Estimating the size of lithic artifact assemblages. A view from the Southern Carpathians Middle Paleolithic

Gabriel POPESCU[*]

Abstract: *The current work is focusing on the on the issue of estimating the size of artifact assemblages and uses a recently developed method, for establishing a number of indices with particular relevance to the subject. This method is put into practice to a number of seven Middle Paleolithic assemblages from the Southern Carpathians.*

Rezumat: *Prezenta lucrare analizează problema estimării numărului de artefacte litice şi utilizează o metodă dezvoltată recent, pentru stabilirea unei serii de indici cu relevanţă specială asupra subiectului. Această metodă este pusă în practică pe un număr de şapte industrii litice atribuite Paleoliticului Mijlociu din sudul Carpaţilor.*

Keywords: *Lithic analysis, quantification, fragmentation, Middle Paleolithic, Southern Carpathians.*

Cuvinte cheie: *Analiză litică, cuantificare, fragmentare, Paleolitic Mijlociu, Sudul Carpaţilor.*

Assessing the size of lithic ***artifact*** assemblages and the effects of taphonomic processes over it, should be among the first steps of any lithic analysis studies. Most of the studies provide the overall density of the lithic specimens of a site, whereas establishing the artifact abundance of a site/layer, has not necessarily been the main concern. This is in contrast with the analysis of the faunal archaeological assemblages which definitely absorbed the integration of taphonomic processes and the need of estimating the abundance taxa of an assemblage. Textbooks (L. Binford 1984; R. Lyman 1994; M. Stiner 1994) and journal articles (Y. Abe *et alii* 2002; R. Lyman 1984; D. Grayson 1989; C. Marean *et alii* 2001) dedicated to faunal analysis, abound with procedures relative to counting the animal bones, and indices for establishing the number of individuals, anatomical elements etc.

Although the importance of taphonomic processes and depositional effects over the accumulation of lithic assemblages and site formation processes, trampling damage and edge damage effects has, by no means, been the focus of many archaeologists (G. Clark, M. Barton 1993; D. Crabtree 1972; H. Dibble *et alii* 1997; H. Dibble *et alii* 2006; S. McBrearty *et alii* 1998), the implications of these processes over the abundance estimation, have not been detailed at length until very recently (P. Hiscock 2002).

Most of the studies, when artifact abundance is at focus, either count for only the complete component or flake initiations (e.g. complete and proximal and longitudinal fragments) (W. Andrefsky 1998; H. Dibble and M. Lenoir eds. 1995), or treat the complete and fragmentary components as equal units, as is the case for most of the Romanian lithic studies (M. Cârciumaru 1999; Al. Păunescu 2001). While counting flake initiations, does offer a minimal number of flakes produced (W. Andrefsky 1998), it nonetheless provides low estimates, and a better suited index has been recently developed (see P. Hiscock 2002). On the other hand, the treatment of the whole lithic assemblage component (complete and fragments) as equal units, is even more unproductive, as it overlooks, the effects of fragmentation processes significant for all components of the archaeological record.

Recently P. Hiscock (2002) provided more units toward the estimation of the quantity of knapping activities having as starting point the MNI measure, within the faunal analysis, which gives the minimum number of animals to count for the skeletal specimens (P. Hiscock 2002, pp. 252-255).

Before taking the step forward with this study, it is important to take a short look over the state of the art within the Romanian archaeology lithic studies, relative to the subject. Until recently (R. Dobrescu 2007, 2008; M. Cârciumaru *et alii* 2007), the information relative to the general composition of the lithic assemblages, did not provide a detailed image in respect with the lithic data class and blank types, in terms of providing separate counts for whole and different fragmentary component of the assemblages and, detailed metric attributes. Fragment units, such as, distal and medial components, were not at focus, within older studies, and (except for the retouched component), and were generally considered as fragments and/or shatter. At best, one can distinguish the count of flake initiations, where an analysis of platform types and count has been the focus (see Al. Păunescu 2001). Moreover, when the artifact abundance is the focus, all artifact fragments are counted and treated as equal units, giving, therefore, an overestimate of the actual abundance (M. Cârciumaru 1999; Al. Păunescu 2001, to cite the

[*] Institute of Archaeology, „Vasile Pârvan” 11, Henri Coandă st., Sector 1, 010667, Bucureşti, gropopescu@yahoo.co.uk

Studii de Preistorie 5, 2008, p. 37-49.

most detailed). This is an actual issue in the recent publications either. I do not want to argue that those products were not recognized, or accounted for, by the archaeologists, but that their importance, in respect with a better understanding toward the general processes that played a major role in the formation of the lithic assemblages, and their consequences, has not been fully addressed.

The aim of this work is to use and explore the utility of such method and the units of measurement, like those provided by Hiscock (2002), at a number of Middle Paleolithic assemblages from the Romanian Southern Carpathians (tab. 2, 3), and to further detail and explore some of them. This research is based on my own analysis of assemblages at hand and recent published data (Al. Păunescu 2001), when available relative to the Flake initiations.

