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THE CRAFT OF TEXTILE PRODUCTION AT THE NEOLITHIC AND ENEOLITHIC COMMUNITIES IN TRANSYLVANIA

(PhD Thesis Abstract)

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KEY WORDS: textile production, Neolithic, Eneolithic, textile imprints, textile tools, spindle whorls, loom weights, spools, spinning, twining, weaving, Transylvania.

INTRODUCTION

The functional, practical and symbolic importance of textiles in everyday life, and also during special events (ceremonies, celebrations, rituals, etc.) within human communities, has been highlighted by numerous studies in anthropology, history, archeology, and the textile remains found during archaeological excavations are seen, as shown by researchers Penelope Walton and Gillian Eastwood (1983), as "*the remains of one of man's more intimate artifacts*". However, the importance of textile products and the activities devoted to textile production in prehistory was generally ignored by archaeologists due to the rarity of such archaeological remains. Specialist's focus on the study of well-preserved artifacts, found frequently in archaeological sites (pottery, stone, bone, metal) can lead to erroneous interpretations regarding the role they played over time. Certainly the number of objects discovered at archaeological sites is not necessarily directly proportional to the significance or value those objects had to the society that produced and/or used them. Therefore, ignoring the textile evidence implies forfeiting a wealth of information, which, in addition to the reconstitution of the "invisible handicraft", as the art of prehistoric textile production is metaphorically called, allows access to cultural, social and economic details, complementing the data collected from other archaeological remains.

The huge advances in research in the West compared with the sporadic and inconsistent efforts in Romania fully justify the need for a systematic, scientific approach to align Romania with the Western European map of discoveries and research on prehistoric textiles. This is particularly true since the new trends in this field of studies suggest a growing interest in this area of research.

The purpose of this paper is to characterize the craft of textile production (with all its implications: economic, social, symbolic, etc.). during the Neolithic and Eneolithic in the geographical area of Transylvania, starting with the study of the main evidence preserved in the soil conditions specific to the southeast of Europe (textile imprints and tools - spindle whorls and loom weights).

The pioneering nature of this paper justifies to a large extent limiting the research to a confined geographical area such as that of Transylvania. The obstacles encountered in the research were due primarily to the difficulty of finding and gathering the material necessary for the study (searches conducted in over 15 museum collections were not always successful), the absence of data in the context of discovery, the difficulty of cultural and chronological assignment / clasification of some of the artifacts etc. The absence of references and methodological models in Romania was offset in large part by a three month research internship (May - August 2009) at the Centre for Textile Research (*CTR)*, University of Copenhagen.

The extensive bibliography I was able to access (over 500 titles), as well as discussions with *CTR* researchers, allowed for familiarization with and application of complex methodologies of investigation and interpretation of archaeological material pertaining to textile production, without which the doctoral thesis could not have been completed. I would like to thank the *CTR* researchers and to all colleagues and friends who have provided the archaeological material and supported me in conducting the research necessary for this paper.

Despite the hardships encountered, we hope that the proposed model of systematic analysis and the results that followed will constitute a source of inspiration and information not only for the archaeologists and historians interested in the technological process involved in textile production, but also for those interested in more complex issues related to the economic, social and symbolic role of textile products.

The thesis is comprised of 762 pages, 486 with text, 276 annexes including 121 plates. Beside these plates the thesis also contains 208 in line illustrations (figures and graphs) and 44 tables. For the abstract we chose to maintain the number assigned to figures and tables in the original text.

CHAPTER I
GENERAL OVERWIEV

I.1. PRELIMINARIES OF THE RESEARCH

I.1.1. Research Context

The study of archaeological textiles, whose beginnings are placed in the nineteenth century, gained increasing traction in Western Europe over the last decades. Increased attention was given to perishable fibre artifacts on one hand, thanks to new interdisciplinary methods of investigation introduced in archeology, and on the other hand, to directing and stimulating the interest of archaeologists towards the reconstruction of daily life, domestic crafts, and especially towards the activities of women in prehistoric and historic communities.

In contrast to western countries, Romanian interest in prehistoric textile production remains at a mediocre level. Generally speaking, artifacts related to textile production and textile products have not been systematically discussed and published. The most recent studies in the field (by researcher

Carmen Marian from Iasi and her collaborators on textile imprints on Cucuteni pottery, and Dănuț Prisecaru on Bronze Age textile tools) are still minor compared to the opportunities potentially available through researching of prehistoric textile production, and represent only a first step in the scientific approach to the field of prehistoric textiles.

I.1.2. Defining the area of the research

We analyzed mainly the Transylvanian Inner-Carpathian area, that is the Depression of Transylvania, known as „The Voivodate of Transylvania" or „Voivodal Trabsylvania" in the Middle Ages (fig. 1.1). Due to the fact that the Neolithic and Eneolithic sites were not researched in their entirety in this area and the partial access to the museums' collections, there is a clear disproportion of the quantity of analyzed material in the same area.

Fig. 1.1. Map of Romania with historical regions delimited. The researched area corresponds to the Depression of Transylvania.

We studied materials from 54 sites consisting in textile impressions, spindle whorls and loom weights. There is a clear disproportion of the three categories of materials. The most representative are the loom weights (identified in 45 sites), then the spindle whorls (23 sites) and the textile impressions (identified in 11 sites only).

I.1.3.Defining the cultural and chronological frame

Defining the Neolithic and Eneolihic and establishing their chronology are somewhat difficult tasks if we consider the different periodization systems proposed in the literature. The terminology used is also a subject of interpretations and disputes. The Neolithic and Eneolihic are seen as two separate epochs even though some authors still use the term "Neolithic Eneolithic". There is a recent trend towards replacing the "Eneolithic" term with "Copper Age" (or "Kupferzeit") thus adapting it to the central-western European terminology. We can see such an example in the recent periodization system created by Gheorghe and Magda Lazarovici (2006, 2007).

Since there are many contradictory opinions regarding the final period of the Eneolithic (*Late Eneolithic* or the *Late Copper Age*), we did not include the final part of the Eneolithic in our research. The research is carried out upon the following culture/cultural groups: Starčevo-Criş, Vinča, Cluj-Cheile Turzii-Lumea Nouă cultural complex, Linear Ceramic culture, Iclod, Suplac, Oradea-Salca-Herpaly, Turdaş, Foeni, Petreşti, Ariuşd, Tiszapolgár and Bodrogkeresztúr. They are chronologically situated between ca. 6000-3500 B.C.

I.2. THE RESEARCH METHODOLOGY FOR ARCHAEOLOGICAL TEXTILES. PRINCIPLES AND USES

I.2.1 Defining textiles

Even though there is a great resemblance between the textile products and the half-rigid or rigid basket-like or mat-like structures (*basketry* or *wickerwork*), we support the definition of Elisabeth Barber in separating these two categories of artifacts. Barber says that textiles are all types of woven and not woven materials that look like "thin sheets of material made from fibres, which are soft and floppy enough to be used as coverings for people and things" (Barber 1991, 5). *The archaeological textiles* are those textiles that managed to survive through the times. The preserving conditions determined certain forms of conservation of the original textile: a. intact, fragmentary or in deterioration process; b. carbonized; c. mineral replacements or *pseudomorphs*; d. imprints or negative impressions left by original textiles in the ground or on burned or unburned clay, etc.

I.2.2. The analysis of archaeological textiles. Woven textile structures

Besides the primary analysis and classification method (Walton, Eastwood 1983), the research of archaeological textiles rapidly progressed by applying new cutting-edge methods of scientific interdisciplinary inquiry

(Andersson Strand *et alii* 2010). Although, applying these methods depends on the conservation degree and the preservation form of the archaeological textiles. For textile impressions, the investigation possibilities are much more restrained. In this case, we can only register the most visually noticeable properties like the structure of the textile product (the binding type or the technological procedure through which the textile product was made; the thickness of the thread systems; the edge type); the characteristics of the component threads (the torsion direction, the torsion angle, the thickness); decoration; technological errors; joining; wearing marks and so on.

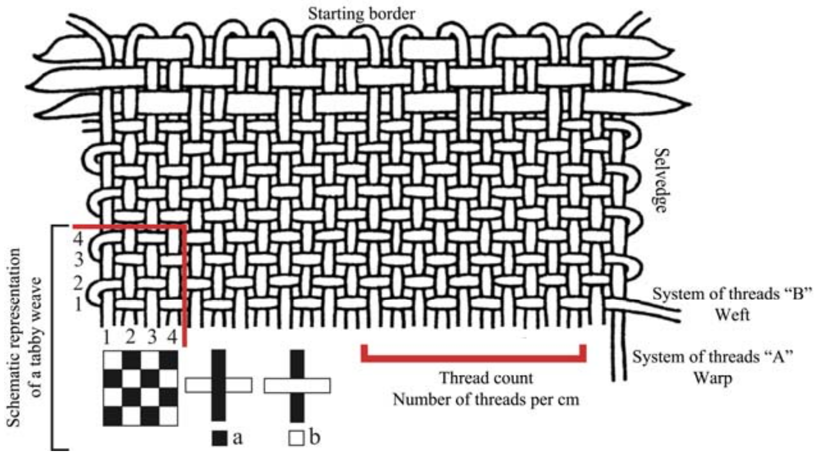

Fig. 1.6. Tabby weave: naturalistic representation of the main structural elements (*apud* Walton, Eastwood 1983); schematic representation by squares (*apud* Cioară 1998)

We adopted a structural classification of the woven textiles proposed by Lena Hammarlund (2005), who defined 28 different categories of fabrics. The primary differentiation of the fabrics was made according to: the binding type (the characteristic of the Neolithic period is the plain weave) (fig. 1.6), the fineness group (defined according to the fibres' thickness) and the thickness group (defined according to the value of the cover factor).

I.2.3. The study and typological definition of the twined textiles

The twined textiles are a recently defined category of textiles in the Romanian literature (Mazăre 2011c). Analyzing the twined textiles' structure meant running through the same methodological stages as in the case of woven textiles. Due to the fact that both the manufacturing technique and the structures' aspect are different from those of the woven materials, we treated the twined textiles separately. For classifying the twined structures we looked at the older study of James M. Adovasio (1977).

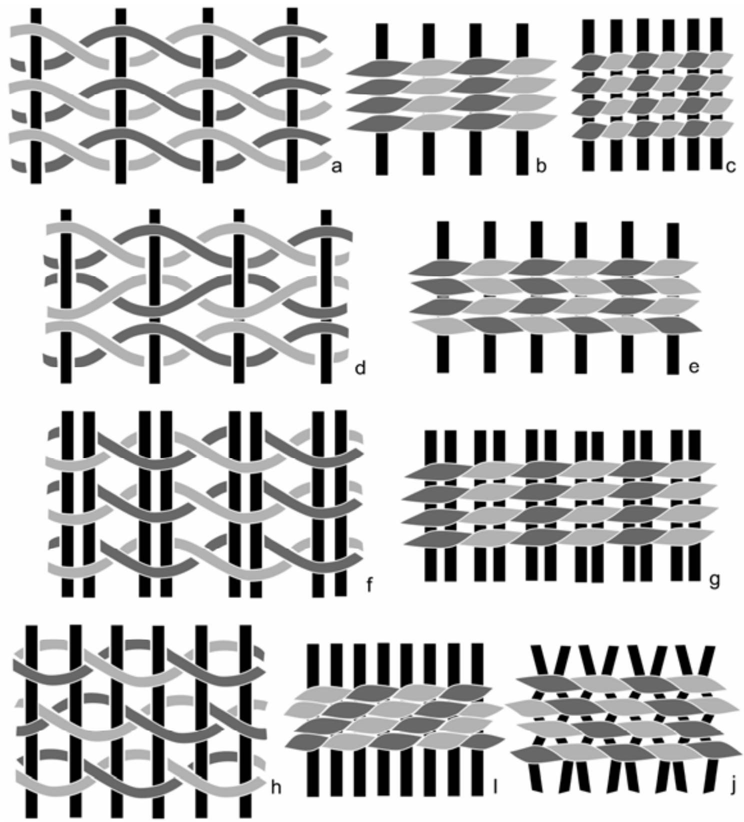

Fig. 1.11.Examples of twined structures belonging to class II_2 (two-thread weft twining): a. Open simple Z-twist twining (II_2-z-A3); b. Tight simple S-twist twining (II_2-s-A1); c. Closed simple S-twist twining (II_2-s-A2); d. Open simple ZS-twist twining (II_2-zs-A3); e. Tight simple ZS-twist twining (II_2-zs-A1); f. Open Z-twist twining over two passive elements (II_2-z-B3); g. Closed S-twist twining over two passive elements (II_2-z-B2); h. Open diagonal Z-twist twining (II_2-z-C3); i. Tight diagonal S-twist twining, with parallel warp threads (II_2-s-C1a); j. Closed diagonal Z-twist twining, with transposed warp (II_2-z-C2b); (draw: P. Mazăre *apud* Seiler-Baldinger 1991; Médard 2010).

