig. 6) is an example of working with gridded data. It shows quantities of small flakes (up to 15 mm long) in units of 4 square meters. Small flakes are considered as waste material from the manufacture of flint tools. Large accumulation of small flakes (over 2000 pieces) were observed in the northern part of investigated area. Many of them have traces of surface retouch on their dorsal face. The concentration was interpreted as a place where a master had manufactured surface retouched implements, most likely bifacial

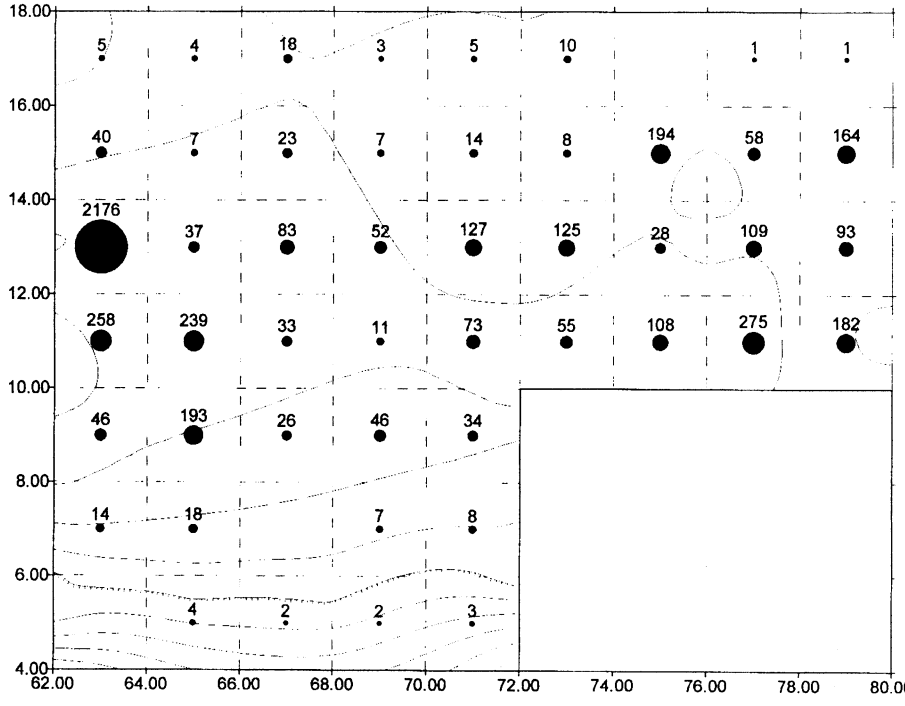

Fig. 6. Distribution map of small flakes

points and knives. According to its position, this group belongs to Early Bronze age phase of occupation. A large number of small flakes was also recorded in the southern part of the excavated area. Keeping in mind the smaller number of flakes with surface retouch traces here, these might be remains from Middle Neolithic flint tool manufacture. It should be pointed out, that the presence of surface retouch traces was not specified in the database, so it is an empirical observation. In order to confirm it with quantitative data it is necessary to re-examine all of the flint debris material from the site.

In concluding this paper, some advantages and shortcomings of the use of computer databases might be highlighted. The major advances are that databases allow research to proceed more quickly and provide it with a more global aspect due large amount of data available for analysis. This approach allows the research process to become more positivist in contrast to intuitively or subjectively based procedures. Databases are especially useful for generating maps of vertical and/ or horizontal distribution. The use of intrasite distribution analysis for chronological or behavioural resolution of meaningful areas provides important information for our considerations about the past on particular sites. Modern software allows for the generation of graphical displays of results (maps, charts, diagrams, etc.) which are useful for both research and presentation.

Analysis using computer databases in most cases only confirms observations made after visual inspection during the process of investigation, because research capabilities are limited by the selection of the criteria chosen for data set. The answers to additional questions derived in the course of the research usually

require additional data, i.e. re-examination of the material. It should be also pointed out, that not all empirical observations can be supported with the results of statistical/quantitative analysis, but it does not necessarily mean those considerations are wrong.

The widespread adoption of more powerful and informative quantitative methods is believed to be an important direction in the development of archaeology. Increasing numbers of computer software packages developed for archaeology, as well as the modernization of standard commercial packages, opens broad perspectives for the analysis of archaeological materials on the intrasite or regional level. The main precondition is to have appropriately organized data and observations. The amount of archaeological data being stored in electronic memory is increasing every year and is already becoming an indispensable part of the future of archaeology.

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Papiškių 4-os gyvenvietės medžiagos analizė naudojant kompiuterines duomenų bazes

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Santrauka

Mūsų žinios apie akmens amžių daugeliu atvejų remiasi duomenimis, gautais iš daugiasluoksnių paminklų, kuriuose daugiau ar mažiau susimaišiusi kelių laikotarpių medžiaga. Tokie paminklai neretai teikia unikalios informacijos archeologijos mokslui, todėl būtina kurti naujus ir tobulinti jau esamus tyrimų metodus medžiagai iš maišytų paminklų tirti.