Fragmentation and Minimum Number Estimates

Given that this approach has been detailed at length in the above mentioned paper, I will not go further into detail with it, but will only present its basic characteristics and the calculation steps for the counting units that Hiscock provided (tab. 1). Some of the terms that have been proposed (NAS and MNF for example), are comparable with correspondent indices, such as, NISP and MNI, used in the faunal analysis and, represent the count of the recovered artifacts (complete and/or fragmentary) and an estimate of the minimum number of flakes detached from a core, respectively. As stated by Hiscock, while the NAS do offer a general image of an artifact assemblage composition, it does not measure the size of an assemblage affected by the taphonomical processes (P. Hiscock 2002, p. 252). Therefore, an index of the minimum number of the knapping activities was needed, as well as, derivates of it (see below), as a better understanding of the consequences that fragmentation had over an assemblage abundance, is looked for.

Different fragmentation patterns are characteristic to different sites, irrespective of their cultural or non-cultural processes including, trampling, manufacture, use. A standard classification of fragments, which definitions are given in several lithic analysis textbooks (W. Andrefsky 1998; D. Crabtree 1972; J. Whittaker 1994), is employed here. As such, I have recorded in my own analysis of the subject assemblages, the following categories: *complete flake, longitudinal fragments, transverse fragments (divided in three categories: proximal, medial and distal)*. No *marginal* or *surface* fragments were recorded (see P. Hiscock 2002 for details). The diversity of the fragment types recognized and their density in some of the subject assemblages, as well as, my own results (see below) similar to Hiscock's, strengthen the need for an additional index to that currently used by Andrefsky and other lithic analysts.

Following Hiscock's suggested indices and calculation steps the following equations have been undertaken for the current work:

1. Flake Initiations: C + P + (LCS/2), where C represents the complete flakes, P is the proximal component and LCS/2 the number of the longitudinal fragments divided by 2, considering two fragments per flake. As we shall see, that index will lower the actual abundance especially for the assemblages where distal fragments accounts for most of the fragmented component.
2. MNF index as suggested by Hiscock (2002, p. 254): MNF= C+T+L, where T represents the category of the transverse fragments, excluding medial, and L, the count of the longitudinal fragments displaying the fracture initiation and termination, excluding the medial portions.
3. MNC – Minimum Number of Cores, given by the equation: MNC=complete cores + (core fragments/k), where *k* is the result of mean weight complete cores / mean weight core fragments.
4. MNR – Minimum Number of Retouched artifacts, computed using the same method as for the MNF. Both MNF and MNR indices can and should be further detailed, when different raw materials are present within an assemblage. For the current work I have split the raw material in two categories: coarse grained (quartz, quartzite etc.) and fine grained (flint, jasper etc.). The calculation steps of these indices are similar to MNF and MNR. .
5. MNA – Minimum number of artifacts, as a result of MNF + MNC.

Results and Implications

At first glance it is quite evident that the all the assemblages display a relatively high degree of fragmentation (tab. 2) and a variety of fragmentation patterns, in terms of the general data class, with most of the fragments belonging to the flake terminations (distal fragments). A quite different pattern is distinguishable (tab. 2) when the retouched tools are considered. Invariably the vast majority of them represent the complete items and, a much less significant amount of tools is represented by the fragmented blanks, either the raw materials are considered together or divided by the two groups of raw material established (tab. 3, 5, 6, 7). Of these, the most important components are the distal and the proximal fragments. Given that, the differences between the total retouched pieces, retouched blanks initiations, and MNR are not really significant. However, the variation in medial and distal fragments might mead significant variations relative to the retouched initiations to total retouched ratio and MNR. This might be significant, when larger assemblages (such as Ohaba Ponor - Bordu Mare III) are involved. Therefore the use of MNR is better suited, as well, when the retouched component is of concern. The relevance and importance of the MNF index is quite clear when the overall *artifactual* composition of an assemblage is at focus, and deserves further discussion. A very important difference between my study and Hiscock's is that minimum number estimates resulted from my analysis are tested against the NAS, and not to an actual number derived through refitting. However, the results are very significant and reveal important discrepancies between the NAS, FINI and MNF Indices. First of all, the importance of distal fragmentation pattern leads to very small accounts of the flake initiation index, and hereby lowers the minimum number estimate to an unnecessarily extent. It is necessarily to stress that the discrepancy between NAS and FINI is averaging between 32-55 %. Looking at the MNF index values one acknowledges the fact that it gives a more reliable way as to the minimum estimates of the knapping activities, an idea that is supported by the relationship between the MNF, NAS and MNA (tab. 3, 4).
The MNF is therefore, as suggested by Hiscock as well, a better suited index to use, when assemblages similar to those discussed by Hiscock and myself, displaying more distal fragments, are in the thick of it. Given that the number of medial fragments per flake varies, these fragments are not included in the MNF calculation index. On the other hand, none of these assemblages display an emphasis on medial fragments, nor they represent the only transverse fragment type, within any of the assemblages. For the subject assemblages, the small sample of medial fragments, would not significantly change the ratio NAS: MNF or NAS: MNA, even if the number of the medial fragments would be divided by an average number per flake ranging from 2 to 4, or even more (see P. Hiscock 2002, p. 255) and then added to the MNF, MNA indices respectively (tab. 4, 5; fig. 1)[1]. Anyway, if the context requires it, and especially for the small samples, adding a mean value of the Medial fragments (to count for a Medial index) might be useful to improve for the MNF and MNA estimations overall.