Additionally, we referred to Annemarie Seiler-Baldinger's study (1994) regarding the classification of the textile techniques and the methodology of investigating the twined structure discovered in the Neolithic lake dwellings of the Swiss Plateau (Médard 2010). Thus, the twined structures have been divided according to the following classification model:

Classification level	The defined typological category	Classification criteria	Numbering (Coding system)
1.	Technological class	The active-passive relation between the thread systems	I, II, III... ($I_{2-3...}$; $II_{2-3..}$ ..)
2.		Twist direction	z, s, zs
3.	Technological type (connection type)	The passive elements' layout	A, B, C...
4.		The distance between the rows	1, 2, 3....
5.	Subtypes/variants	Structural and technological features	a, b, c.../$_1$, $_2$, $_{3...}$

Applying this system assigns a code to each twined structure, as in the following example:
I_2-z-A1 = Simple Twined Structure, Two Z Twist Warps;
II_2-s-C3 = Open Diagonal Twining, Two S Twist Wefts (see **fig.** 1.11).

I.2.4. Problems related to the analysis of textile impressions

The textile imprints or impressions are negative of the real textiles, most frequently preserved on the bottoms of the ceramic vessels. In order to study the textile impressions one has to make very accurate molds. Unlike the real archaeological textiles, the impression can offer additional information about the functionality of the textiles (like, for instance, using some of the textile categories in manufacturing ceramics). We have to admit, though, that the range of information regarding the technical aspects of the fabrics is thus restrained. Moreover, some factors like the properties and the quality of the textile product, the clay's degree of contraction, the deformation during the burning process (for ceramics) and so on can influence the original aspect of the textile product. Taking the above-mentioned aspects into consideration we developed an analysis sheet for investigating the textile impressions. Each impression is registered in a database according to a thoroughly defined set of criteria (for more details see Mazăre 2010).

I.3. THE METHODOLOGY OF RESEARCH FOR THE TEXTILE TOOLS. PRINCIPLES AND USES

The textile tools are all artifacts which had a functional role in the technological chain of manufacturing textiles. Archaeologically identifying them is not always an easy task. The most certain functional interpretation is that of the spinning and weaving tools: spindle whorls, loom weights and spools. These are also the artifacts we analyzed in the present thesis. The large number of the bone, horn and stone tools as well as the absence of the weare trace studies did not allow us to analyze these types of artifacts. Nevertheless, we referred to them in a separate chapter as potential sources of analyzing and interpreting within further research.

I.3.1. The analysis protocol

There are several methodological models of analyzing textile tools in Western Europe. One of the most recent and best structured, organized as a database is that of the Centre of the Textile Research in Copenhagen (*CTR* Textile Tools Database). Starting from it, we created our own Microsoft Access database with largely the same analyzing and registration protocol. We intended thus the exhaustive registration of all data regarding tools (spindle whorls, loom weights, spools). In our database, each artifact is characterized upon: piece code, location, settlement type, the context of the finding; cultural and chronological framing; preservation status, typological assignment; raw material; aspect/morphology; dimensions; details of the perforation; wearing marks; functional interpretations and observations; holding institution, collection, inventory number, bibliography.

I.3.2. Defining and classifying the textile tools

I.3.2.1 Spindle whorls

The spindle whorls are the main pieces of evidence regarding the spinning activity in prehistory. Moreover, they are indirect clues of practicing weaving. The analysis of the spindle whorls regarded mainly their functional attributes. All these attributes were registered following all measurement rules illustrated in fig. 1.13. When the artifacts are fragmentary, we tried to estimate the overall weight and the maximum diameter. We used the following abbreviations:

G – weight (g)

Ø – the maximum diameter of the spindle whorl (mm)

h – height = thickness (mm)

ØP – the (exterior) maximum diameter of the perforation (mm)

ØPm – the minimum diameter of the perforation (mm)

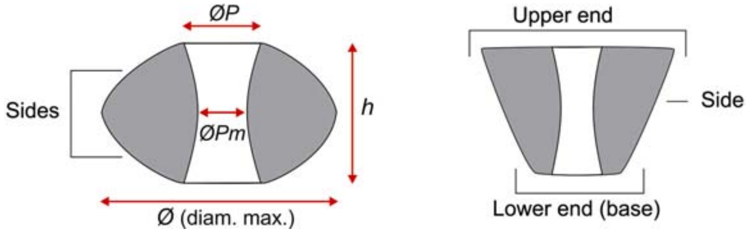

Fig. 1.13. Model for measuring the dimensions of spindle whorls and their associated names

For classifying spindle whorls we started from the model that has been proposed by F. Médard (2006). We adapted and modified this model to create a hierarchic typological system that has several levels of classification, with the following structure:

I	1	A	1	a
Category: raw material	***Class***: Size (weight)	***Group***: the flattening degree (*h/diam.*) (**fig.** 1.14)	***Morphological type***: Morphology (**fig.** 1.15)	***Subtype:*** the profile's aspect (**fig.** 1.19)

According to this system, each artifact is defined by a typological code. Examples:

I1-A-3b = very small, flat burned clay spindle whorl of convex shape with a concave upper end

II4-B-3b = perforated ceramic fragment, big, medium-flattened, with an irregular form, curved profile (for a detailed presentation of the spindle whorls' classification system used in the present thesis see Mazăre 2012).

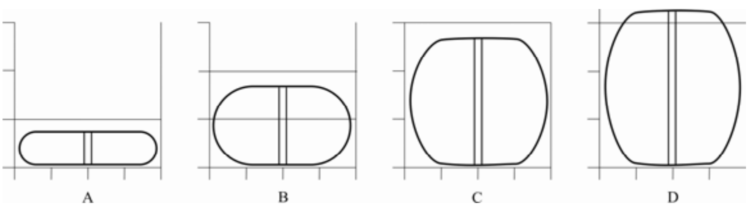

Fig. 1.14. Defining typological groups of spindle whorls in accordance with the ratio between height and diameter (h/diam.) (draw: P. Mazăre *apud* Médard 2006)

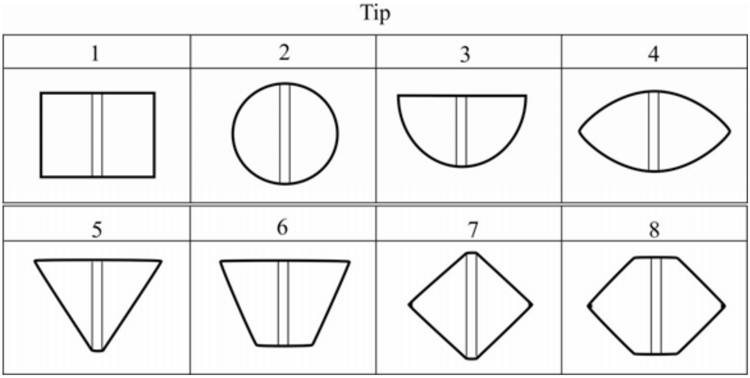

Fig. 1.15. Basic shapes used in defining the types of spindle whorls

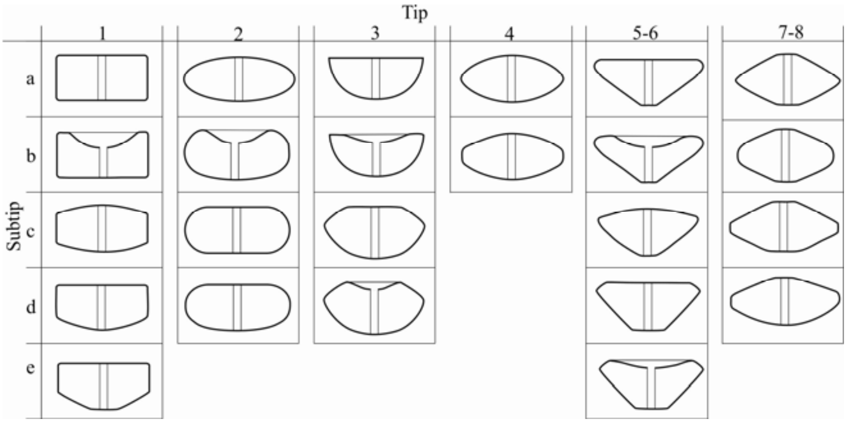

Fig. 1.19. Examples of subtypes defined for spindle whorls belonging to group B (flattened spindle whorls, h/diam. < 0.65)

I.3.2.2. Loom weights

The loom weights are objects having different forms and weights. They can be perforated or not perforated and look like simple stones, made of various materials (ceramic, stone, metal). They are used for tensioning the warp fibres in a vertical loom. As in the case of the spindle whorls, we analyzed the loom weights regarding mainly the functional attributes on which the technological optimum depends upon, though tensioning and equally distributing the warp fibres. The weight and the thickness are seen as the main functional attributes of the loom weights. Other important features are the width and/or diameter and height and the diameter of the hole (fig.1.24).

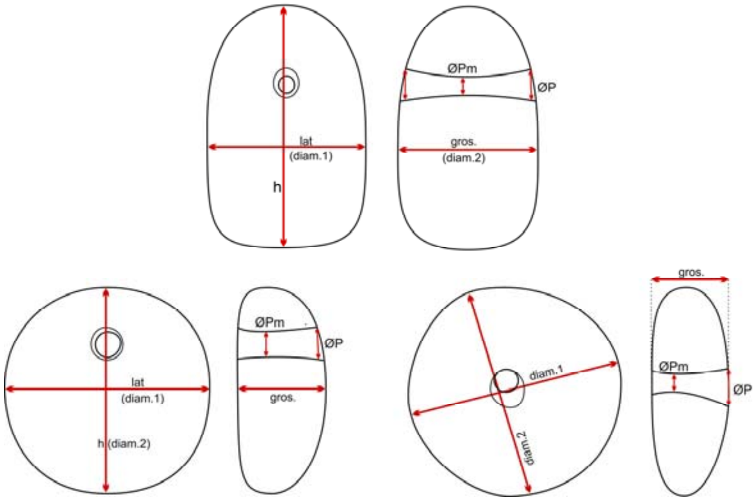

Fig. 1.24. Criterias for defining and messuring loom weights

For classifying loom weights – as in the case of the spindle whorls – we adopted a hierarchic typological system with several classification levels. In the end, a typological code is assigned to each artifact according to the following structure:

I	1	A	1	a
Category: absence/lack and the position of the attaching hole	***Class***: size (weight)	***Group***: the flattening degree (*thick/wide*) (**fig.** 1.27)	***Morphological type***: Morphology (**fig.** 1.29)	***Subtype:*** the elongation degree (*width/height*) **fig. 1.30**

Examples:
I1-A-1.a = upper perforated weight (with a single perforation), very small (under 50 g), flat, irregular form, elongated
I4-C-6.c = large-sized, upper perforated weight (750-1250 g), thick flattened, conical, short and wide
III3-B-3 = medium-sized, central perforated weight (250-750 g), medium flattened, circular form

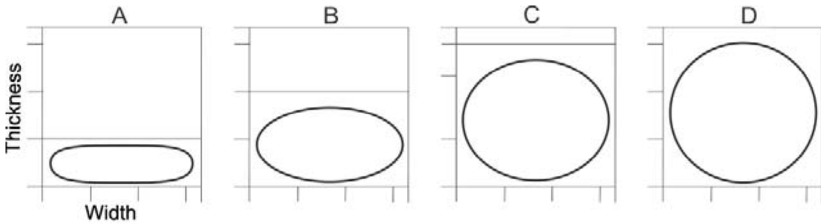

Fig. 1.27. Defining typological groups according to the ratio between the thickness and width of the weights

