PERISHABLE TECHNOLOGIES AND THE
GENESIS OF THE EASTERN GRAVETTIAN

ABSTRACT: Past research on Paleolithic technologies has focused on the manufacturing and use of stone and, to a lesser extent, bone, antler, and ivory artifacts and the implications of these inventories for hunting strategies, subsistence practices, and settlement systems. Coeval technologies in less-durable media, sporadically reported from Paleolithic sites, have received much less attention and their implications for past lifeways have been left unexplored. This paper reports on numerous fiber cordage, and textile impressions on fired clay fragments recovered from the Gravettian site of Pavlov I in the Czech Republic. This, together with coeval data from the nearby sites of Dolní Věstonice I and II, attests to the use of plant-derived fiber for the production of a broad range of perishable implements including cordage, possibly netting, and non-heddle-loom-woven twining some 15,000 years before such items are documented in the European Mesolithic or Neolithic.

The extensive use of this perishable technology carries a number of important implications and ramifications concerning past human lifeways for this portion of Europe. Specifically, as suggested by ethnographic data indicating that the fibers most likely employed in perishable production were harvested and processed in the fall, the existence of this industry suggests the Moravian sites were also occupied during that season. Moreover, since ethnographic data also indicate that the procurement, processing, and use of plant fibers is strongly associated with females, we argue that women were present and processing these items in Upper Paleolithic Moravian sites, thus supporting their identification as base camps.

The existence of a fiber-based weaving technology at these sites, in what has heretofore been considered a big game hunting cultural milieu, indicates that our basic reconstructions and characterizations of this lifeway are in error. Instead of being dependent on hide and animal products processed largely as a consequence of stone and bone industries, at least some Upper Paleolithic groups led a far different life style in which fiber-based technologies played a major role, not only in storage and transportation needs, but also in basic food procurement. The group(s) who produced the Pavlov textiles also produced cordage and cordage byproducts like hunting nets and snares. This way of hunting is far different from directly confronting an animal with stone-tipped spears, first, it is communal, and second, it is far less stressful and dangerous. Both of these distinctions carry implications about selection pressures for morphology as well as for social organization.

Our findings suggest that the Gravettian adaptations – elaboration of processing rather than kill weaponry, large seasonal aggregations, and harvesting of numerous fur bearers – taken together, point to the central role played by hunting utilizing perishable technologies. Thus, we suggest that the genesis of Gravettian material culture inventories may not lie in the influx of new populations but in a change in hunting technology and the concomitant change in the organization of the hunt.

KEY WORDS: Gravettian – Pavlovian – Perishable technologies – Mass harvesting – Female labour
INTRODUCTION

The Upper Paleolithic sites of Predmosti, Dolni Věstonice I and II, and Pavlov I and II, Moravia, Czech Republic, are all ascribable to the Pavlov culture, a local variant of the Eastern Gravettian technocomplex (Figure 1). These sites are well known for producing the earliest evidence of a number of technological innovations including ground stone technology (in the form of pendants and enigmatic large rings) and ceramic technology (in the form of animal and female figurines) in both Europe and the world at large (Svoboda et al., 1996, Vardiver et al., 1990). Recent research suggests that these sites and the culture they represent produced yet another innovation, the use of plant fibers in the manufacture of textiles, basketry, cordage, and perhaps netting. The evidence of this innovation is in the form of negative impressions of fiber-based constructions on small fragments of fired and unfired, or very low-fired, clay, the largest of which (No.12-1957) weighs a scant 9 g and measures only 34.9 x 22.1 mm and is but 13.6 mm thick.

PERISHABLE TECHNOLOGY

The impressions from Pavlov I and Dohli Věstonice II indirectly represent two distinctly different sets of structures: basketry and/or textiles on one hand and cordage and cordage by-products on the other. Technically, basketry is usually treated as a subclass of textiles, defined as a larger all-encompassing class of woven materials. However, in terms of process and product both textiles and basketry can be regarded as belonging to or representing two distinct, albeit closely interrelated, industries and thus these two categories can be defined at an equivalent classificatory level. Specifically, basketry consists of those items, including containers, bags, and netting, which, as recognized by many researchers (e.g. Baille, 1952, Drooker, 1992, Mason, 1904), are usually not fully pliable and, as Driver (1961; 159) points out, are manually woven without the support of any frame or loom. Textiles represent generally infinitely flexible materials, such as cloth and fabric, produced with the aid of a frame or loom. The difference between basketry and textiles is customarily determined by the degree of flexibility of the specimen, the form of the item, and whether the item was used for some variety of handling or horizontal frame. Since these three features – and thus the distinction between basketry and textiles – can usually only be determined by examination of actual specimens and generally are not well represented, if at all, by impressions of fragmentary specimens, no final determination as to whether the Gravettian impressions represent flexible loom-woven materials or inflexible non-loom-woven constructions can be definitively made. Regardless of whether a supportive frame was used, however, the manufacturing process can often be distinguished from impressions. Of the three major and generally mutually exclusive manufacturing processes (i.e. twining, coiling, and plaiting [Advavasio 1970, 1977]) one technique, twining, is represented in the Gravettian collection.

Impressions of cordage are also present at both Pavlov I and Dolni Věstonice II. Cordage is a perishable structure consisting of one set of elongate fibrous elements twisted or spun together to form a uniform, cylindrical, and generally flexible strand of potentially unlimited length (cf. Emery 1966: 8-14, Scholz 1975: 9, Wendrich 1991: 3). The range or set of structures produced by twisting and/or spinning lengths of fibrous material includes and subsumes items denoted in English usage by the following set of terms: thread, yarn, ply, cord, string, cable, and rope.