As stated before, those indices may further be used to elaborate the information, by raw material estimates, when available data are at hand and, when the context requires it. This is also a way to diminish the ambiguities that may appear when fragments of different raw materials are counted together for the same index. Therefore, the same calculation steps were followed for what I called the fine grained raw material category (e.g. flint, jasper etc.). This is a result of sampling constraints; otherwise, when large assemblages are available, it is recommendable to distinguish those estimates for each extant raw material category. Nonetheless, even the current context gives interesting and significant results (tab. 5, 6). The results display a fairly different pattern in terms of fragmentation patterns as well as in the degree of fragmentation, from the quartz/quartzite materials. Pursuant to, all the four indices (FINI inclusive) show not much discrepancy and, the NAS-MNF, NAS-MNA relationships are very strong and significantly correlated (fig. 5, 6). The bigger degree of fragmentation for the coarse grained raw materials, overall, is unsurprisingly though and generally characteristic to quartz and quartzite assemblages (V. Mourre 2004). This is happening, mostly, on account of different flaking characteristics of those largely defined groups of raw material, but at the same time, on account of differential access to raw material that stands for differential procurement patterns, reduction strategies and intensity of use. In terms of blank selection another interesting pattern comes to light.

[1] All tables and graphs and statistical tests were run with the SPSS 11.5 for Windows.

It is obvious that for much of the retouched artifacts the complete specimens represent by far the largest number, followed by proximal and distal blanks (distal blanks surpass the proximal fragments, but not significantly, for quartz/quartzite). Although the patterns of blank selection, in terms of the completeness of the blanks selected are similar, the extent of blanks selected to retouch is very significantly different between the two categories, and has much to do with the raw material procurement and use, and the size, overall, of an assemblage, knapped out from a raw material or another. The linear regression analysis is very strong and significant in this respect (fig. 1) (r= 0. 930, r^2= 0. 865, p= 0.002, with MNA and raw material (aggregated) as constant, independent values). There is hereby 87 % explained variation of the percentage of retouched blanks, given by the MNA values overall, by raw material. This is quite remarkably strong and very significant at 0.01 level. The regression scatter plot reveals, as stated above, totally different patterns of blank selection, when the analysis is conducted by raw material categories (fig. 1). Thus, the fine grained raw material reveals a strong positive relationship between the MNA and the frequency of retouched blanks, again very strong and significant (r= 0.9763, r^2= 0.988, p= 0.012) (r= -0.642, r^2= -0.4213, p= 0.120, for coarse grained raw materials), with the MNA explaining for almost 95 % of variation of the frequency of fine grained retouched blanks. The regression scatter plot is very cogent in this respect (fig. 1), with the regression line displaying a very clear positive slope, as expected from the regression values, and the regression points closely lined up along the regression line. As a consequence, the regression *beta* (Pearson's r) has a strong positive, significant value (p= 0.012), for 95% confidence degree. The coarse grained raw materials displaying a totally different negative slope, weaker and statistically not significant (see above), suggesting that the bigger the overall density of an assemblage will be, than, the retouch frequency of that assemblage will lower (see also J. Riel-Salvatore, M. Barton 2004; J. Riel-Salvatore *et alii* 2008). This is again quite remarkable given that we are dealing with old collections, inherently biased to a certain degree, by both recovery field methods and collections curation history. These results confirm the expectations of a model, according to which, the retouched tools assemblage richness depends mostly on the size of the retouched assemblage (D. Grayson, S. Cole 1998). Moreover, at least according to these results, the general size of a retouched assemblage and the retouched "types" richness, is expected to be explained through the variation of the size of an assemblage overall, depending upon the context of raw material availability, mobility patterns, geographical setting, settlements systems etc. (G. Popescu *In press*) In most of the cases (W. Andrefsky 1994; P. Brantingham 2003), when raw material is readily available, even though of poorer quality, there is not so much concern for tools curation or for the use of more formalized reduction strategies. This has all to do with the concept of *effective raw material availability*, which has elsewhere been detailed at length (J. Riel-Salvatore, M. Barton 2004; J. Riel-Salvatore *et alii* 2008). However, more analyses and test (on larger assemblages) are more than welcomed in order to test for the validity and strength of those implications.

We must now turn back a little to the indices and, take a short look to the MNC (Minimum number of cores). As suggested by Hiscock, this index is being calculated as a result of complete cores + (core fragments/k), where k is the result of mean weight complete cores / mean weight core fragments. Upon circumstances, (e.g. small sample vs. large), the use of MNC index is definitely useful to calculate, but for raw material categories too (when available data at hand). In my analysis it has proven to be useful especially when the Bordu Mare, Peştera Hoţilor and Nandru level 2, were at focus. Given the small sample and the raw material for the rest of the sites involved, the MNC proved to be identical with the total number of cores (complete and fragmentary counted together). Of course, more analysis and larger core samples are needed, in order to refine the results of this index and to make it an even stronger estimate.