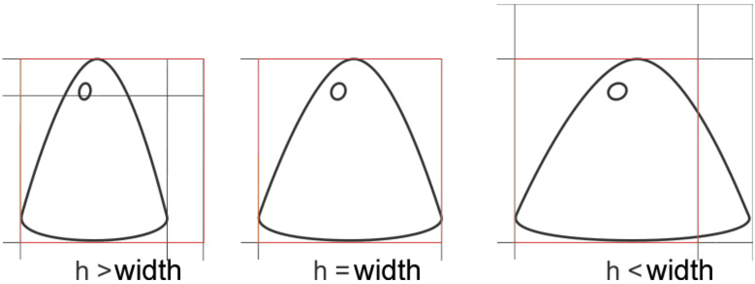

Fig. 1.30. Defining subtypes according to the elongation (slimness) degree of the weights, the ratio between height and width respectively

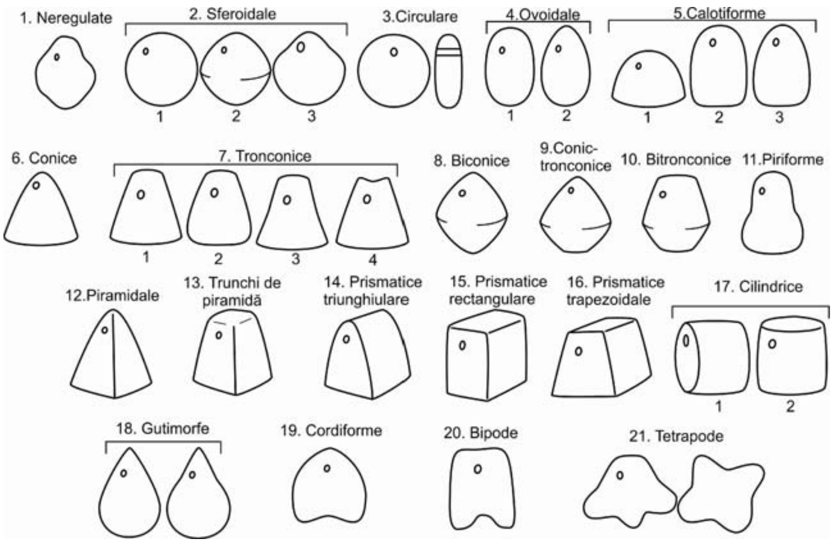

Fig. 1.29. Loom-weight types defined according to the primary morphology (examples of the upper-perforated weights)

CHAPTER II
THE TEXTILE PRODUCTION TECHNOLOGY IN PREHISTORY

If we take a look at the classification made by Heather M.-C. Miller upon the prehistoric skills, we notice that making of textiles is the most complex and complicated of all skills (Miller 2007, 44).

The reconstruction of the technological chain of manufacturing textile required several documentation sources: archaeological finds or genuine textile; paleoetnobotanical and archaeozoological data, microscopic, chemical or structural analyses for determining the raw material; historic and iconographical sources of the Antiquity, ethnographic data and experimental studies.

II.1. THE TEXTILE FIBRES. THE PROCUREMENT OF RAW MATERIAL

There were two main natural fibres categories used from prehistory until nowadays: vegetal fibres and animal fibres.

II.1.1. Vegetal fibres

Vegetal fibres have their chemical composition as shared characteristic: they are mostly made of cellulose. The main vegetal fibres types used from prehistory until nowadays (flax, hemp, nettle, tree bast, cotton) were similarly discussed: vegetal characteristics, technological properties, origin and expanding and cultivation area (for the cultivated textile plants), archaeobotanical evidences, prehistoric textile evidences and ways of cultivating or obtaining.

Flax (*Linum usitatissimum* L.) and the tree bast are considered to be the most frequently used vegetal fibres in prehistory. They are the main types of fibres identified in the Neolithic lake dwellings (approx. 4000-2600 BC) in the circum-alpine region, which has the most numerous textile remains and flax vegetal macro-rests in Europe (Körber-Grohne 1991; Barber 1991; Feldtkeller 1998; Bazzanella *et alii* 2003; Rast-Eicher 2005; Altorfer, Médard 2000a, 2000b; Médard 2006, Médard 2010). Recent archaeobotanical studies for that area show that the transition from cultivating oleaginous flax (with large seeds) to the textile type (with small seeds) began in the Horgen culture (3400-2800 BC) (Herbig, Maier 2011). The data would indicate the fact that flax was cultivated during Neolithic mainly for its seeds; its fibres were also used, but not in large quantities.

Hemp, stinging nettle fibres as well as other fibres of cultivated plants or spontaneous flora were identified through archeological findings of the prehistoric period (Alfaro Giner 1980; Alfaro Giner 1984; Barber 1991; Körber-Ghrone 1991; Roche-Bernard, Ferdiere 1993; Mannering 1995; Shishlina *et alii* 2002; Bazzanella *et alii* (edit.) 2003; Rast-Eicher 2005; Gleba 2008). The recent find in the site of Hódmezővásárhely-Gorzsa (Tisza culture, 5th millennium BC), namely an amphora-like vessel containing over 900 velvetleaf seeds (*Abutilon theophrasti* Medic.) (Medović, Horváth 2012) could support the early use of the *Malvaceae* as textile plants. Researchers believe that the importance of nettle as textile plant in the prehistoric times was greater than that currently estimated and its resemblance with other vegetal fibres hindered its identification up to very recently (Médard 2006, 27; Bergfjord, Host 2010).

II.1.2 Animal fibres

Varying on their origin and molecular structure, animal fibres are classified in two major groups: *hair* fibres and *silk* fibres.

Wool is the main hair fibre used from prehistory until nowadays. Although it is generally believed that wool sheep developed beginning around the of the 4th millennium BC (Barber 1991; Ryder 1992; Ryder 1993), Michael L. Ryder does not exclude the possibility of using wool in the previous times, when it was used in manufacturing felt-like textiles (Ryder 2005, 123). Recent research proved that the earliest textile remains made of wool belong to the Majkop culture in Northern Caucasus (approx. 3700–3200 BC) (Shishlina *et alii* 2003). In Europe, there is no evidence for using sheep wool earlier than the 3rd millennium BC (approx. 2800 BC) (Rast-Eicher 2005, 121, Sherratt 1997, 205). The acid soil sites in Northern Europe, in which wool textile remains have been preserved since the 2nd millennium BC are the most important sources for the study of Bronze Age textiles as well as for the following epochs (Broholm *et alii* 1940; Hald 1980; Bender Jørgensen 1986, 1992).

Apart from wool, other types of hair fibres (from domesticated as well as wild animals) were ascertained for prehistory and Antiquity: goat hair, horse hair, beaver hair, badger hair and so on (Plin.*NH,* 8. 47; Roche-Bernard 1993; Banck-Burgess 1999; Bazzanella *et alii* (edit.) 2003; Gleba 2008), but we assume their role in producing textile as of minor importance.

II.2. FIBRES PREPARATION

Understanding and reconstructing the process of preparing fibres depends on consulting ethnographic sources, which fill up the fragmentary and opaque archaeological data.

II.2.1. Processing the vegetal fibres

The most well-known processing techniques are those characteristic for flax and hemp and they go on as follows: drying the plants, retting, washing and drying the stems, separating the fibres from the ligneous part, hackling the fibres (Ewers 1989, 180; Rottoli 2003, 66; Médard 2006, 41; Martial, Médard 2007, 71; Zaharia 2008, 102). There are also other ways of processing, both ethnographically and experimentally documented, especially for the spontaneous flora (tree bast and nettle fibres) (Hald 1980, 125; Stewart 1984 *apud* Médard 2000a, 73; Dunsmore 1985, 9; Refsing 2003, 109; Hurcombe 2009).

The microscopic and experimental studies carried out upon the flax fibres of the lake dwellings in the Northern Alps show that flax was prepared through an archaic method by partially retting and the manual tearing off of the fibres. More exactly, processing the fibres was resembling to that illustrated in the frescoes on the Ancient Egyptian tombs (Rast-Eicher 2000; Leuzinger, Rast-Eicher 2011).

Several categories of archaeological artifacts were identified during the research (combs made of thorns or bone spike; denticulated flint tools and so on), all of which could have been used in preparing and separating the fibres (Schibler 1992, pl. 41/7; Roche-Bernard 1993, 50; Caspar *et alii* 2005; Médard 2006, 36, 41-42; Beugnier 2007; Hurcombe 2007; Hurcombe 2009).

II.2.2. Processing the animal fibres (wool)

Preparing the wool traditionally undergoes four stages: shearing the sheep, sorting and washing the wool, combing and hackling (Focşa 1969/1973, 189; Teodorescu 1979, 278; Dunăre 1971, 22-24; Dunăre 1974, 294, Zaharia 2008, 32-36), stages which were probably carefully observed in prehistory with wool used as textile fibre.

II.3. THREAD PRODUCTION (SPINNING)

Apart from the silk filaments, there are no fibres in natural form. Threads are made after a series of technological procedures, generally known as spinning. Spinning is the technique through which fibres (of different type and quality and variable length) are paralleled, combined and twisted together to form a continuous filament, with a potential unlimited length. We know two major technical procedures: the free spinning, with no tool used and spinning with the use of a tool. The most known and widely spread additional spinning tool is the spindle.

II.3.1 Free spinning, without tools

This is a spinning technique documented upon iconographical sources in Antiquity and still used today in certain areas of the world. It is characteristic especially for spinning long vegetal fibres (tree bast fibres) and for making coarse fibres or cords/strings (Médard 2006, 99-102, fig. 99-115; Martial, Médard 2007, 75; Hardy 2007, 15; Breniquet 2008, 110). Archaeologically, the spinning without a tool leaves no trace other than the finite product, which is not different from the products made by other spinning techniques. A number of authors believe though the prehistoric fibres, strings and cords were freely made, with no additional instruments (Nadel *et alii* 1994; Adovasio *et alii* 1996; 1997; Soffer *et alii* 1998; 2000). F. Médard (2010) assumes that the majority of tree bast fibres used in making twined textiles in the Neolithic lake dwellings in Switzerland was spun without using a spindle.

II.3.2 Spinning with instruments

The spindle (with or without spindle whorl) is the most commonly used tool in the process of spinning the fibres. There are several techniques of spinning using the spindle. These techniques were used in prehistory and Antiquity, according to the iconographic sources and are still used in present times, as shown by the ethnographic data: spinning by rotating the spindle in the hand, spinning with a supported spindle and spinning with a suspended spindle (Crowfoot 1931; Patterson 1956; Alfaro Giner 1984; Barber 1991; Dunsmore 1985; Dunning 1992; Hecht 1989; Stærmose Nielsen 1999; Médard 2006; Gleba 2008). A culturally determined characteristic which can influence the spinning technique consists in positioning the spindle whorl on the spindle, respectively in its upper part or in the lower part of the spindle and, more rarely, at the middle of the spindle.

The most widely spread artifacts used for spinning are the spindle whorls. In the Near East, the earliest spindle whorls were found in different Pre-Pottery Neolithic settlements (PPNB) (Breniquet 2008, 113), which is clear evidence for their oldness. In Europe they are known since the Early Neolithic (Barber 1991; 54), but their number is impressively increasing from the Bronze Age on.

A special spinning technique, still used today in some areas is that illustrated on the frescoes in the Egyptian tombs. It consists in spinning or twisting one or two fibre filaments previously obtained from thin strips of plied fibres (Crowfoot 1931, 1954; Alfaro Giner 1984; Barber 1991; Vogelsang-Eastwood 1992; Evely 2000; Breniquet 2008). The microscopic observations and the experimental studies proved that the same spinning technique was used in the Neolithic as well (Leuzinger, Rast-Eicher 2011).

The ethnographic sources show that there are other procedures of spinning/twisting fibres, apart from those made using a spindle. Although the archaic tools (Vuia 1960; Maier 1973; Hald 1980; Schirrer 1996; Chmielewski 2009a) could exist in the prehistoric times, they are difficult to identify in the field. Nevertheless, we assume that the prehistoric communities simultaneously used several spinning techniques.