In addition to the indirect evidence of unmodified cordage, close scrutiny of the Pavlov I impressed clay assemblage has revealed several impressions of knotted cordage. Depending on its precise configuration (i.e. mesh diameter, knot type, method of construction), knotted cordage often represents fragments of netting, either derived from various kinds of capture nets or from more complex netting forms, such as string bags and sundry types of restraining devices. Following Emery (1966: 30), netting is defined as a cordage byproduct "built up by the repeated interworking of a single continuous element with itself." The usual method employed for the production of
TABLE 2. Groeningen radiocarbon dates from Dolni Vestonice II, Czech Republic.

<table>
<thead>
<tr>
<th>Lab Number</th>
<th>Site Prevalence</th>
<th>Radiocarbon Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>GN-2092</td>
<td>brickyard</td>
<td>28,300 ± 300 BP</td>
</tr>
<tr>
<td>GN-2098</td>
<td>brickyard</td>
<td>29,000 ± 200 BP</td>
</tr>
<tr>
<td>GN-13962</td>
<td>units A-C</td>
<td>27,660 ± 80 BP</td>
</tr>
<tr>
<td>GN-14831</td>
<td>triple burial</td>
<td>26,640 ± 110 BP</td>
</tr>
<tr>
<td>GN-15276</td>
<td>burial DV XVI</td>
<td>25,570 ± 280 BP</td>
</tr>
<tr>
<td>GN-15277</td>
<td>unit 1</td>
<td>25,740 ± 210 BP</td>
</tr>
<tr>
<td>GN-15279</td>
<td>unit 2</td>
<td>26,920 ± 250 BP</td>
</tr>
<tr>
<td>GN-15278</td>
<td>unit 3</td>
<td>27,070 ± 260 BP</td>
</tr>
<tr>
<td>GN-21122</td>
<td>unit 4</td>
<td>26,970 ± 280 BP</td>
</tr>
<tr>
<td>GN-15324</td>
<td>southern hearth</td>
<td>27,070 ± 170 BP</td>
</tr>
<tr>
<td>GN-15325</td>
<td>eastern hearth</td>
<td>26,970 ± 160 BP</td>
</tr>
<tr>
<td>GN-15327</td>
<td>western hearth</td>
<td>27,080 ± 170 BP</td>
</tr>
<tr>
<td>GN-21123</td>
<td>unit LPI-4</td>
<td>26,390 ± 190 BP</td>
</tr>
<tr>
<td>GN-14838</td>
<td>mammoth deposit</td>
<td>26,100 ± 200 BP</td>
</tr>
</tbody>
</table>

Source: Svoboda et al. (1996: Table 6.2).

TABLE 3. Quantity and frequency of twining types at Pavlov I, Czech Republic.

<table>
<thead>
<tr>
<th>Type</th>
<th>Structural Characteristics</th>
<th>Quantity</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Open Simple Twisting Z Twist Weft</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>II</td>
<td>Close Simple Twisting S Twist Weft</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>III</td>
<td>Open Simple Twisting S Twist Weft</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>IV</td>
<td>Close Diagonal Twisting Z Twist Weft</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>V</td>
<td>Open Diagonal Twisting Z Twist Weft</td>
<td>4</td>
<td>13.8</td>
</tr>
<tr>
<td>VI</td>
<td>Close Diagonal Twisting S Twist Weft</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>VII</td>
<td>Open Diagonal Twisting S Twist Weft</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>VIII</td>
<td>Close Simple Twisting (unknown weft twist)</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>IX</td>
<td>Open Twining Z Twist Weft (unknown warp engagement)</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>X</td>
<td>Simple Twisting S Twist Weft (unknown weft spacing)</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>XI</td>
<td>Twining (unknown weft spacing, warp engagement, weft twist)</td>
<td>7</td>
<td>24.1</td>
</tr>
</tbody>
</table>

Total 29 100.0

aboriginal or prehistoric nets is a variant of looping called knotted looping. Knotted looping, in turn, is defined as a single-element looped structure in which the loops are secured by knots (Emery 1966: 34). Netting produced by this technique exhibits a mesh of varying size depending on intended use and is called knotted netting. While several varieties of knotted netting exist (Emery 1966), only one type of knotted netting is thus far inferred for the Gravettian collection from Pavlov I.

THE IMPRESSIONS

The data base
The data base for this study consists of a set of 90 negatively impressed, small, fired and unfired clay fragments. Eighty-nine of these specimens derive from the multi-year excavations at Pavlov I (Klima 1955, Svoboda 1994, Svoboda et al. 1996) while the remaining example originates from Dolni Vestonice II excavated by Klima.

FIGURE 3. Schematic diagrams of twining types represented by the textile impressions at Pavlov I. a – Type I; b – Type II; c – Type III; d – Type IV; e – Type V; f – Type VI; g – Type VII.
The cordage-impressed specimen from Dolni Věstonice II was recovered during discontinuous salvage excavations conducted at this locality between 1985 and 1987 (Klima 1995; Svoboda 1991). This work revealed the remains of a number of settlement units consisting of shallow hearths ringed by small pits, probable remnants of lightly constructed surface dwellings, and the famed triple and single burials. These remains indicate, as is the case with Pavlov I, multiple occupational episodes on the slopes of the Pavlov Hills during the time between 29,200–25,200 BP (Table 2).