After all these indices, been established as they were, both MNF and MNC are reliable to use, keeping in mind however that they reflect, as already argued, minimum estimates of the actual flaking production and objective pieces from which the flakes were break off. They are hereby more reliable estimates when the *artifactual* abundance is at focus. Having established the MNC index it has been consequently possible to be added to the MNF index and produce the MNA index (tab. 3-7). In order to test for the strength of these analyses it is necessarily that the indices MNF and MNA to display a predictive strong positive relationship as a result of both argued to be the reflection of the actual flake abundance of an assemblage (see P. Hiscock 2002). Moreover, it is also expected that the relationship between NAS and MNA to be similarly modeled and display the similar positive slope, NAS MNA relationship been the reflection of the actual *artifactual* abundance of an assemblage. In order to do that a linear regression analysis is undertaken for both relationships (fig. 2, 3). Once again, in order to strengthen the results reliability, the analysis is run according to the raw material categories. Figures 2 and 3 present the illustration of this relationship and display as expected, a remarkably strong positive relationship between those indices (r= 0.999, r^2= 0.999, p< 0.001, for NAS-MNF and r= 0.999, r^2= 0.999, p< 0.001 for NAS-MNA relationship). Clearly, there is no unexplained variation overall, as the size of the residuals is insignificant, and the regression slope and correlation coefficient are the same. These values hold true when the regression is run within each group (see fig. 2, 3 Rsq. values. They are all significant at 0.01 level). It is therefore quite clear, for assemblages at hand that these indices are valid heuristics for estimating the actual abundance of an assemblage, and MNF can be predicted from the NAS counts. It is expected however, that the advocated relationship to display variation upon different contexts including settlement patterns, regional geographical setting, fragmentation patterns etc. Especially true for the old collections, the recovery methods and collections curation history may be an important bias. No matter how important that variation might be, the general trend it displays should be consistent with the general positive statistical slope. An exception probably being, the very strong biased assemblages.

An argument has been made, for the use of a method recently developed (P. Hiscock 2002) as a heuristic for the evaluation of the actual *artifactual* abundance of a lithic assemblage. My own results, similar to Hiscock's prove that this method is a valuable one for this endeavor. It is therefore expected that it has much to offer for analyses relative to differential reduction strategies, raw material procurement patterns and management and intensity of use, to account for further discussions relative to the land-use strategies and mobility patterns.

Of course more analyses are suited from different other sites, in order to test for its strengths and weaknesses and to draw attention toward different kinds of biases that may affect its overall results. Importantly, this method can be used as a heuristic to evaluate *artifactual* abundance of any lithic assemblage, irrespective of its regional and cultural setting or time span involved.

References

Y. Abe *et alii* 2002 — Y. Abe, C.W. Marean, P. Nilssen, E. Stone, Z. Assefa, The analysis of cutmarks on archaeofauna: A review and critique of quantification procedures, and a new image-analysis GIS approach., *American Antiquity*, 67, p. 643-663.

W.Jr. Andrefsky 1994 — Raw material availability and the organisation of technology, *American Antiquity*, 59, 1, p. 21-34.

W.Jr. Andrefsky 1998 — *Lithics*. Cambridge University Press, Cambridge.

M. Barton, G. A. Clark 1993 — Cultural and natural formation processes in late Quaternary cave and rockshelter sites of western Europe and the Near East, in P. Goldberg, D. T. Nash and M. D. Petraglia, eds., *Formation Processes in Archaelogical Context.*, Prehistory Press, Madison, WI, p. 33-52.

L. Binford 1984 — *The faunal remains of Klassies River Mouth*. Academic Press, New York.

P. Brantingham 2003 — A neutral model of stone raw material procurement, *American Antiquity*, 68, p. 487-509.

M. Cârciumaru 1999 — *Le Paléolithique en Roumanie*, Grenoble.

M. Cârciumaru *et alii* 2007 — M. Cârciumaru, M. Anghelinu, G. Lucas, L. Niţă, L. Steguweit, M. Margărit, L. Fontata, A. Brugere, V. Dumitraşcu, U. Hambach, M. Cosac, O. Cârstina, F. Dumitru, Şantierul paleolitic de la Poiana Cireşului (Piatra Neamţ): O sinteză a rezultatelor recente (1998-2005), *MCA(SN),* 2, 2000-2006, p. 5-33.

D.E. Crabtree 1972 — *An Introduction to flintworking, Ocasional papers of the Idaho State University Museum*, 28.

H. Dibble *et alii* 1997 — H. Dibble, P. Chase, S. McPherron, A. Tuffreau, Testing the reality of a "living floor" with archaeological data, *American Antiquity*, 62, p. 629-651.

H. Dibble, M. Lenoir 1995 — *The Middle Paleolithic Site of Combe Cappelle-Bas France*, University of Pennsylvania Museum, Philadelphia.

H. Dibble *et alii* 2006 — H. Dibble, S. McPherron, P. Chase, W. Farrand, A. Debenath, Taphonomy and the concept of Paleolithic cultures: The case of the Tayacian from Fontechevade (Charente, France), *Paleoanthropology,* p. 1-21.