II.4. CREATING TEXTILES. TYPES OF TECHNIQUES AND TEXTILE STRUCTURES

Prehistoric textiles demonstrate a wide range of structures, manufactured both with primary and advanced techniques. We surveyed a few such techniques, believed to be representative, the more so as they are documented for the Neolithic and Eneolithic periods on the Romanian territory.

II.4.1. Needle looping techniques

These techniques are also known as „*nålebinding*" (Bender Jørgensen 1992, 14) or *Nadelbindung* (German) (Böttcher 2004). For prehistory it seems that the more common usage was that of making fishing nets, as proven by the discoveries from Mesolithic sites of Friesack, Germany, 8th millennium BC (Hardy 2008), Tybrind Vig, Denmark (Bender Jørgensen 1992; 2003) and the Neolithic sites of Bolkilde, Denmark (Bender Jørgensen 1992; 2003; Hardy 2007), Feldmeilen–*Vordelfeld* (Switzerland) (Bazzanella *et alii* 2003). In Romania, the textiles made by needle looping were identified as imprints only on Cucuteni pottery (approx. 4500–3500 BC) (Cucoş 1999; Marian, Ciocoiu 2004; Marian *et alii* 2004; Marian 2009; Văleanu, Marian 2004).

I.4.2. Sprang

Sprang is a word of Scandinavian descent, generally used today to describe the so-called 'plaiting-on-stretched-threads' technique (Collingwood 1974). Even though there are Bronze Age discoveries that demonstrate the *sprang* technique, authors believe that it becomes more widely spread in the Iron Age (Barber 1991, 122; Collingwood 1974, 39-42). One single textile impression found at Cucuteni-*Cetăţuie*, Iaşi County (Cucuteni culture) was assigned to the sprang technique (Marian *et alii* 2004; Marian 2009). We state that it is, in fact, a structure made by a simple linking, which is a less-evolved method than the *sprang*.

II.4.3. Twining

The twining technique is thought to be very closely related to the weaving technique, better said one of its predecessors. It can be used for a wide range of fibre types, more or less rigid, with fibre tensioning frames or without such devices. Just like today, the textiles made with the twining technique were widely spread in prehistoric times, having different types of structures. The Upper Paleolithic finds from Pavlov I, Dolní Věstonice I and II (Adovasio *et alii* 1996; Adovasio *et alii* 1997; Soffer *et alii* 1998; Soffer *et alii* 2000, 2000b) show that the twining is one of the oldest textile technique used by the prehistoric man. Evidences for this type of technique are present as early as the Pre-Pottery Neolithic in the Near East (Helbaek 1963; Burnham 1965; Barber 1991). In Europe, this technique is noticed in several settlements both in textile remains and as ceramic impressions. The largest number of textile remains with twined structure was discovered in the lake dwellings in the Swiss Plateau, generally dated in the 4th-3rd millennia BC (Médard 2010). In the Romanian territory we only inventoried 27 twined structures as textile impression discovered in 11 Neolithic and Eneolithic settlements, those in the present thesis included.

II.4.4. Weaving

Weaving is considered the most advanced textile technique. The woven structures can be obtained using different devices which could be found in more or less evolved forms starting from prehistory until present (Hoffmann 1964; Taber, Anderson 1975; Hald 1980; Collingwood 1982; Alfaro Giner 1984; Hecht 1989; Alfaro 1990; Barber 1991; Broudy 1993; Seiler-Baldinger 1994; Evely 2000; Bazzanella *et alii.* 2003; Wild, Walton-Rogers 2003; Ciszuk, Hammarlund 2008; Breniquet 2008; Zaharia 2008; Grömer 2010). Taking into consideration the loom weights found in numerous Neolithic settlements, we can conclude that the warp-weighted loom is the only type that can be clearly documented for this period. The archaeological finds demonstrate that the representative binding structure for the Neolithic fabrics was the plain weave and its derivatives. Evidence of the oldest woven textiles was found in the Near East (Heldbaek 1963; Burnham 1965; Adovasio 1975; Barber 1991; Breniquet 2008). The oldest textile fragments from Europe were discovered in the submerged Neolithic settlement of La Marmota (lake Bracciano) dated to 5480–5260 BC (Rottoli 2003; Gleba 2008). The major group of Neolithic textile vestiges dated ca. 4000–2600 BC were found in the lake-dwelling sites of Switzerland and Southern Germany. Elsewhere in Europe they appear sporadically in the form of textile imprints and are generally older than woven textiles found in Central Europe. The earliest Neolithic textile imprints were found in Hungary, at various sites belonging to the Körös culture (Makkay 2001, Richter 2009). All woven structures found so far in Romania are dated in the Eneolithic (there is only one exception, belonging to the Vinča culture). All prehistoric woven textiles discovered in Romania appear as ceramic impressions belonging to the Foeni cultural group and to the Tiszapolgár and Cucuteni cultures.

CHAPTER III
FINDS RELATED TO THE NEOLITHIC AND ENEOLITHIC TEXTILE PRODUCTION IN TRANSYLVANIA

III.1. Textile imprints

During our research we have managed to identify and analyse 27 impressions found within 10 archaeological sites and belonging to the Starčevo-Criş, Vinča, Turdaş, Tiszapolgár cultures and the Foeni and Iclod cultural groups (tab.3.1).

		Starčevo-Criş	**Vinča**		**Turdaş**	**Foeni**		**Iclod**	**Tiszapolgár**	
Site code	**Site name**	*IIIB-IVA*	*A3-B1*	*B1-B2*	-	-		*I*	-	*B*
ALN	Alba Iulia-*Lumea Nouă*					2	1			
DAC	Dăbâca-*Cetate*									1
DOR	Doroltu-*Castel*								1	
HGC	Hunedoara-*Grădina Castelului*	1								
LBT	Limba-*Bordane*			1						
LVL	Limba-*Vărăria*			4						
MSP	Miercurea Sibiului-*Petriş*		3							
TAG	Ţaga							1		
TLL	Turdaş-*La Luncă*				1					
TRD	Turdaş				10					
VSG	Valea Sângeorgiului				1					
Total		**1**	**8**		**12**	**3**		**1**	**1**	**1**

Twined textile	21	String (Cord)	1
Woven textile	4	Uncertain textile structure	1

Table 3.1. Cultural and site distribution of the analysed textile impressions

III.1.1. Twined textiles

They represent the majority of textile structures identified as impressions on Transylvanian pottery (tab. 3.1). With the exception of the Foeni imprints, belonging to Eneolithic, all the others are within the Neolithic period.

The twined textiles were characterised based on the following criteria: raw materials, the components diameter, the thickness and density of textiles, the orientation of its rows of active elements, its edges (margins), technological details (and faults), usage marks.

We identified 8 types of twined textiles (fig. 3.1). Of these the majority were created in diagonal twining with more or less closed rows. A single imprint revealed a simple twined structure (III2-s-A1; ALN-0018, cultura Foeni). Also, a single imprint revealed a twined structure with an inversed active system. (IV_2-S-C2b; TRD-5271, Turdaş culture). At all of the structures the active elements (weft threads) were twined in S orientation.

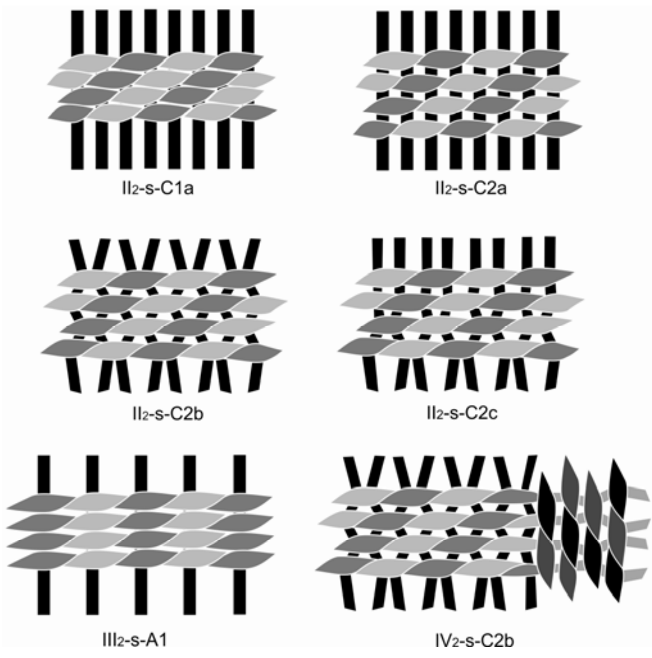

Fig. 3.1. Types of twined textile structures identified as imprints on Neolithic and Eneolithic pottery from Transylvania

All of the twined textiles were made using stripes or bundles of vegetal fibres, some looking similar to decorticated stems/fibres, used in raw form.

The elements' diameters are between 0.7 and 3.6 mm with an average between 1 and 2.67 mm. In conclusion all these textiles are thicker than all other weaved textiles analysed. Even so there are variations in thickness that allow a separation into 4 classes. The thickest are more similar to mats than textiles structures. Some display rows of curvilinear active elements, a clue that they were manufactured freely, without any tension frame or device.

III.1.2. Woven textiles

We had the opportunity of analysing only four such woven imprints (tab. 3.1), even though, at least for Tiszapolgár culture there are records of more imprints. With the exception of the narrow woven textile found in the Neolithic site of Limba, all the others are dated into Eneolithic. All the structures were made using the tabby weave technique, but displayed different morphological and technological particularities, thus dividing them into various types: I. warp-faced tabby narrow band; II. balanced tabby weave.

According to the ratio between thickness and density we can distribute the 4 imprints into as many different classes (fig.3.12).

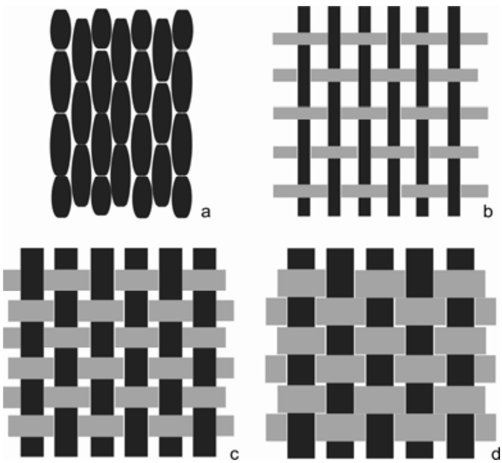

Fig. 3.12. Types of woven textiles identified as imprints: a. I-5c = medium-coarse and dense narrow band, warp-faced plain weave (LBT.1050); b. II-2a = thin and open plain weave (ALN.1001); c. II-6b = coarse and medium-dense plain weave, (DAC.58024); d. II-7c = very coarse and dense plain weave (DOR.61329)

The woven textiles were created using simple or plied yarns. With the exception of the narrow cloth, made of z-twisted yarns, all the others were made using s-twisted yarns. The twist angle varies between 30º and 53º. The thickness of system A threads is almost identical to those threads from B system. The thinner threads (0.32 mm) are found within the weaving imprint from Lumea Nouă belonging to the Foeni cultural group, and the thicker ones (1.4 mm) in the one recovered at Doroltiu, from the Tiszapolgár culture settlement.

III.1.3. Uncertain structure textiles

From the Starcevo-Criş IIIB-IVA settlement at Hunedoara-*Grădina Castelului* we have a textile imprint with an unidentified structure, representing the oldest textile imprint from Transylvania. Even if the structure and its functionality are uncertain we can distinguish that the fragment reveals a rugged character, most likely produced using unspun fibres, with a diameter between 1 and 3.9 mm.

III.1.4. String type elements

Although it is not necessarily a textile structure we opted to include a segment of a string imprinted on a pottery fragment belonging to the Iclod cultural group. It has a diameter of 3.5 mm and was crafted using two elements secondary twisted in the Z direction, with a torsion angle of 24°.

III.2. TEXTILE TOOLS

Even though the database contains over 690 records of textile tools, part of these were excluded from the analysis due to their uncertain cultural and chronological coordinates, the final number of analysed artefacts being thus reduced to 652. Of these 458 artefacts are of certain cultural affiliation, with a total of 12 cultures and/or cultural groups, the remaining 194 being recorded as uncertain from the point of view of their cultural affiliation (tab. 3.12.)