Vienas iš kelių gauti papildomos ir pakankamai patikimos informacijos apie praeitį – naudoti kompiuterizuotas duomenų bazes, o duomenis savo ruožtu toliau analizuoti pasitelkiant statistinius metodus. Kompiuterinių duomenų bazių naudojimas ne tik žymiai pagreitina tyrimų procesą, bet ir leidžia gauti kokybiškų naujų žinių apie praeitį.

Tyrimams pasirinkta Papiškių 4-a gyvenvietė, kasinėta 1989-1991 metais. Paminklas yra Vokės aukštupyje, upės salpoje esančioje nedidelėje kalvelėje. Gyvenvietės kultūriniai sluoksniai užkloti durpių sluoksnio. Tai leido išlikti organinės kilmės

radiniams – kaulams ir gintarui. Paminklo medžiaga tipologiškai suskirstyta į tris chronologiškai skirtingus kultūrinius kompleksus – mezolito, viduriniojo neolito ir senojo žalvario amžiaus. Kasinėjimų metu buvo pradėtas taikyti erdvinės fiksacijos metodas, t.y. buvo tiksliai užrašomos visos trys radinio vietos koordinatės.

Paminklo radiniams aprašyti buvo sukurtos keturios duomenų bazės – individualiems titnago radiniams, titnago skaldai, keramikai ir likusiems radiniams. Buvo stengtasi kuo plačiau apibūdinti kiekvieną radinių kategoriją tipologiniais bei technologiniais aspektais, taip pat įvedant jų radimo vietą.

Duomenys buvo panaudoti atlikti stratigrafinėms ir planigrafinėms analizėms. Išdėsčius skirtingų laikotarpių radinius vertikaliame gyvenvietės kultūrinio sluoksnio pjūvyje, buvo gautas gana chaotiškas vaizdas, būdingas daugiasluoksniams maišytiems paminklams (pav. 1). Statistiškai apskaičiavus atskirų kompleksų radinių vidutinį aukštį, paaiškėjo, kad mezolitiniai radiniai aptikti giliausiai, o viduriniojo neolito ir žalvario amžiaus radiniai atitinkamai aptikti aukščiau. Tai įrodo, kad pirminis tipologinis suskirstymas buvo teisingas. Stratigrafinė analizė leido išskirti ir dvi chronologiškai skirtingas mezolitinių radinių grupes (pav. 2).

Planigrafinė titnaginių strėlių antgalių analizė parodė, kad viduriniojo neolito lancetiniai antgaliai koncentravosi prietinėje tyrinėto ploto dalyje (pav. 3), tuo tarpu lygiai retušuoti trikampiai antgaliai, būdingi žalvario amžiuje, rasti daugiausiai šiaurinėje ploto dalyje (pav. 4). Buvo padaryta prielaida, kad skirtingų laikotarpių radiniai koncentravosi skirtingose tyrinėto ploto vietose. Statistiškai buvo apskaičiuota radinių, atrinktų pagal atskirus kriterijus, vidutinė pozicija šiaurės – pietų ašies atžvilgiu (1 lentelė). Skaičiavimai parodė, kad šiaurinėje dalyje buvo aptikta daugiau stambių titnago dirbinių, plokščiai retušuotų dirbinių, gludintų titngaų, tokių titnago dirbinių tipų, kaip plokščiai retušuoti peiliai, gludinti kirveliai, gremžtukai, platėjantys link ašmenų ir kt., taip pat keramikos su augalinėmis priemaišomis. Pietinėje dalyje gausiau rasta smulkių dirbinių, skelčių bei dirbinių iš jų, mikrorėžtukų, keramikos su mineralinėmis priemaišomis molio masėje, taip pat gintaro dirbinių. Tokie apskaičiavimai leidžia apibrėžti būdingus kultūrinių kompleksų bruožus netgi tuomet, kai neįmanoma tiksliai atskirti skirtingų laikotarpių medžiagos.

Planigrafinė radinių paplitimo analizė leidžia nustatyti gyvenvietės teritorijoje vietas, susijusias su tam tikra veikla. Gludintų nuoskalų, nuskilusių nuo kirvelių ašmenų, paplitimas rodo vietas, kur gludinti kirveliai buvo naudojami darbui (pav. 5). Jeigu teisinga prielaida, kad kirveliai buvo naudojami statybai, tai nuoskalų paplitimas rodo buvusių pastatų vietas. Smulkių nuoskalėlių (iki 1,5 cm) paplitimas leidžia nustatyti vietas, kur buvo gaminami retušuoti titnago dirbiniai. Viena tokių dirbtuvių aiškiai tik pastebima šiaurinėje tyrinėto ploto dalyje (pav. 6).

Tyrimas parodė, kad naudojant kompiuterizuotas duomenų bazes galima greitai atlikti planigrafines ir stratigrafines analizes bei kitokius statistinius skaičiavimus. Gauti rezultatai gali būti panaudoti sprendžiant paminklo vienalaikiškumo problemas, taip pat apibrėžiant buvusių gyventojų veiklos aspektus.

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