It should be stressed that despite the absence of precise vertical control, the samples do not derive from disturbed or intrusive contexts as there are no underlying or overlying culture-bearing strata of significantly older (e.g. Middle Paleolithic or Aurignacian) or younger (e.g. Mesolithic or Neolithic) ages at these sites. Hence, these impressions cannot be viewed as later (or earlier) additions to the Pavlov I and Dolni Věstonice II artificial inventories.

**Analytical procedures**

The analytical procedures applied to the Gravettian impressions follow those specified in Chapman & Adovasio (1977) for negative impressions recovered from open archaeological loci. Positive impressions were prepared according to protocols specified by Drooker (1992: 251-254). Positive casts were examined and photographed by employing a research-grade Leica-Wild M10 1:10 zoom stereomicroscope with an apochromatically corrected optical system, and all measurements were taken with both a Helios dial sliding caliper and a Fowler Maxi-Cal electronic digital sliding caliper. Measurements are presented in the metric system.

In most cases, each clay fragment presents one impression of a single technological type, but on occasion, more than one type was discovered to be impressed on a clay specimen. In such cases, a single specimen number is assigned to the clay fragment and the separate impressions associated with it are designated by sequential lower case letters (e.g., No.7a–1957, No.7b–1957, etc.).

The identifiable impressions were assigned to seven textile/basketry types, five cordage types, one possible knotted netting type, and six residual categories according to procedures outlined in Adovasio (1977), Emery (1966), and Hurley (1979).

**Analytical results**

**Textile/Basketry**

Twenty-nine impressions representing seven specific structural types and four residual categories of textiles or basketry were identified in the Gravettian impression sample (Table 3, Figure 3). These specimens are briefly described and discussed below by sequential type number.
It should be noted that the measurements provided here were taken on actual positive casts rather than scaled photographs as was the case in the preliminary analysis reported by Adovasio et al. (1996). The present measurements and all other analytical details, therefore, supersede those provided in the earlier publication.

**Type I: Open Simple Twining, Z Twist Weft**

*Number of specimens:* 2

*Specimen numbers:* No. 5–1957, No. 58–1962

*Types of specimens:* Wall or body fragment without selvage (n=2)

*Number of individual forms:* 2 (7)

*Types of forms:* Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments:

These specimens represent examples of plain or simple twined weaving over single warps. Specifically, the specimen consists of tightly spaced warps and Z-twisted weft rows spaced at regular intervals so as to expose the warps. In one case (No. 5–1957), warps and wefts are both produced from two-ply, Z spun, S twist cordage (see Type III cordage description, below) while in the other the warps are composed of Type II cordage (two-ply, S spun, Z twist [see description below]) while the wefts comprise an indeterminate cordage type. Texture of both specimens is either semi-flexible or flexible. The specimens are unmedned and lack selvages. The sections of fabric preserved in these impressions display heavy pre-impression usu-weave. Method of insertion of new warp and weft elements is unknown. In both cases, the specimens may derive from either portions of woven bags or mats or from lengths of fabric of an indeterminate shape. As with the other examples of twining from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle frame.

**Raw material:**

*Weft Element:* Rotted vegetal fiber, genus and species unknown

*Warp Element:* Rotted vegetal fiber, genus and species unknown

**Measurements:**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp Diameter, Range</td>
<td>0.25–0.36</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>0.31</td>
</tr>
<tr>
<td>Warp Diameter, Range</td>
<td>0.35–0.40</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>0.38</td>
</tr>
<tr>
<td>Warp per cm, Range</td>
<td>12.0</td>
</tr>
<tr>
<td>Warp per cm, Mean</td>
<td>12.0–16.0</td>
</tr>
<tr>
<td>Warp per cm, Mean</td>
<td>14.0</td>
</tr>
<tr>
<td>Angle of Twist (Warp)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Twists per cm (Warp)</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Angle of Twist (Wet Plies)</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Twists per cm (Wet Plies)</td>
<td>Indeterminate</td>
</tr>
</tbody>
</table>

**Type II: Close Simple Twining, S Twist Weft**

*Number of specimens:* 3 (7)

*Specimen numbers:* No. 50–1963, No. 51–1963

*Types of specimens:* Wall or body fragment without selvage (n=2)

*Number of individual forms:* 2 (7)

*Types of forms:* Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments:

These two specimens, like other simple twined forms, represent an example of plain twined weaving over single warps. Specifically, the specimen consists of tightly spaced warps and S-twisted weft rows. Warps are produced from single-ply or multiple-ply S spun cordage (Type VII [see below]). Likewise, the specimen of one specimen (No. 50–1963) is produced from Type VII cordage while the warps of the other consists of fibers whose direction of twist is indeterminable. Texture is either semi-flexible or flexible. The specimens are unmedned, undecorated, and lack splices and selvages. They are moderately frayed to badly worn. Method of insertion of new warp and weft elements is unknown. In both cases, the specimens may derive from either portions of woven bags or mats or from lengths of fabric of an indeterminate shape. As with the other examples of twining from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle frame.