R. Dobrescu 2002 — Atelierul aurignacian din punctul Coasta Buşagului (Buşag, comuna Tăuţii Măgherăuş, jud. Maramureş), *SP*, 1/2001, p. 5-33.

R. Dobrescu 2008 — *Aurignacianul din Transilvania*. Renaissance, Bucureşti.

D. Grayson, S. Cole 1998 — Stone tool assemblage richness during the Middle and Early Upper Paleolithic in France, *JAS*, 25, p. 927-938.

D.K. Grayson 1989 — Bone transport, bone destruction, and reverse utility curves, *JAS*, 16, p. 643-662.

P. Hiscock 2002 — Quantifying the size of artifact assemblages, *JAS*, 29, p 251-258.

R. Lyman 1984 — Quantitative Units and Terminology in Zooarchaeology, *American Antiquity,* 59, 1, p. 36-71.

R. Lyman 1994 — *Vertebrate Taphonomy,* Cambridge University Press, New York.

C. Marean *et alii* 2001 — C. Marean, Y. Abe, P. Nilssen, E. Stone, Estimating the Minimum Number of Skeletal Elements (MNE) in Zooarchaeology: a Review and a New Image-analysis GIS Approach, *American Antiquity*, 66, p. 333.

S. McBrearty *et alii* 1998 — S. McBrearty, L. Bishop, T. Plummer, L. Dewar, N. Conard, Tools underfoot: human trampling as an agent of lithic artifact edge modification, *American Antiquity*, 63, p. 108-129.

V. Mourre 2004 — Le débitage sur enclume au Paléolithique moyen dans le sud-ouest de la France, In *Session 5 :* Van Peer Ph., D. Bonjean, P. Semal, eds., *Paléolithique moyen, UISPP, Lisbon 2001*, vol. 1239, BAR Series, Oxford, p. 29-38.

L. Niţă 2005 — Technological and funtional observations regarding backed implements from Poiana Cireşului, Piatra-Neamţ, *Annales d'Universite "Valachia" Târgovişte*, 6-7, p. 53-61.

A. Păunescu 2001 — *Paleoliticul şi Mezoliticul din spaţiul transilvan*, Asociaţia Generală a Inginerilor din România (AGIR), Bucureşti.

G. Popescu In Preparation — *Raw material procurement and lithic curation in the Southern Carpathians Middle Paleolithic*, In Preparation.

J. Riel-Salvatore *et alii* 2004 — J. Riel-Salvatore, J. Barton, M. Barton, Late Pleistocene technology, economic behavior, and land-use dynamics in southern Italy, *American Antiquity*, 69, p. 257-274.

J. Riel-Salvatore *et alii* 2008	Riel-Salvatore, G. Popescu, M. Barton, Standing at the gates of Europe: Human behavior and biogeography in the Southern Carpathians during the Late Pleistocene, *Journal of Anthropological Archaeology*, 27, 4, p. 399-417.
M. Stiner 1994	*Honor among thieves*. Princeton University Press, Princeton.
J. Whittaker 1994	*Flintknapping. Making and understanding stone tools*. University of Texas Press, Austin.

Abbreviations

Sites

BHPH – Băile Herculane Peştera Hoţilor;
NPCI – Nandru Peştera Curată Mousterian I;
NPCII – Nandru Peştera Curată Mousterian II;
OPBMI – Ohaba Ponor-Peştera Bordu Mare Mousterin I;
OPBMII – Ohaba Ponor-Peştera Bordu Mare Mousterian II;
OPBMIII – Ohaba Ponor-Peştera Bordu Mare Mousterian III;
OPBMIV – Ohaba Ponor-Peştera Bordu Mare Mousterian IV;

Lithic Class and Blank Class

C.Flake – Complete flake;
L.Fragment-Longitudinal fragment;
D.Fragment-Distal fragment;
M.Fragment-Medial fragment;
P.Fragment-Proximal fragment;
C.Core-Complete core;
F.Core-Core fragment ;
Unret.-Unretouched;
C.tool-Complete tool;
L.tool-Longitudinal tool;
D.tool-Distal tool;
M.tool-Medial tool;
P.tool-Proximal tool.

Raw Material

C.Grained (CG)-Coarse grained;
F.Grained (FG)-Fine grained;

NAS (Number of artifactual specimens)	All recovered artifacts complete or fragmentary
MNF (Minimum number of flakes)	Minimum number of flakes to account for the complete and fragment flakes in an assemblage
MNC (Minimum number of cores)	Minimum number of cores complete to account for the complete and fragment cores in an assemblage)
FINI (Flake Initiations)	Minimum number of flakes to account for the complete, proximal and longitudinal fragments / 2
MNR (Minimum number retouched)	Minimum number of retouched artifacts to account for the complete and fragment retouched flakes
NMA (Minimum number of artifacts)	Minimum number o flaked artifacts in an assemblage.

Tab. 1. Counting units (redrawn from P. Hiscock 2002, p. 252).
Indici analizaţi (după P. Hiscock 2002, p. 252, cu modificări).