In total, from the 51 archaeological sites investigated, we analysed a number of 563 weights, 3 spools and 58 spindle whorls and potential spindle whorls (perforated ceramic fragments, representing 34% of spindle whorls). Although recorded and analysed as weights, a number of 28 artefacts have an uncertain functionality, on the limit between being weights or spindle whorls, either too big to be considered spindle whorls and too small to be weights or heavy enough to be considered as weights but with a shape more easily related to spindle whorls.

Culture/ Cultural group		Number of textile tools								
		Spindle whorls		Loom weights		SW/ LW		Spools		Total
		(certain)	(u.c.a)	(certain)	(u.c.a)	(certain)	(u.c.a)	(certain)	(u.c.a)	
S-C	Starčevo-Criş	6		108	2	8	1			125
VIN	Vinča	4	1	91	28	10	2			136
LN	CCTLNI	2								2
CCL	Linear Ceramic Culture (Notenkopf)	5		8						13
TRD	Turdaş	5	2	22	26	1				56
ICL	Iclod	1	1							2
SUP	Suplac	3	5	3	1					12
OSH	Oradea-Salca-Herpály			4						4
FOE	Foeni	1		7	8					16
PET	Petreşti	1	3	67	25		1			97
ARI	Ariuşd-Cucuteni	8	2	65					1	76
TSZ	Tiszapolgár		2							2
BDK	Bodrogkeresztúr			27						27
VIN/TRD	Vinča/Turdaş		1		53		4			58
CCL/PCC	Linear Ceramic Culture / Precucuteni?		1							1
TRD/FOE	Turdaş/Foeni?		2		3					5
TRD/PET	Turdaş/Petreşti				12					12
PET/FOE	Petreşti (Foeni?)				2					2
ICL/PET	Iclod/Petreşti		1				1			2
PET/COT	Petreşti/Coțofeni?								2	2
ENL	Eneolitic (?)		1							1
	Total	36	22	403	160	19	9		3	**652**

(shaded) = uncertain cultural affiliation (u.c.a)

Table 3.12. Numerical distribution for categories of textile tools in relation to their uncertain cultural affiliation (certain, uncertain)

Archaeological context

From 235 textile tools, 36% were recovered from 81 features and structures of various types, most of them from surface houses. In contrast with spindle whorls, that usually appear alone within a feature, the majority of weights are at least in groups of two. Although a feature/structure can contain more than one weight they are found functionally associated in only a few exceptional cases (fig. 3.17, 3.19). For example, two Eneolithic houses (of Ariuşd and Petreşti cultures) provided groups of 28 weights. Other extraordinary contexts that provided weights and fragments of weights are the ritual pit from Limba (Vinča culture), a pole pit from Petreşti and several ovens from Ariuşd.

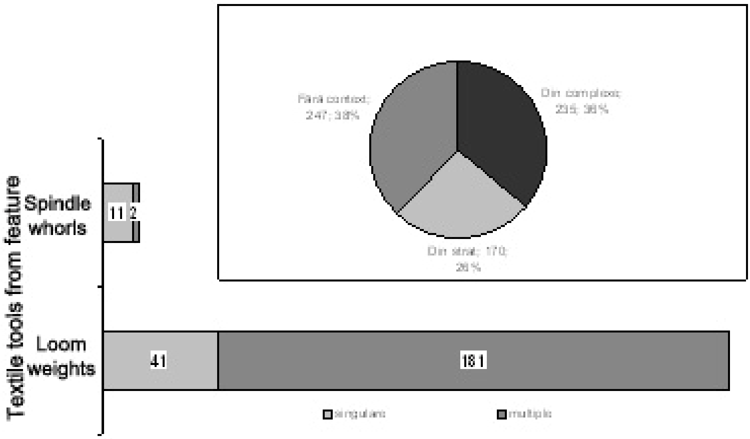

Fig. 3.17. Distribution for textile tools in regards to the archaeological contexts and the ratio between the number of individual and multiple artefacts found within features/structures

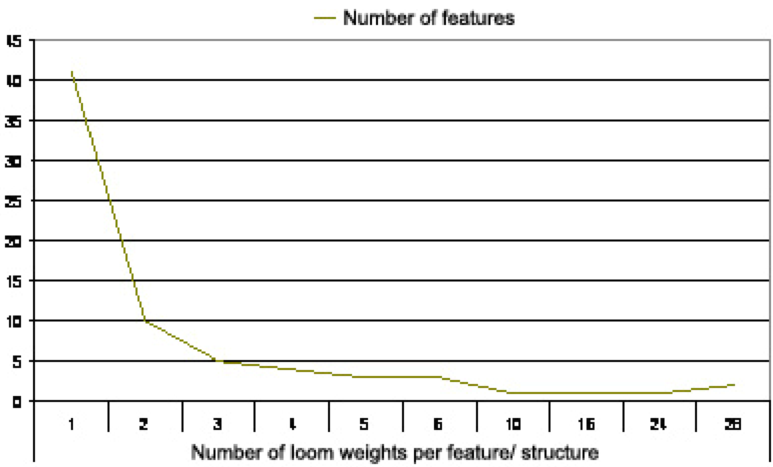

Fig. 3.19. Frequency of weights in relation with the number of features/ structures.

No matter what functional category they fit in (spindle-weights, weights and spools) all the textile tools were presented according to the following analysis criteria: the context of find, fragmentation degree, typological classification, perforation diameter, raw materials, firing and treatment of surface, decor and signs/marks of usage.

III.2.1.Spindle whorls

The spindle whorls represent a category of artefacts poorly represented in the Neolithic and Eneolithic settlements from Transylvania. In total we have managed to gather and analyse a number of 58 artefacts, of which 38 are burnt clay spindle whorls and 20 pierced rounded sherds. Although the numerical repertory is not representative for such a small number of artefacts, we can observe that most spindle whorls were recovered in Eneolithic habitation layers or features and most pierced rounded sherds come from Neolithic settlements.

For burnt clay spindle whorls we identified 8 base types, some with sub-types and variants (fig. 3.31). Most of them can be classified as small sized (2) = under 25 g and medium (3) = 25-50 g. In average the heaviest are those of bi-conical shape from the Linear Ceramic culture (groups B-C), and the lightest are those of discoid shape (group A) belonging to Ariuşd Culture. Even so, the heaviest spindle whorl was recorded for Ariuşd Culture, estimated around 174 g, much over the values recorded for the entire lot of spindle whorls (fig.3.30).

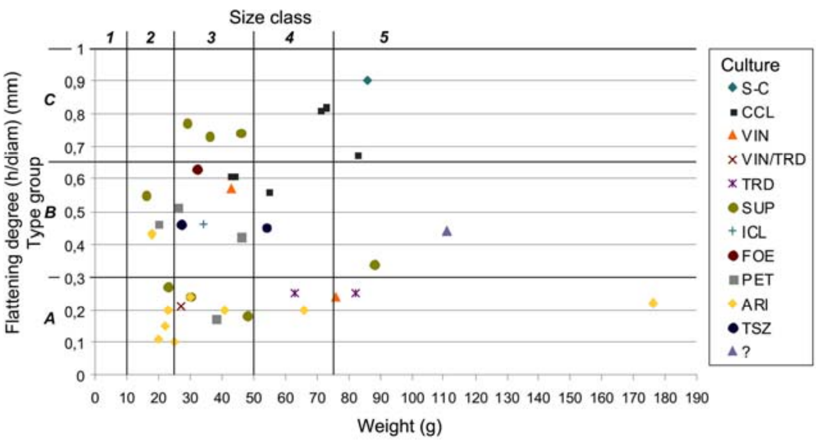

Fig. 3.30. Relationship between the degree of flattening (type group) and weight (size class) for burnt clay spindle whorls against their cultural affiliation

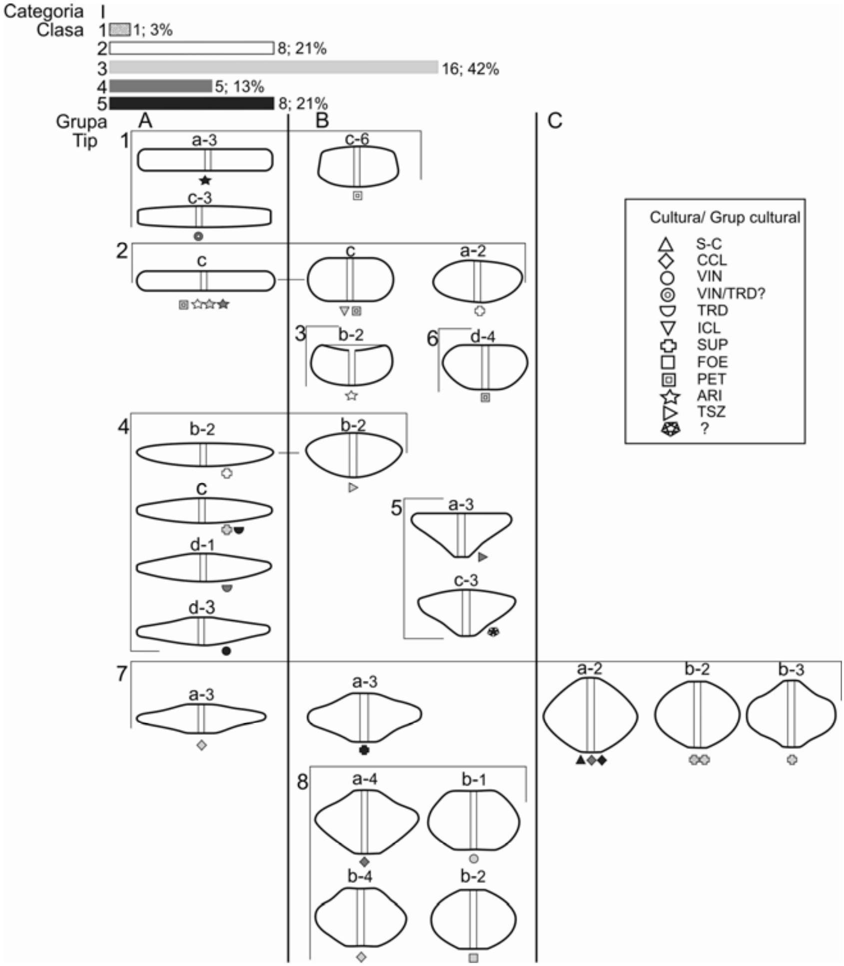

Fig. 3.31. Types of spindle whorls identified compared to cultural affiliation

In the case of pierced rounded sherds, most of them are of circular shape (type 1), only a few with and ellipsoidal morphology (type 2) and irregular (type 3). With the exception of two artefacts of large size (Starčevo-Criş culture), the majority has weights under 20 g, lighter than most of the burnt clay spindle whorls.

III.2.2. Loom weights

The loom weights represent the majority of textile tools investigated (563 items). With the exception of a fragment of (un-burnt) clay weight found at Turdaş (and most likely belonging to Turdaş culture) all the others are made of burnt clay. Given the large number of artefacts and their diverse typological variations the analysis was conducted according to their cultural affiliation.

For each culture we identified several types of weights, some cases being rather similar in terms of artefact morphology. The highest similarity, in terms of morphology, weight and thickness we have for the central perforated loom weights belonging to Vinča, Turdaş, Foeni and Petreşti cultures. The most diverse types were recorded for upper perforated weights of Ariuşd (fig. 3.82) and Petreşti cultures, also presenting the highest variety of subtypes and variants.