**Raw material:**

*Weft Element:* Rotted vegetal fiber, genus and species unknown

*Warp Element:* Rotted vegetal fiber, genus and species unknown

**Measurements:**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp Diameter, Range</td>
<td>0.39–1.36</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>0.62</td>
</tr>
<tr>
<td>Warp Diameter, Range</td>
<td>0.40–1.09</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Type III: Open Simple Twining, S Twist Weft**

*Number of specimens:* 3

*Specimen numbers:* No. 3–1957, No. 68–1962, No. 79–1962

*Types of specimens:* Wall or body fragment without selvage (7)

**Technique and comments:**

These specimens represent some of the more unique and complex forms identified in the Gavrovati assemblage. The specimens, like those described above (i.e. Types I and II), represent examples of plain twined weaving over single warps. Specifically, each of these items consists of tightly spaced warps and S-twisted weft rows spaced at regular intervals which leave the warps exposed. In one case (No. 3–1957), warps consist of a fibrous bunch to which has been imparted little to no twist, and wefts are produced from single-ply, S spun cordage. The other two examples have warps and/or wefts of either single- or multiple-ply S twist cordage (Type VII) and wefts of indeterminable twist. Owing to the unique qualities expressed by two of these specimens (Nos. 3–1957, No. 68–1962), each deserves separate commentary.

**Specimen No. 3–1957:** A uniquely impressed article bearing an imprint of twined fabric on both sides and one edge of the clay fragment. The impressions on both sides of the specimen represent the same structural basketry/textile type (i.e. Type III) but appear to be parts of different constructions. If the obverse and reverse impressions represent two separate sections of fabric, they may have been spliced or sewn together with a running stitch, the imprint of which is borne on the edge of the impressed clay specimen. Six circuits of a right to left running stitch are visible on one edge of the specimen and may represent a composite selvage employed to join the two putatively separate fabric sections.

**Specimen No. 68–1962:** The only specimen from this assemblage which exhibits both side and end selvages. The specimen apparently represents a corner of a fabric of unknown configuration. Specifically, three warps and two wefts are in evidence. The warps form an end selvage in which they are folded into the adjacent weft row at a 90° angle while the wefts form a continuous side selvage. The stubs of the warps are not visible.

Texture of all specimens is either semi-flexible or flexible and none of the exhibit medns or are decorated. The amount of wear from utilization is indeterminable on one specimen (No. 3–1957) while the others demonstrate heavy use-wear. Method of insertion of new warp and weft elements is unknown. The specimens may derive from either portions of woven bags or mats or from lengths of fabric of an indeterminate shape. As with the other examples of twining from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle frame.

**Raw material:**

*Weft Element:* Rotted vegetal fiber, genus and species unknown

*Warp Element:* Rotted vegetal fiber, genus and species unknown

**Measurements:**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp Diameter, Range</td>
<td>0.50–0.50</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>0.50</td>
</tr>
<tr>
<td>Warp Diameter, Range</td>
<td>1.28–1.31</td>
</tr>
<tr>
<td>Warp Diameter, Mean</td>
<td>1.29</td>
</tr>
<tr>
<td>Warp per cm, Range</td>
<td>8.0</td>
</tr>
<tr>
<td>Warp per cm, Mean</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Warp per cm, Mean</td>
<td>8.0</td>
</tr>
<tr>
<td>Warp Gap, Range</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Warp Gap, Mean</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Angle of Twist (Warp)</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Twists per cm (Warp)</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Angle of Twist (Wet Plies)</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>Twists per cm (Wet Plies)</td>
<td>Indeterminate</td>
</tr>
</tbody>
</table>
Type V: Open Diagonal Twining, Z Twist Weft (Figure 6)

Number of specimens: 4
Specimen numbers: No. 2-1954, No. 7b-1957, No. 10b-1957, No. 11-1957
Types of specimens: Wall or body fragment without selvage (No. 7b-1957, No. 11-1957)
Wall or body fragment with side selvage (No. 2-1954)
Center fragment without selvage (No. 10b-1957)

Number of individual forms: 4 (?)
Types of forms: Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments:
These specimens represent examples of diagonal (twill) twined weaving over paired warps. Specifically, each specimen consists of tightly spaced warps and Z-twisted weft rows spaced at regular intervals so as to expose the warps. Warps are produced in two cases (No. 7b-1957, No. 10b-1957) from single-ply S spun cordage while the others have warps made of either single-ply Z spun or two-ply S spun, Z twist cordage (Type VI see below)). In one case (No. 10b-1957), the weft element is produced of fibers whose direction of twist is indeterminate while the other three specimens have wefts made of either single-ply Z spun or two-ply S spun, Z twist cordage (Type VI). Texture is either semi-flexible or flexible. The specimens are unembellished and undecorated.

One specimen (No. 2-1954) displays evidence of a side selvage of the continuous wrapped variety. Another specimen (No. 10b-1957) displays a center whose exact configuration is indeterminate. The sections of fabric preserved in these impressions all display heavy wear from utilization. Method of insertion of new warp and weft elements is unknown. The specimens may derive from woven bags or mats or from lengths of fabric of unknown shape. As with the other examples of twining from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle loom.

Raw material:
Weft Element: Retted vegetable fiber, genus and species unknown
Warp Element: Retted vegetable fiber, genus and species unknown

Measurements:
Warp Diameter, Range: 0.40-0.68 mm
Warp Diameter, Mean: 0.49 mm
Weft Diameter, Range: 0.74-0.81 mm
Weft Diameter, Mean: 0.81 mm
Warps per cm, Range: 8.0-12.0
Warps per cm, Mean: 9.33
Wefts per cm, Range: 4.0-8.0 (No. 2-1954, 7b-1957)
Wefts per cm, Mean: 6.0 (No. 2-1954, 7b-1957)

Weft Gap, Range: 1.44-2.36 mm (No. 2-1954, No. 7b-1957, No. 11-1957)
Weft Gap, Mean: 1.77 mm (No. 2-1954, No. 7b-1957, No. 11-1957)
Angle of Twist (Warps): Indeterminable
Twists per cm (Warps): Indeterminable
Angle of Twist (Welt Plies): Indeterminable
Twists per cm (Welt Plies): Indeterminable