Site/ Layer			Blank Class						Total
			Unret.	C.Tool	L.Tool	D.Tool	M.Tool	P.Tool	
BHPH	Class	C.Flake	39	13		0		0	52
		L.Fragment	2	0		0		0	2
		D.Fragment	30	0		2		0	32
		M.Fragment	16	0		0		0	16
		P.Fragment	17	0		0		1	18
		Shatter	18	0		0		0	18
		C.Core	9	0		0		0	9
		F.Core	8	0		0		0	8
		Nonflaked	2	0		0		0	2
	Total		141	13		2		1	157
NPC I	Class	C.Flake	36	17	0	0			53
		L.Fragment	0	0	1	0			1
		D.Fragment	13	0	0	1			14
		M.Fragment	4	0	0	0			4
		P.Fragment	6	0	0	0			6
		Shatter	19	0	0	0			19
		C.Core	5	0	0	0			5
		F.Core	1	0	0	0			1
		Nonflaked	2	0	0	0			2
	Total		86	17	1	1			105
NPC II	Class	C.Flake	41	21		0	0	0	62
		L.Fragment	4	0		0	0	0	4
		D.Fragment	19	0		1	0	0	20
		M.Fragment	6	0		0	2	0	8
		P.Fragment	10	0		0	0	2	11
		Shatter	29	0		0	0	0	29
		C.Core	6	0		0	0	0	6
		F.Core	4	0		0	0	0	4
		Nonflaked	3	0		0	0	0	3
	Total		126	19		1	2	1	149

Tab. 2. Lithic assemblage composition for the subject assemblages.
Componenţa inventarului litic pentru industriile litice analizate.

Site/Layer					Blank Class				Total
			Unret.	C.Tool	L.Tool	D.Tool	M.Tool	P.Tool	
OPBM I	Class	C.Flake	16	5	0	0		0	21
		L.Fragment	3	0	1	0		0	4
		D.Fragment	12	0	0	1		0	13
		M.Fragment	4	0	0	0		0	4
		P.Fragment	4	0	0	0		2	6
		Shatter	13	0	0	0		0	13
		C.Core	2	0	0	0		0	2
	Total		54	5	1	1		2	63
OPBM II	Class	C.Flake	10	5					15
		L.Fragment	2	0					2
		D.Fragment	10	0					10
		M.Fragment	4	0					4
		P.Fragment	4	0					4
		Shatter	5	0					6
		C.Core	2	0					2
		F.Core	2	0					2
	Total		39	5					44
OPBM III	Class	C.Flake	566	85	0	0	0	0	651
		L.Fragment	22	0	1	0	0	0	23
		D.Fragment	354	0	0	11	0	0	365
		M.Fragment	85	0	0	0	2	0	87
		P.Fragment	185	0	0	0	0	9	194
		Shatter	83	0	0	0	0	0	83
		C.Core	38	0	0	0	0	0	38
		F.Core	11	0	0	0	0	0	11
		Nonflaked	12	0	0	0	0	0	12
	Total		1356	85	1	11	2	9	1464
OPBM IV	Class	C.Flake	82	10		0		0	92
		L.Fragment	3	0		0		0	3
		D.Fragment	32	0		2		0	34
		M.Fragment	4	0		0		1	5
		P.Fragment	19	0		0		0	20
		Shatter	8	0		0		0	8
		C.Core	2	0		0		0	2
		F.Core	2	0		0		0	2
	Total		153	10		2		1	166

Tab. 2. Lithic assemblage composition for the subject assemblages (continued).
Componenţa inventarului litic pentru industriile litice analizate (continuare).

	Specimen Counts								Total Counts				
			Transverse			Cores							
Site	Complete	Long.	Proximal	Medial	Distal	C.Core	F.Core	Shatter	NAS	Fl.Ini.	MNF	MNC	MNA
Herculane M	52	2	18	16	32	10	8	18	156	71	86	16	102
Nandru MI	53	1	6	4	14	5	1	19	103	60	68	5	73
Nandru MII	62	4	11	8	20	6	4	29	146	75	83	8	91
Bordu Mare MI	21	4	6	4	13	2	0	13	63	29	38	2	40
Bordu Mare MII	15	2	4	4	10	2	2	5	44	20	25	3	28
Bordu Mare MIII	651	23	194	87	365	38	11	83	1452	857	1028	48	1076
Bordu Mare MIV	92	3	20	5	34	2	2	8	166	114	129	4	133

Tab. 3. Different approaches of counting for the subject assemblages. Coarse grained and fine grained raw materials aggregated.
Diferite metode de numărare a industriilor analizate. Materie primă cu textură grosieră şi cu textură fină combinate.

	Specimen Counts								Total Counts				
			Transverse			Cores							
Site	Complete	Long.	Proximal	Medial	Distal	C.Core	F.Core	Shatter	NAS	Fl.Ini.	MNF	MNC	MNA
BHPH	51	2	18	16	32	10	8	18	155	70	85	16	101
NPC I	26	0	5	3	11	2	1	17	67	31	37	2	39
NPC II	26	3	2	5	10	4	2	31	83	31	39	4	43
OPBM I	18	4	4	4	13	2	0	13	58	24	35	2	37
OPBM II	13	2	4	4	10	2	2	5	42	18	25	3	28
OPBM III	546	22	173	82	340	34	11	75	1283	730	897	44	941
OPBM IV	78	3	18	5	32	2	2	8	148	98	113	4	117

Tab. 4. Minimum number estimates for coarse grained raw material.
Numărul minim estimat pentru materie primă cu textură grosieră.