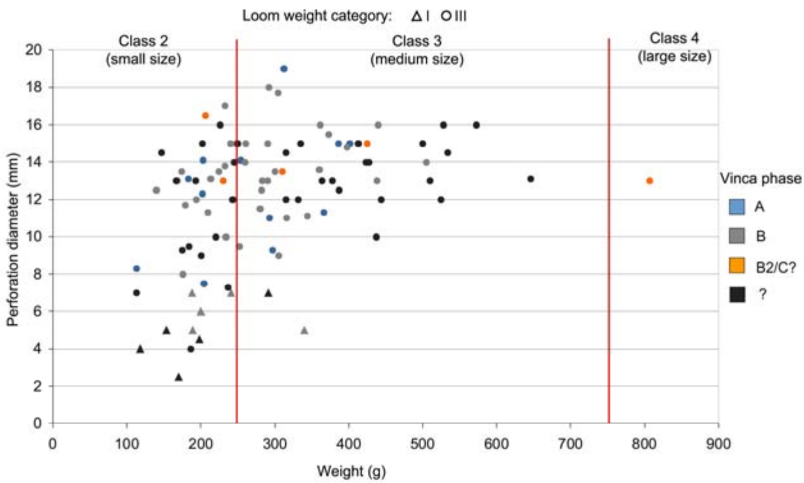

Fig. 3.55. Relationship between perforation diameter, weight (size class) and typological category (I, III) for Vinča culture weights

The weight of the loom weights is somehow similar, most of them found in between 150 and 700 g. The majority of weights are classified as medium sized (3), around 250 and 600 g. There are also exceptions, for example the weights belonging to the Linear Ceramic culture, all under 60 g. Also for Starčevo-Criş Culture, the upper perforated weights are of small size and weigh between 80 and 250 g thus being generally smaller even compared to the majority of central perforated ones from the same culture. Of small size (under 250 g) are the upper perforated weights from Vinča and Foeni cultures and some of those belonging to Ariuşd culture. All the central perforated weights of Ariuşd culture and most of Bodrogkeresztúr ones weigh under 250 g. The heaviest weight is found in Ariuşd culture, 937 g.

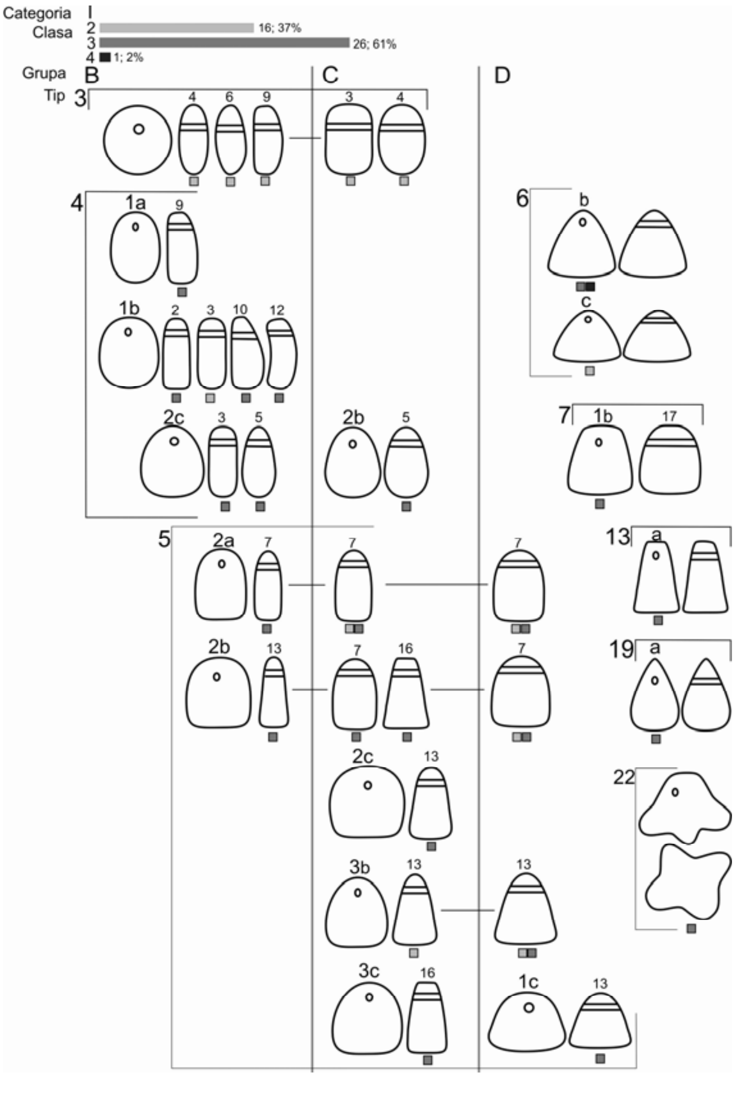

Fig. 3.82. Types of upper perforated weights belonging to Ariuşd culture

The thickness of all weights is within 20 and 80 mm. For Petreşti and Ariuşd upper perforated weights we observe a tendency of elongation and flattening, thus entering group B (according to the ratio between thickness and width). Also in group B we have the majority of central perforated weights; in general these have a larger perforation than the upper perforated ones (fig. 3.55), and in the case of Vinča and Turdaş cultures they are mostly decorated.

III.2.3. Spools

We gathered under the nomination of *spools* all the small sized ceramic artefacts, in general having a maximum length of 10 cm and weighting between 8 and 245 g; they mostly have cylindrical shapes, often with prominent ends, resembling the spools and reels presently used for coiling threads.

We have managed to analyse only three artefacts that have the characteristics of spools. One of these artefacts originates from the Ariuşd culture settlement of Şoimeni-*Dâmbul Cetăţii* (SDC-8765), and the other two from Tărtăria (TAR-13991) and Pianul de Jos (PJP-10385), with an uncertain cultural affiliation (Petreşti or Coţofeni culture). All of these artefacts are of small sizes, with the weight between 55 g and 75 g. They display similar sizes, the maximum diameter varies between 32/30 and 40/41 mm and height between 46 and 56 mm.

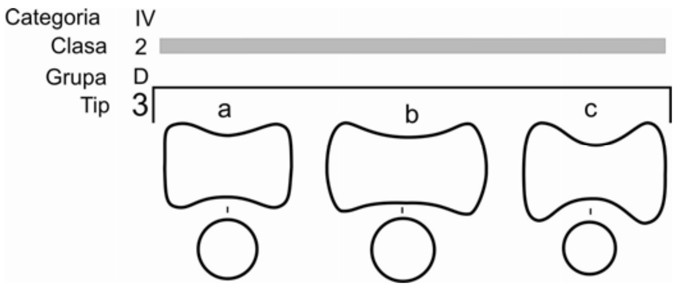

Fig. 3.92. Types of spools

III. 3. OTHER TOOLS POTENTIALLY USED IN THE TEXTILE MANUFACTURING TECHNOLOGY

Besides spindle whorls and weights for looms, identifying other tools among the artefacts recovered archaeologically is rather difficult due to many circumstances, the most crucial being the lack of ware traces analysis to clearly discern the artefact's functionality. This is the reason why we have not included such artefacts in our research strategy and we have not approached them with the same analytical eye as in the case of spindle whorls and loom weights. In conclusion this subchapter is additional and is mainly based on bibliographical sources and in a small percentage on direct analysis. It is structured from general to particular, from defining the main artefacts involved in textile production to a case-study of artefacts from bone tools found within the complex Neolithic settlements from Limba. We will make reference here only to this last part.

The complex settlements from Limba have provided a number of 174 bone tools, extensively studied and published (Mazăre 2005). They originate from the Starčevo-Criş III B and Vinča (phases A2-A3 and B1-B2) habitation layers. Of these a number of 89 artefacts could have been used in textile production practices: pin beaters, weaving needles, shed or patterning sticks used in small weaving implements, warp spacers, tips of combs used for fibre separation, shuttles, weaving knives, instruments for detaching the fibres from stalks/ bark, needles used in *nålbinding* or *looped-needle netting*.

CHAPTER IV
FUNCTIONAL INTERPRETATION

IV.1. FUNCTIONAL INTERPRETATION OF THE TEXTILE TOOLS

IV.1.1. **Spindle whorls**

Burnt clay spindle whorls

The literature deals with plenty of discussions on the actual usage for spindle whorls, evolving from simple notions to complex experimental interdisciplinary studies (Liu 1978; Raymond 1984; Barber 1991, Bier 1995, Crewe 1995, Keith 1998; Grömer 2005; Martial, Médard 2007, Breniquet 2008; Chmielewski 2009). Of these we notice the recent studies of the researchers from the Centre for Textile Research (*CTR*), University of Copenhagen (Mårtensson *et alii* 2005-2006; Mårtensson *et alii* 2006a, b). Also important are the studies of F. Médard (2006) or T. Chmilelewski and L. Gardyński (2010) with physical descriptions of artefacts and analyses of the moment of inertia and rotational speed, based on their mechanical properties. The limitations of these studies are found in the fact that they mainly deal with a single type of spinning (suspended spindle spinning), thus excluding the functional evaluation of spindle whorls in relation with other types of spinning that might have been used in prehistory.

All of these studies are an argument for the interpretation of Neolithic and Eneolithic finds from Transylvania. These spindle whorls are divided into two main categories, corresponding to typology groups and to different mechanical properties. On one category we have the flattened discoid spindle whorls of group A, and on the other the medium and tall ones from groups B and C. Items from group C are usually heavier than the rest, with an average weight of 1,6 to 1,7 times that of groups A and B. Taking into account the relationship between the radius of spindle whorls and the moment of inertia on one side and the relation between the radius and rotation speed on the other side we can approximate that, in average, the rotation of group B spindle whorls is about 1.3 times faster and 1.8 shorter than the flat discoids of group A. In exchange the added weight from group C (with an increased height) indicates a higher moment of inertia and thus a longer time of rotation compared to B group. These observations might suggest that, if the technique of spinning would have been that of suspended spindle, the different spinning whorls would have been used to produce threads of varied quality.

Other observations are made on the relationship between weight, diameter and height of spindle whorls and the diameter of perforation; also observed is the perforation’s degree of alignment in relation to the centre; all the usage markings and / or the external notches of discoid spindle whorls is also analysed and so on. In conclusion, the characteristics of Neolithic and Eneolithic spindle whorls from Transylvania might actually indicate two ways of spinning, with resulted threads of different quality, and probably originating from different fibres: 1. spinning with suspended short and thick spindles, with the spindle whorl either on the upper or lower part; these would have produced finer threads (possibly from flax?); 2. spinning with suspended or suported longer and thinner spindle, with the spindle whorl located on the upper side; these would spun / twist long fibres or filaments of fibres (possible tree bast?) or plying the yarn.

Pierced rounded sherds

In this case the balance between diameter and height noticed for modelled clay artefacts, allowing them to be used as spindle whorls, can only be found exceptionally. As a consequence we consider that most of these pieces were used for other purposes and only a few can be related to spinning practices. An interpretation for the items lighter than 20 g is that they might have been used as pairs of discs fixed on the spindle and acting as supplemental weight next to a spindle whorl. Other uses are also possible beside this one (Raymond 1984, 19-20, fig. 5; Crewe 1998, 12).

IV.1.2. Loom weights

Currently, most of the weights (made from burnt clay) found in archaeological sites are named and defined functionally by archaeologists as loom weights (the upper perforated ones) and fishing net weights (the central perforated ones). Besides these there are other functional possibilities, mentioned by the literature: *heat stones*, pedestals or supports, weights for holding down the roof etc. The main criteria for differentiating loom weights from the other types lies in the context of discovery (the most obvious contexts are those that provide weights in rows or groups) and usage markings, although all of these can be interpreted differently. As opposed to upper perforated weights, the central perforated ones rarely provide usage marks that would sustain their usage suspended. This could be a clue that they were used for something quite different.

The function of weights in the warp weighted looms

Ethnographical data as well as the experimental studies of F. Médard (2000, 88-97) or those performed within *CTR* (Mårtensson *et alii* 2007a; Mårtensson *et alii* 2009) have shown that the weight (mass) and maximum width are the fundamental functional parameters of loom weights. The density and uniform, balanced distribution of threads depends on these properties, and a relation can be established with the ease of weaving and the width of the textile resulted. Choosing the loom weight according to width and weight is done in relation with the type of weaving that is aimed at and the type of fibres used. (Mårtensoon *et alii*. 2009, 390) (tab 4.7; fig. 4.15).