Type VI: Close Diagonal Twining, S Twist Weft

Number of specimens: 2
Specimen numbers: No. 6-1957, No. 26-1956
Types of specimens: Wall or body fragment without selvage (n=2)

Number of individual forms: 2 (?)
Types of forms: Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments:
These specimens represent examples of diagonal (twill) twined weaving over paired warps. Specifically, they each consist of tightly spaced warps and S-twisted weft rows. In one case (No. 6-1957), warps and wefts are produced from a fibrous bunch to which has been imparted little to no discernible twist. The other specimen has wefts made of Type VII cordage (see below) with warps that are obscured and thus of indeterminate configuration. Texture is either semi-flexible or flexible. The specimens are unembellished, undecorated, and lack selvage. One specimen (No. 6-1957) bears a moderate amount of wear from utilization. Method of insertion of new warp and weft elements is unknown. The specimens may derive from woven bags or mats or from lengths of fabric of unknown shape. As with the other examples of twining from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle loom.

Raw material:
Weft Element: Retted vegetable fiber, genus and species unknown
Warp Element: Retted vegetable fiber, genus and species unknown

Measurements:
Warp Diameter, Range: 0.76-0.85 mm
Warp Diameter, Mean: 0.80 mm
Weft Diameter, Range: 0.42-0.46 mm
Weft Diameter, Mean: 0.45 mm
Warps per cm, Range: 12.0 (No. 6-1957)
Warps per cm, Mean: 12.0 (No. 6-1957)
Wfts per cm, Range: 10.0
Wfts per cm, Mean: 10.0
Weft Gap, Range: Not applicable
Weft Gap, Mean: Not applicable
Angle of Twist (Warps): Indeterminable
Twists per cm (Warps): Indeterminable
Angle of Twist (Welt Plies): Indeterminable
Twists per cm (Welt Plies): Indeterminable
Type VII: Open Diagonal Twining, S Twist Welt (Figure 7)

Number of specimens: 3
Specimen numbers: No. 29 - 1965, No. 30a - 1965
Types of specimens: Wall or body fragment without selvage (No. 30a - 1965, No. 42 - 1960)

Type VIII: Close Simple Twining, (unknown welt twist)

Number of specimens: 2
Specimen numbers: No. 540 - 1962, No. 60 - 1962
Types of specimens: Wall or body fragment without selvage (n=2)

Number of individual forms: 2 (7)
Types of forms: Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments: These specimens represent examples of diagonal (twist) twined weaving over paired warps. Specifically, each specimen consists of tightly spaced warps and S-twisted welt rows spaced at regular intervals so as to expose the warps. Warps are produced either from Z-twisted Type VI (No. 30a - 1965) or S-twisted Type VII (No. 29 - 1965) cornale. In the only identifiable case (No. 29 - 1965), wefts are produced from Type VII cornale. The warps of the other specimens are produced from fibers whose direction of twist is indeterminable. One of these impressions (No. 29 - 1965) is a quite complicated and well-preserved specimen which exhibits a side selvage. This selvage is of the continuous self-entwined with clockwise wrapping between weft rows. Texture of all specimens is either semi-flexible or flexible. None display mends or decorative components. One specimen (No. 29 -1965) exhibits a moderate amount of fraying from use-wear while the other impressions appear to be in a state of advanced disintegration. Method of insertion of new warp and weft elements is unknown. The specimens may derive from woven bags or mats or from lengths of fabric of unknown shape. As with the other examples of weaving from Pavlov I, these specimens may have been produced on a hanging or horizontal non-heddle frame.

Raw material: Welt Element: Rettet vegetal fiber, genus and species unknown
Warp Element: Rettet vegetal fiber, genus and species unknown

Measurements: No measurements taken.

Type IX: Open Twining (unknown warp engagement), Z Twist Welt

Number of specimens: 2
Specimen numbers: No. 1 - 1956, No. 8 - 1954
Types of specimens: Body or wall fragment without selvage (n=2)

Number of individual forms: 2 (7)
Types of forms: Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments: These specimens represent twined weaving over single or possibly paired warps. The specimens represent plain twining if the warps are single and diagonal (twist) twining if the warps are paired. Specifically, the specimens consist of tightly spaced warps and Z-twisted welt rows spaced at regular intervals leaving the warps exposed. Warps of both specimens and one set of welt elements (No. 1 - 1954) are produced from two-ply Z spin, S twist cordage (see Type II cordage, below). The warps of the other specimen are produced from a fiberglass fabric to which has been imprinted little to no discernible twist. Texture is either semi-flexible or flexible. The specimens are unwoven and lack selvage. The section of fabric preserved in one impression (No. 8 - 1954) displays heavy use-wear. A fragment of the specimen is being exhibited a limited amount of wear from utilization, although the degree is unquantifiable. Method of insertion of new warp and weft elements is unknown. These specimens may be either portions of woven bags or mats or lengths of fabric of unknown shape. Though it is possible to manually produce lengths of fully flexible fabric with a gauge as fine as that evinced by this specimen, production would be far simpler on a hanging or horizontal non-heddle frame.