	Specimen Counts								Total Counts				
			Transverse			Cores							
Site	Complete	Long.	Proximal	Medial	Distal	C.Core	F.Core	Shatter	NAS	Fl.Ini.	MNF	MNC	MNA
BHPH	1	0	0	0	0	0	0	0	1	1	1	0	1
NPC I	27	1	1	1	3	3	0	2	38	29	31	3	34
NPC II	36	1	9	3	10	2	2	0	63	46	47	4	51
OPBM I	3	0	2	0	0	0	0	0	5	5	5	0	5
OPBM II	2	0	0	0	0	0	0	0	2	2	2	0	2
OPBM III	105	1	21	5	25	4	0	8	169	127	131	4	135
OPBM IV	14	0	2	0	2	0	0	0	18	16	16	0	16

Tab. 5. Minimum number estimates for fine grained raw materials.
Numărul minim estimat pentru materie primă cu textură fină.

			Transverse							
Site	Complete	Long.	Proximal	Medial	Distal	NASFG	MNAFG	TOTRet	RetINI	MNRet
BHPH	1	0	0	0	0	1	1	1	1	1
NPC I	8	1	0	0	1	38	34	10	9	10
NPC II	14	0	2	2	1	63	51	19	13	16
OPBM I	2	0	2	0	0	5	5	4	4	4
OPBM II	2	0	0	0	0	2	2	2	2	2
OPBM III	41	0	4	1	4	169	135	50	45	45
OPBM IV	4	0		0	0	18	16	5	5	4

Tab. 6. Minimum number retouched artifacts. Fine grained raw materials.
Numărul minim de artefacte retuşate. Materie primă cu textură fină.

			Transverse							
Site	Complete	Long.	Proximal	Medial	Distal	NASCG	MNACG	TOTRet	RetINI	MNRet
BHPH	12	0	1	0	2	155	101	15	13	14
NPCI	9	0	0	0	0	67	39	9	9	9
NPCII	7	0	0	0	0	86	43	7	7	7
OPBMI	3	1	0	0	1	58	37	5	4	5
OPBMII	3	0	0	0	0	42	28	3	3	3
OPBMIII	44	1	5	1	7	1295	941	58	50	52
OPBMIV	6	0	0	1	2	149	117	9	6	8

Tab. 7. Minimum number retouched artifacts. Coarse grained raw materials.
Numărul minim de artefacte retuşate. Materie primă cu textură grosieră.

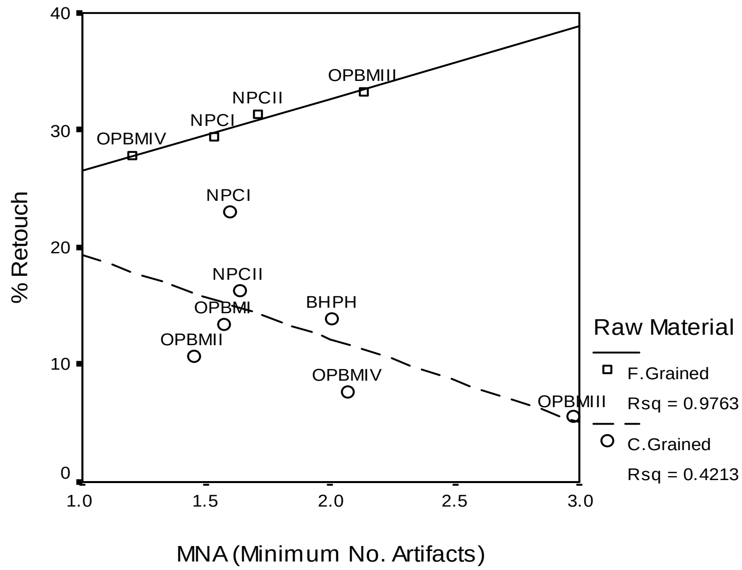

Fig. 1. Model of the relationship between the MNA and retouched frequency (%) for the subject assemblages by raw material; r= 0.988, Rsq.= 0.9763, p<0.012, for fine grained raw materials; r= -0.642, Rsq.= -0.4213, p= 0.120, for coarse grained raw materials.
Modelul relaţiei dintre MNA şi frecvenţa retuşării (%) pentru industriile litice studiate, pe tip de materie primă;
r= 0.988, Rsq.= 0.9763, p<0.012, materie primă cu textură fină; r= -0.642, Rsq.= -0.4213, p= 0.120, materie primă cu textură grosieră.