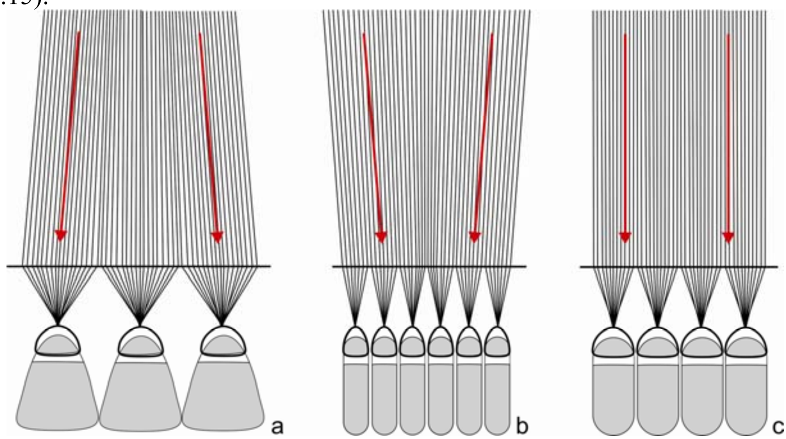

Fig. 4.15. Relationship between the width of loom weights, the orientation of yarn threads and the width of the textile at the upper (starting) and lower (ending) margin (*apud* Médard 2000; Mårtensoon *et alii* 2007a; Mårtensoon *et alii* 2009)

Type of fabric	Type of yarns	Type of loom-weights
Coarse, open frabric	Thick yarns	Heavy, thick loom weights
Coarse, dense frabric	Thick yarns	Heavy, thin loom weights
Thin, open (weft-faced) fabric	Thin yarns	Light, thick loom weights
Thin, dense fabric	Thin yarns	Light, thin loom weights

Table 4.7. Relationship between the type of weaving (type of fibres) and the weight type (defined by weight and width) used in their production (apud Mårtensoon *et alii* 2009)

Evaluating the functional parameters of the loom weights and estimating the aspect and properties of textiles based on these parameters. Case studies

It is the merit of Lindei Mårtensoon *et alii* (2009) of setting the bases of a method for reconstructing the production of a tabby-weave using a vertical loom, starting from the functional attributes (weight and width) of a given loom weight. The calculus proposed allows also the evaluation of a degree of efficiency of weights usage in the production of textiles. We applied this method on representative samples from each culture studied. As a novel element we have applied the method also for loom weights ensembles.

Example:

Loom weights ensemble - L1/1965, Păuca-*Homm*		
No.of loom weights: 28		
Weight:	238 - 493 g	Medium Weight: 388 g
Thickness:	2,4 - 5,3 cm	Medium Thickness: 3,7 cm
Fabric width:	No.of loom weights / 2 layers of warp threads x 3,7 cm = 51,8 cm ≈ 50 cm	

Artefact code	PHO-9883	PHO-9879	PHO-9873
Type code	I3-B-5.2a-7	I2-A-4.2a-2	I3-B-5.2a-8
Weight:	493 g	242 g	373 g
Thickness:	4,45 cm	2,4 cm	4,05 cm

Warp thread tension	*10 g TFU*			*20g TFU*			*30 g TFU*			*40g TFU*		
Warp threads/ loom weight	50	25	37	25	12	19	17	8	13	13	6	10
Warp threads x2 loom weights	100	50	74	50	24	38	34	16	26	26	12	20
Warp threads/cm	23	21	18	11	10	9	8	7	6	6	5	5
No. of warp yarn	1150	1050	900	550	500	450	400	350	300	300	250	250
Technical evaluation	Unlikely -too many threads/cm			Optimal			Optimal			Optimal		

Amount of warp yarn = amount of wet yarn	1000 m	750 m	666 m
Yarn consumption for 1 m^2 cloth =	2040 m	1428 m	1332 m
Time consumption for spinning the yarn =	51 h	28 h	25 h

According to this evaluation, apart from a single exception, all the weights analyzed could have been used to tension the yarn threads in a vertical loom. According to the calculus, the most efficient weights, able to properly tension threads of variable thicknesses are the elongated and flattened weights such as those from Petreşti culture as well as the round upper or central perforated weights from Vinča, Turdaş and Bodrogkeresztúr cultures. The quantity of threads necessary for producing one square meter of textile is also dependant from the density and thickness of threads used.

IV.1.3. Spools

On the functionality of spools we have several hypotheses, gathered as a list of main functional interpretations by J. Carrington Smith (2000) and more recently by M. Gleba (2008). Accepting the idea that they were indeed connected to the production of textiles we can give as most plausible the interpretation of the spools being used as small weights to tension the threads in textiles created by weaving or by using other techniques (Carrington Smith 2000; Ræder Knudsen 2002; Mårtensson *et alii* 2007b; Gleba 2008). According to this functional role they should be found in archaeological context as groups or ensembles. The issue of their functionality is left open by the fact that in the Neolithic and Eneolithic habitation layers, they are recovered only as isolated finds so far.

IV.2. THE FUNCTIONAL ROLE OF NEOLITHIC AND ENEOLITHIC TEXTILE PRODUCTS

The archaeological discoveries from Europe compared to the ethnographical sources and historical writings show that the textile products were used as utensils around the house and as well as personal items (especially clothing). Also their function could also pass over the daily life and become symbolic and spiritual artefacts. In general, we can assume a correspondence between the quality of a textile product and its value and function.

IV.2.1. The Neolithic and Eneolithic anthropomorphic representations and their importance in reconstructing the textile functions

Especially for the South-Eastern Europe the anthropomorphic representations are the main source of interpretation on the usage and functionality of textiles and their actual role as clothing. The archaeological literature is abundant in interpretations on clothing representations on anthropomorphic figurines. Based on this literature and the actual analysis of the figurines we have identified several types of pieces and clothing accessories specific to these representations. A repertory for the representative cultures of the Neolithic and Eneolithic cultures for Romania was also created. The difference between textile clothing and that created using other materials is quite difficult and therefore we tried to elaborate some criteria for establishing the differences. We have also tried to answer a few questions such as:

- What are the clothing pieces made from textiles that are depicted on figurines or other representations and what was the technique used in their production?
- Are the realistic representations of full garments (dresses), from the Eneolithic female figurines the consequence of a wider phenomenon that could be linked also to the emergence of weaving imprints on Cucuteni and Tiszapolgár vessels or the apparition of weight ensembles from Gumelnița culture settlements, some of them engraved with female silhouettes?
- Is the clothing depicted on the figurines the actual clothing worn by the members of the community on a daily basis and is there a correspondence between the clothing depicted and the status and social identity of the one wearing it (in terms of sex, role and social status)? In this respect, are these figurines an expression of societal stratifications within prehistoric communities and if so in what manner did the textile contributed to the expression of these differences?

IV.2.2. The role of textiles in pottery manufacturing

The textile impressions analysed by us, as well as the numerous impressions of mats on Neolithic and Eneolithic vessels are proof of frequent usage of perishable fibres products in the technology of pottery manufacturing. From the various interpretations given by archaeologists on the basis of experiments and ethnographical analogies we can distinguish several ways of using textiles: 1. As support for setting the vessel to dry after modelling; 2. As support on which the vessels were raised (a primitive variant of rotational devices); 3. As implements to create an imprint for a better adhesion between separately created vessel components; 4. As actual items in the structure of the vessels, serving as consolidation for walls and bottoms (in this case being burnt along with the vessels); 5. They also served for decorating the vessels (for more details see Mazăre 2011b; Mazăre *et alii* 2011). No matter what the degree of usage was, it indicates that textiles were a common, usual presence. For certain these textiles were of inferior quality, out of initial usage or representing pieces from items created for a different purpose. Even so they are proof that textiles, especially weaved ones, were quite a common presence in these communities.

CHAPTER V
SYNTHESIS OF NEOLITHIC AND ENEOLITHIC TEXTILE PRODUCTION IN TRANSYLVANIA

V.1. CHARACTERISTICS OF NEOLITHIC AND ENEOLITHIC TEXTILE PRODUCTION IN TRANSYLVANIA

The data presented in the paper, although reduced to only a few categories of artifacts, provides sufficient arguments to support the existence of a textile production in the Neolithic and Eneolithic communities in Transylvania.

Types of textile structures and techniques of production

Based on the analysis of textile imprints from Neolithic and Eneolithic, two types of textile structures made using two different fabrication techniques could be identified: twining and weaving. They complement the data already known from Romania with regard to fabrication techniques and textile structures used in the Neolithic and Eneolithic (Mazăre 2011a) (Fig. 5.1).

Imprints of fabric reveal two types of structures that indicate the use of two different methods of weaving, involving different tools: woven fabric bands using small instruments, and loom weaving. Fired clay weights found in most Neolithic and Eneolithic sites suggest the use of a vertical warp weighted loom as the main technique for producing larger woven textiles.

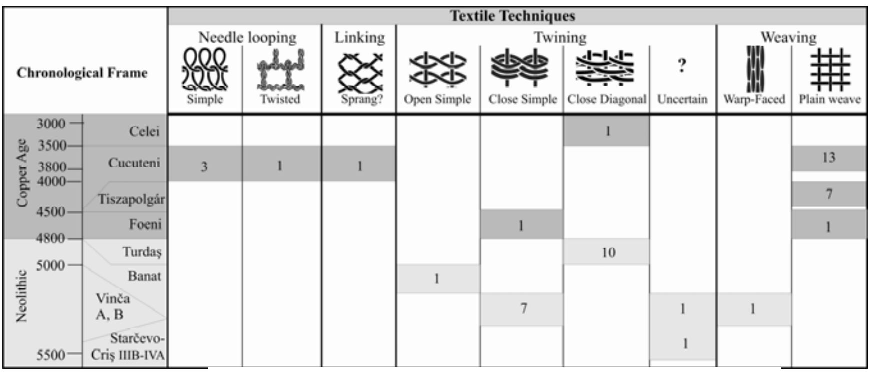

Fig. 5.1. The frequency of techniques and textile structures as identified for Neolithic and Eneolithic settlements in Romania (apud Mazăre 2011).

We believe that much like the twined textile outfits discovered in the Swiss Plateau (Médard 2010, 145) or those found in the form of imprints in the Vinča cultural area south of the Danube (Adovasio, Maslowski 1988), the ones identified in the form of imprints in Transylvania were made without the use of a tension frame.

Raw materials - Selection and differentiated exploitation in textile production

The lack of textile remains in the geographical area being analyzed makes it impossible to identify precisely the types of raw materials used. However, textile imprints show two different patterns in the use of fibres: in raw form (for twined textiles), and preprocessed, yarn (spun thread) (for woven textiles). In both cases it is plant fibre, but it is possible the raw material used was different, an indication to this effect being the textile vestiges from Neolithic (millennium IV-III BC) in the circum-Alpine area. In that case, twined textiles were largely made from tree bast fibres, while woven fabrics were made almost exclusively from flax yarn. Therefore, it is possible that textiles woven in Transylvania were also made of flax. Unfortunately arhaeobotanical data from Romania is hardly sufficient to support this hypothesis. Other cultivated textile plants (eg velvetleaf - A*butilon theophrasti* medic.) or from the spontaneous flora (e.g. nettle - *Urtica dioica*) could also have been used. The reduced amount of fibre provided by the oleaginous flax variety cultivated during the Neolithic leads us to believe that it was used only for certain textiles, probably thin and open fabrics as is the imprint found on the Foeni ceramic from Alba Iulia.

Preparation and transformation of raw materials. Yarn production

For the Transylvania area there is no evidence to document the methods of processing fibres, the transformation of raw fibre into yarn being attested only by spindle whorls and woven textile imprints. The method of processing and then spinning the fibres, similar to that practiced in ancient Egypt, and also highlighted by the analysis of U. Leuzinger and A. Rast-Eicher (2011) in the case of Neolithic flax vestiges in the northern Alps, could correspond to that practiced by Neolithic communities in Transylvania. The idea is supported by both the S plied yarn observed in textile imprints, and the methods of spinning suggested by the study of spindle whorls.

The use of spindle whorls of different sizes and shapes among Neolithic and Eneolithic communities in Transylvania could be related to several possible scenarios: use of different kinds of fibres, production of different quality yarns, use of different techniques, gender differentiated handling of textile tools within the same community. However, the small number of spindle whorls found raises questions about the importance of spinning and indirectly about the importance of weaving in the Neolithic and Eneolithic communities in Transylvania, although the number of loom weights found is considerably higher.

Textile production. Weaving and the differentiated use of the weights in the loom

Production of various quality fabrics using fibres with different properties and probably of a different nature is demonstrated by the morphological and ponderous variety of the weights (if they were indeed used in the loom). The fact that this variety is registered at the cultural level (in the same cultural area or even within the same site) could be an indication that fabrics of different quality were being used within the same communities.