Raw material: Welt Element: Rettet vegetal fiber, genus and species unknown
Warp Element: Rettet vegetal fiber, genus and species unknown

Measurements: Welt Diameter, Range 0.35 - 0.74 mm
Warp Diameter, Range 0.56 mm
Welt Diameter, Range 0.66 - 0.80 mm
Welt Diameter, Mean 0.73 mm
Warp per cm, Range Indeterminable
Warp per cm, Mean 10 (No. 1 - 1954)
Welts per cm, Mean Indeterminable
Welt Gap, Range 6 (No. 1 - 1954)
Welt Gap, Mean 1.17 - 1.35 mm (No. 1 - 1954)
Angle of Twist (Warp) Indeterminable
Twists per cm (Warp) Indeterminable

Type X: Simple Twining (unknown welt spacing), S Twist Welt

Number of specimens: 7
Types of specimens: Wall or body fragment without selvage (n=6)

Number of individual forms: 7 (7)
Types of forms: Semi-flexible bag or mat, or fully flexible fabric, exact form unknown

Technique and comments: All of these specimens represent fragments of twining clearly in varying states of severe disintegration. Specifically, they all but completely lack structural integrity. Distinctions between coarse versus open, simple versus diagonal, and S versus Z-twisted warps in all cases are ambiguous at best. Classification as twining is based on the observation of fragmentary lengths of cordage diagonally lying against and crossed over by similar cord segments in the manner of warps crossing warps. Recollection of measurements and details of manufacture are preclusive in all but one instance. Specimen No. 15 - 1960 consists of a single warp with one discernible welt crossing. The warp consists of a segment of final S-twisted (Type VII [see below]) cordage which is bent at 180° at one end and clipped short to form a folded end selvage. Details concerning the weft of this specimen are unavailable. Considering the diameter of the fragmentary cords comprising these twining specimens, texture is

54

55
TABLE 4. Quantity and frequency of cordage types at Pavlov I and Dolni Vestonice II, Czech Republic.

<table>
<thead>
<tr>
<th>Type</th>
<th>Structural Formula</th>
<th>Quantity</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Z</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>II</td>
<td>Z</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>III</td>
<td>Z</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>IV</td>
<td>Z</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>V</td>
<td>S</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>VI</td>
<td>Z</td>
<td>8</td>
<td>40.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Note: The pound sign ($) is used to denote oblique interlacing or braiding.

Type I: Single, One-Ply, Z Span
Number of specimens: 1
Species numbers: No. 7a–1957

Type II: Multiple, Two-Ply, Z Span, Z Twist
Number of specimens: 2
Species numbers: No. 64–1962, No. 72–1962

Technique and comments:
Only one length of cordage is represented by this specimen. Specifically, this impression represents a specimen which consists of a single bunch of fibrous material given a Z twist. Based on two primary manufacturing attributes, angle of twist and number of twists per centimeter, the specimen is categorized as very hard spun. Very hard spun cordage often indicates a high level of manufacturing proficiency and product quality. Although no splices or decorative components are apparent in this specimen, it does display a rat-tail configuration. In other words, the diameter of the specimen gradually and regularly narrows and thins from one end to the other. The specimen does not exhibit extensive wear.

Technique and comments:
Each cordage specimen consists of two Z spin fibrous bunches combined with a final Z twist. Several of these impressions are sufficiently unique as to warrant individual commentary. Impression No. 9–1957 is a mass of parallel strands, all of which exhibit the same structural configuration. They do not appear to derive from a twisted fabric but this possibility cannot be wholly discounted. Specimen No. 12a–1957, while not unique in its own right, does derive from an impressed clay fragment which also bears an impression of netting produced with cordage of the same final twist (see below). Probably the most unique Type III specimen is No. 38–1954. This impression is, more properly speaking, a cordage-based miscellaneous construction. It consists of three parallel lengths of Type III cordage arranged as pseudo-warp with a secondary crossing element secured to them apparently with successive overhand knots. The structural assignment of the crossing component is unknown.

Cordage
In addition to the individual warp and weft units described above, twenty impressions of cordage, representing five structural types and two residual categories, have been identified to date in the Gravettian sample. These specimens are briefly described and discussed below by sequentially numbered type (Table 4). Nineteen of these impressions are from Pavlov I while the remaining one is from Dolni Vestonice II. It should be noted that the measurements and data of the Dolni Vestonice II impression have been combined and reported with those of the same type from Pavlov I.

Single-Ply Cordage
One impression, from the 1957 excavations at Pavlov I, reveals the presence of a single-ply cord. Single-ply cordage consists of a single set of fibrous elements twisted together in one direction, either right (S twist) or left (Z twist). Typically, such examples often represent the ply components of unraveled pieces of multiple- or compound-ply specimens, or they may represent the constituents of a work in progress that was never completed. In other cases, they may have been intentionally produced and used as single-ply cords for expedient and non-taxing uses in situations where high strength and durability are not a requirement.

Multiple-Ply Cordage
Six impressions of multiple-ply cordage have been identified in the Pavlov I fired and unfired clay assemblage. Multiple-ply cordage consists of two or more twisted sets of elements (i.e. two or more single plies) secondarily twisted upon one another. Generally, the plies forming multiple-ply cordage, taken individually, are twisted or spun in the same direction. When these plies are then united to form a more substantial structure (i.e., multiple-ply cordage), they are combined by twisting together in the direction opposite that of their initial spin. The alternation of twist directions over successive stages of manufacture serves to interlock the plies together in a coherent composition.

It is interesting to note that in many of those cases where the structural identity of the warp and weft elements is discernible in the twined specimens enumerated and described above, these components are produced from Type III cordage.