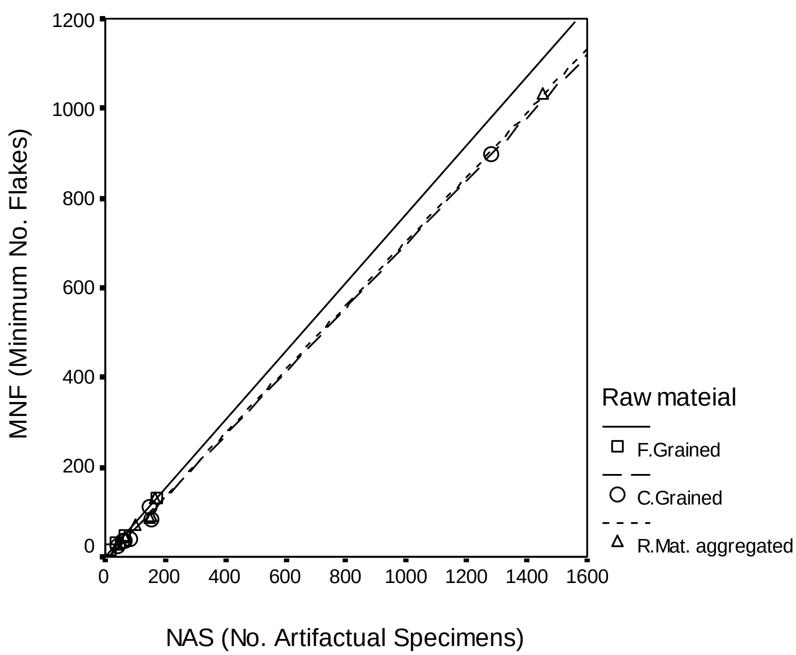

Fig. 2. Regression analysis of the relationship between the NAS and MNF, by raw material category; Rsq.= 0.999, R= 0.999, p< 0.001 for fine grained raw materials; Rsq.= 0.999, R= 0.999, p< 0.001 for coarse grained raw materials; Rsq= 0.9998, R= 0.999, p< 0.001, raw materials aggregated.
Analiza de regresie a relaţiei dintre NAS şi MNF, pe tip de materie primă; Rsq.= 0.999, R= 0.999, p< 0.001 materie primă cu textură fină; Rsq.= 0.999, R= 0.999, p< 0.001 materie primă cu textură grosieră; Rsq= 0.9998, R= 0.999, p< 0.001, ambele categorii de materie primă combinate.

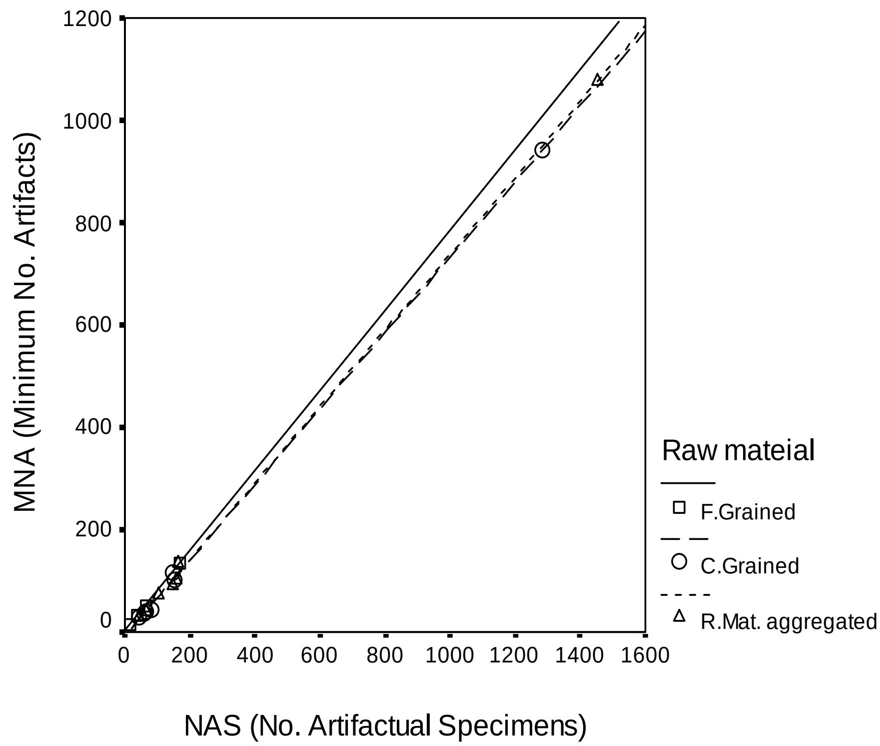

Fig. 3. Regression analysis of the relationship between the NAS, and MNA, by raw material category; Rsq.= 0.999, R= 0.999, p< 0.001 for fine, grained raw materials; Rsq.= 0.999, R= 0.999, p< 0.001 for coarse grained raw materials; Rsq= 0.999, R= 0.999, p< 0.001, raw materials aggregated.
Analiza de regresie a relaţiei dintre NAS şi MNA, pe tip de materie primă; Rsq.= 0.999, R= 0.999, p< 0.001 materie primă cu textură fină; Rsq.= 0.999, R= 0.999, p< 0.001 materie primă cu textură grosieră; Rsq= 0.999, R= 0.999, p< 0.001, ambele categorii de materie primă combinate.