Even if we tried to solve the dilemma of parallel existence, within the same settlement, of the two types of weights (perforated top and center), the question of their functionality remains open. Although they could have been used as weights in the loom, we suspect however that center perforated weights, mostly from the sites of the Vinča and Turdaş cultures, had other functional purposes than those perforated at the top.

Even if weight loom weights rows were not found in the Neolithic and Eneolithic sites in Transylvania, the two sets of 28 weights found in two Eneolithic dwellings could be an indication of two looms. On Romania's territory we marked several areas (mainly Eneolithic) containing between 20-32 weights. Thus, the groups of weights we analyzed integrate into a broader technological area, defined by the same preferences or rather subject to the same technological standards.

Time and amount of raw materials necessary to produce fabrics

According to ethnographic analogies, the whole process of textile production was long and hard and ran sequentially throughout the entire year. For the prehistoric period it is difficult to approximate the time allocated to textile production. According to experimental data and calculations regarding the loom weights, we can estimate that the time needed to produce enough yarn to weave a square meter of fabric should have varied between less than 2 days and more than 7 days, depending on the thickness of yarn and fabric density. The act of weaving required, in turn, its specially allocated time. The speed of completing the fabric was determined by the quality of the yarn being woven, as well as the fabric density, and, of course, its physical dimensions.

Knowing the average amount of fibre produced from 1000 flax plants per m^2 (Eason, Molloy 2000) and applying several formulas, we estimated that the area needed to be cultivated in order to produce 1 m^2 of fabric could reach or exceed 5 m^2. This data pertains to flax being grown today, as it is a well-known fact that back in the Neolithic and Eneolithic, plants were less developed than today and thus produced less fibre.

Locations for textile activities. Context of discovery of utensils associated with textile production.

Ethnographic sources indicate that the activities dedicated to textile production generally occurred outdoors, within settlements. The locations of discovered weights, especially concentrations of weights, show that weaving with warp-weighted looms was an activity mostly performed indoors. Therefore, the question arises of whether the weaving was performed in family homes or inside dedicated buildings.

Textile production: a common, prestigious, or ritualistic activity?

The fact that concentrations of weights cannot be found in all dwellings has led some researchers to believe that, in the Neolithic and Eneolithic, weaving was a craft held by only a small group of individuals, being practiced only in buildings designated for the textile activities of the settlement (Todorova 1978; Comşa 1990). At the same time, the discovery of clusters of weights in some areas of worship, such as the sanctuary at Parța (Lazarovici et alii 2001, 209-214) might suggest, in addition to the specialization of a particular social class (sacerdotal elite?), a symbolic, ritual function of weaving. Holding the monopoly over the knowledge related to the production of specific categories of textiles, with special destination and function and perceived within the society as prestige goods, might have been a premise for the emergence of a elite of textile craftsmen A big question mark is raised by the weights or weight fragments found isolated, both inside and outside homes. If knowing a craft implies care for the tools involved in that craft and valuing of those tools, the opposite must also be true; displaying negligence toward or abandoning them suggests that they were ordinary, even worthless.

V.2. SYMBOLIC MEANINGS OF THE TEXTILE CRAFT

To reconstitute the many meanings of the craft, tools and textile products from prehistory we started in the present and looked into the past, from the most recent to the most distant data provided by linguistics, history, anthropology / ethnology, mythology and archeology.

The enrichment of language with many words and expressions from the world of textiles, attributing the invention of spinning and weaving to deities, magical functions, rituals of spinning and weaving, but also of the tools and textile products, practices with divine roles, protective, founding, in which textiles and textile tools were handled, rules and taboos related to textile activities, etc. are just a few examples that lead to understanding the symbolic dimension of the textile production craft and provide a clearer picture of the impact it had on human communities over time. Although not very numerous, there are some findings suggesting that symbolic manifestations created around textile activities date back to the Neolithic or even earlier.

V.3. *CODA* – IN PLACE OF CONCLUSIONS

Far from offering a clear view of the textile production characteristic of Neolithic and Eneolithic communities, the specific production process, place and time reserved for textile activities, as well as their extent and degree of specialization, etc., evidence of textile production is hard to read and interpret, and can even provide contradictory information. Even so, it is obvious that textiles were produced and used in the Neolithic and Eneolithic communities in Transylvania, this area being part of a larger unit in which textiles are documented way back to the Mesolithic (unwoven) and Early Neolithic (woven and unwoven fabrics).

Although difficult to capture, there are several pieces of evidence that could indicate an evolutionary shift in the craft of textile production, and an increased production of woven fabrics in the Neolithic communities, compared to the Eneolithic ones: the presence of textile imprints on Eneolithic ceramic (in the areas of Tiszaplogár and Cucuteni-Trypillian Culture), morphological and ponderous differences between weights, the Eneolithic ones being adapted for production of more robust fabrics; the groups of weights reported in several settlements (most of them in the cultural area Gumelnița), anthropomorphic representations of women clothed in dresses (mainly in the cultural areas Gumelnița and Cucuteni), which could be an indication of woven garments usage and also that of social differentiation, etc.

If we are to believe the statement by Winiger J. (1995), according to whom, throughout the Neolithic, woven fabrics remained secondary to those made by twining, and rely on evidence from textile imprints, we can claim that the spontaneous vegetation was the main source of textile raw material during the Neolithic. Flax would have been but a plant with limited textile potential, used only to produce certain rare and valuable types of textiles (this would justify their absence as textile imprints). Changes observed during the Eneolithic could be related to standardization, at least for some settlements, of the cultivated textile plants (either flax or other textile plants). A movement towards the cultivation of textile plants would have been a natural consequence of the depletion of resources provided by the spontaneous vegetation due to the form of economy specific to Eneolithic settlements (especially those of *tell* type). The difficulties involved in growing textile plants (flax in particular), as well as the entire process of extracting the fibres further magnified their value. That is why we assume that the specialization indicated by the concentrations of weights discovered in some of the dwellings in the settlements (some at the periphery or even outside settlements) indicate more than a monopoly on the fabrics, but also a monopoly on the raw materials. Perhaps it is premature to promote such theories, but it is possible that the development of this "invisible" craft of textile production, that can hardly be documented archeologically, contributed to the formation of a social hierarchy and elite among Neolithic communities, which, in turn, are well represented from an archaeological point of view. This inequality projected onto a cultural-symbolic level and illustrated mainly by the rich clothing of anthropomorphic figurines suggests that women were the ones knowing the craft.

Although highly speculative due to a lack of sufficient archaeological material available for analysis, the theories presented reflect current textile research in Romania. Further continuation of the research involving interdisciplinary studies, by attracting specialists in palaeobotany, zoology, microwear traces etc. will lead to the enrichment of our knowledge of the evolution of prehistoric textile production and to the confirmation and/or rebuttal of the theories that exist today.

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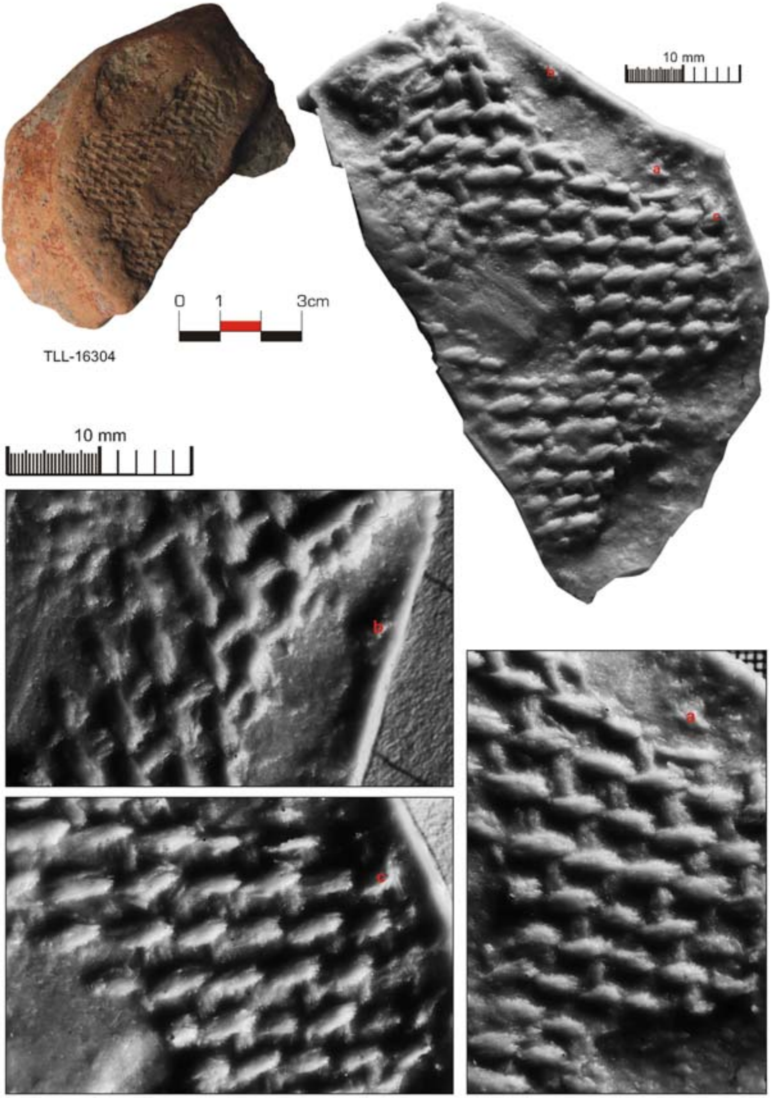
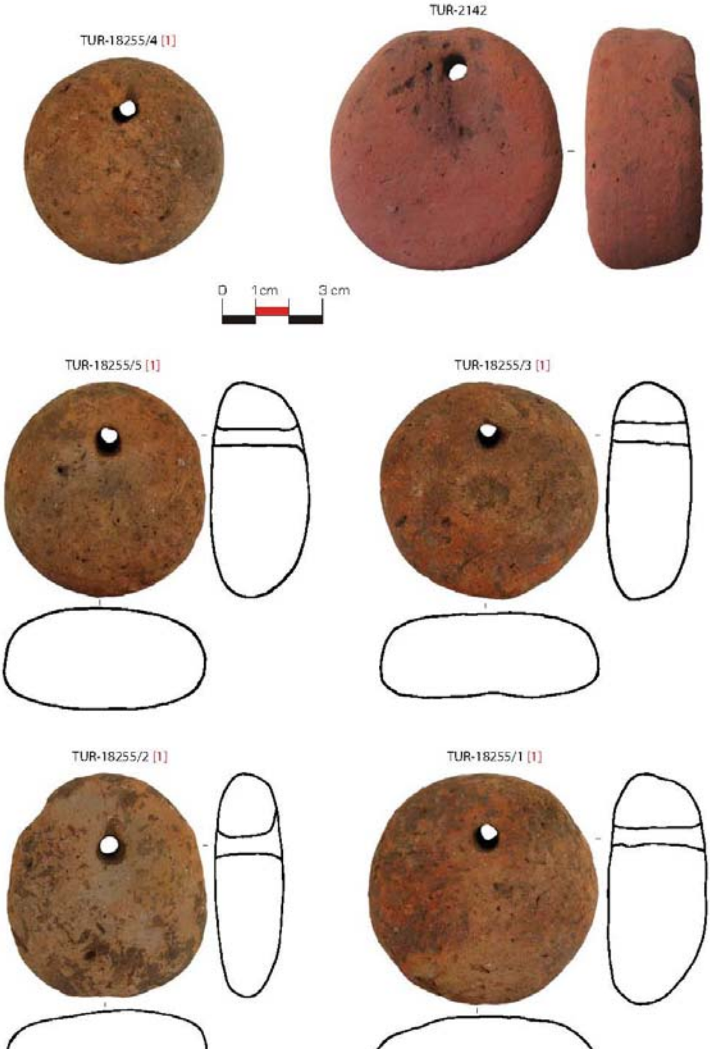


Planşa 20. Amprentă de structură şnurată diagonal (fragment ceramic, mulaj).
Turdaş - *La Luncă*, cultura Turdaş (?)



Planşa 41. Greutăţi perforate superior. Cultura Starčevo-Criş
Turia - *Grădina palatului Apor (Kerskegador)* (TUR) - complex [1] L1/86