Note: The pound sign ($) is used to denote oblique interlacing or braiding.
multiple-ply cordage. In other words, there are at least three, and possibly more, levels of construction. First, individual bunches are initially spun. Second, two or more spun bunches are combined by twisting. Third, these spun and twisted plies are once again combined, with another like unit, by twisting. As with multiple-ply cordage, the alternation of twist directions over successive stages of the laying-up process serves to interlock the entire arrangement of bunches, plies, and/or elements together in an integrated fashion.

Type IV: Compound, Two-Ply, Z Span, S Twist
Number of specimens: 1
Specimen numbers: No. 22–1956

Technique and comments:
This specimen is one of the more interesting ones in the entire assemblage. It is a knotted construction manufactured of cordage more robust and heavier than that of most other specimens in the Gravettian collection, and is the only example of compound-ply cordage. This specimen consists of two plies, each of which is a length of Type II (multiple-ply, two-ply, S span, Z twist) cordage (see above). These separate plies are then combined with a final S twist to create Type IV cordage. More specifically, at the first level of construction these specimens each consist of four bunches of bast fibers which were presumably given an initial S spin but whose direction of twist is indeterminable. Each of these strands is then paired with another and combined to its mate with a Z twist. In the last stage of layering up, the two Z plies are combined with an opposing and final S twist. The specimen is constructed of two lengths of Type IV cordage tied to one another with what appears to be a weaver’s knot or sheet band or a closely related style of knot such as a fishnet knot (see Knotting, below). The specimen is moderately frayed, is not spliced or rat-tailed, and does not display evidence of decoration.

Raw material: Retted vegetal fiber, genus and species unknown

Measurements:
Length, Range: Indeterminable
Length, Mean: 12.46 mm
Cord Diameter, Range: 0.78–1.15 mm
Cord Diameter, Mean: 0.93 mm
Ply Diameter, Range: Indeterminable
Ply Diameter, Mean: 1.82 mm
Angle of Twist, Range: 0.74 mm
Angle of Twist, Mean: 35.0°
Twists per cm, Range: Indeterminable
Twists per cm, Mean: 12.0

Braided Cordage
One impression of braided cordage has been identified in the Pavlov I fired and unfired clay assemblage. Braided cordage consists of a structure in which each component of a set of more than two twisted elements or "plies" is obliquely interlaced with the other members of the set (Emery 1966: 62). Each element may be composed of single-, multiple-, or compound-ply cordage. However, the final combination of these elements, whatever their configuration, is produced not by twisting, but by obliquely interlacing, that is, by braiding. As with compound-ply cordage, there are several levels of construction. First, individual bunches are initially spun, and oftentimes, secondarily twisted with other similar members, as in the formation of twisted cordage. Last, these plies are combined, with at least two other like units, by braiding.

Type V: Braided, Three-Strand (Figure 9)
Number of specimens: 1
Specimen numbers: No. 14b–1960

Technique and comments:
This specimen is a three-strand braided cord produced by crossing each subsidiary component in a left-over-right fashion. Each of the strands or elements has been spun and exhibits a final S twist. The precise structural type of each strand, however, is indeterminable, and each represents a length of Type VII cordage (see below). The specimen exhibits no evidence of splicing, rat-tailing, or decoration. It is lightly frayed.

Raw material: Retted vegetal fiber, genus and species unknown

Measurements:
Length, Range: Not applicable
Length, Mean: 12.46 mm
Cord Diameter, Range: Indeterminable
Cord Diameter, Mean: 1.82 mm
Ply Diameter, Range: Indeterminable
Ply Diameter, Mean: 0.74 mm
Angle of Twist, Range: Indeterminable
Angle of Twist, Mean: 35.0°
Twists per cm, Range: Indeterminable
Twists per cm, Mean: 12.0

Residual Cordage Categories
The two residual categories of cordage discussed below represent those impressions for which a definitive identification and assignment of structural type was not possible. Generally speaking, these impressions bore no recognizable evidence of a length of cordage and its final twist but did not unequivocally reveal the presence (or absence) of constituent plies or their respective direction of twist. In other words, these specimens most likely represent either examples of single-ply cordage or multiple-ply cordage. Eleven such impressions have been identified in the Pavlov I and Dolni Vrbatice II fired and unfired clay assemblage and are presented below by final twist direction.

Type VII: Z Twist
Number of specimens: 3


Technique and comments:
These specimens represent lengths of spun cordage exhibiting a final Z twist direction. While their respective and specific structural types are equivocal, depending on the presence of plies and their corresponding twist directions, these specimens are in all likelihood numbers of either Type I or Type II cordage (see above). None of the specimens exhibits splices, decorative elements, or splitting. One specimen (No. 31–1965) does display evidence of crepe-twisting. Patterns of wear are not discernible.

Raw material: Retted vegetable fiber, genus and species unknown

Measurements:
Length, Range 2.90–9.93 mm
Length, Mean 6.42 mm
Cord Diameter, Range 0.35–0.59 mm
Cord Diameter, Mean 0.51 mm
Ply Diameter, Range Indeterminable
Ply Diameter, Mean Indeterminable
Angle of Twist, Range 25.0°–50.0°
Angle of Twist, Mean 41.6°
Twists per cm, Range 14.0–24.0
Twists per cm, Mean 19.0

Type VII: S Twist
Number of specimens: 8
Specimen numbers:
No. 129–1957, No. 14a–1960,
No. 17–1961, No. 19–1961,
No. 30b–1965, No. 54a–1962,
No. 56–1962, No. DVII–1a–1987

Technique and comments: This use of cordage is a catchall grouping of S-twisted cordage. More specifically, these specimens represent lengths of spun cordage exhibiting a final S twist direction but whose constituent parts are of indeterminable form. While the specific details of manufacture, and hence structural type affiliation, are not discernible, these specimens most likely represent examples of Type III cordage or the complimentary form (i.e. opposing twist direction) of Type I cordage (see above). Three of these specimens (No. 129–1957, No. 17–1961, No. 56–1962) are knotted, and the configuration of these knots indicates that they are most likely weaver’s knots or sheet bends. All three of these knotted constructions display at least two similar knots indicative of netting manufacture (see Knotted Netting, below). One specimen (No. DVII–1a–1987) displays a rat-tail at one end of the cord. None of the specimens provide evidence of splicing or the incorporation of decorative components. Those with discriminable wear patterns, particularly the putative netting specimens, show signs of moderate to heavy use.

Raw material: Retted vegetable fiber, genus and species unknown

Measurements:
Length, Range 2.00–7.85 mm
Length, Mean 4.22 mm
Cord Diameter, Range 0.31–0.96 mm
Cord Diameter, Mean 0.55 mm
Ply Diameter, Range Indeterminable
Ply Diameter, Mean Indeterminable
Angle of Twist, Range 35.0°–50.0°
Angle of Twist, Mean 43.0°
Twists per cm, Range 10.0–20.0
Twists per cm, Mean 14.8

Knotted Netting (?)
Four impressions yielded evidence of at least one kind of knot which may have been used in the production of knotted netting. Knots or ties are generally used to create more complex constructions from cordage and are often effective as high-resolution indicators of the structure and function of perishable tools/implements. Weaver’s knots and sheet bends (which are functionally and morphologically identical except for the method of tying), for instance, are widely used for the manufacture of knotted netting as they provide an effective and simple way for producing a net with a fixed and secure mesh diameter. Nets produced in this manner have been ethnographically and archaeologically documented as being used for the capture (i.e. hunting) of both small and big game animals (e.g. Frison et al. 1986, Andrews, Adovasio 1980). While the assignation of the Pavlov I knot impressions as evidence of netting and its attendant uses may be equivocal, there is no doubt that these impressions minimally reveal evidence of knotted cordage and constructions based on the manipulation of cordage. With near equal certainty these knot impressions are identified as weaver’s knots or one of its variants such as the finkel knot.

In terms of the analysis presented here, cordage and netting are cross-cutting categories. That is, cordage is used to produce nets and netting is comprised of cordage. Thus, the netting specimens are discussed and documented twice, both as cordage (see above) and as netting.

Type I: Weaver’s Knotted Netting (Figure 10)

Number of specimens: 4
Specimen numbers:
No. 129–1957, No. 17–1961,
No. 22–1956, No. 56–1962,
Types of specimens: Body Fragments (n = 4)
No. of nets represented: Indeterminable
Types of nets represented: Indeterminable

Technique and comments: These specimens consist of imprints of knotted cordage. Specifically, seven knots are represented as evidenced by impressions of fibers, both twisted and untwisted, and by multiple crossed or interwoven units of cordage representing the tie itself. The structural type of cordage involved in three of these constructions is Type VII, while the remaining specimen (No. 22–1956) is produced from a compound-plait variety with a final S twist (Type IV). The kind of knot, or specifically, bend (a tie used to join two separate cordage lengths to one another), represented by these constructions appears to be a weaver’s knot or sheet bend or a closely related style of knot such as a finkel knot.

All of the impressions produced from Type VII cordage evince two successive and similarly produced knots. The distance between successive knots is reported below and in conjunction with the geometric relationships between the knots of a standard specimen of knotted netting is used to determine mesh diameter. These results are reported below as extrapolated mesh diameter. The specimens do not present evidence of splicing or decoration but do exhibit a fair amount of use-wear in the form of frayed ends. The fact that no substantial lengths of cordage extending to or from the nets are apparent also attests to a high degree of use-wear. If those specimens do derive from a net (or nets), its method of manufacture, whether via the tension net method or the shuttle and mesh method (Andrews & Adovasio 1980: 309–310; Shaw 1972: 118–119), cannot be determined without evidence of larger netting segments.

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THE MORAVIAN PERISHABLE INVENTORY IN GLOBAL CONTEXT
The textile/basketry and cordage impressions from Pavlov I and Dolní Věstonice II are presently far and away the oldest indications of fiber-based technology in the world. Though the study of the impressed remains of Graevillian perishables is still ongoing, it is abundantly clear that the Pavlov I and Dolní Věstonice II specimens provide explicit evidence of the production and use of cordage, textiles, and/or basketry in at least one region of Europe a minimum of 7,000–10,000 years earlier than anywhere else on the planet. To date, the next oldest examples of fiber artifact production in any form derive from Öhlo II on the Sea of Galilee in the Near East (Nadel et al. 1994). At that site,

FIGURE 10: Positive cast of a weaver’s knot representative of Type I: Weaver’s knotted netting (No.22–1956). (Photo D. C. Hyland, J. M. Adovasio.)
plant fibers of unknown genera or species were used to produce S spur cordage with a final T twist. These items, while not the focus of the study, may indicate the presence of netting or other fibrous items that could be related to the Tarentum, an important period of prehistoric material culture.

Slightly younger charred cordage and/or netting fragments are reported from Mezhirich (Adovasio et al. 1992) in Ukraine and Kosyoty in Moldova, though in another case these are perishable cordages older than 18,000 years. Of broadly comparable age are the charred cordage fragments and impressions on clay from La Grottaferrata (Iseri 1979). The Petrianoan period is also considered to have been inhabited by a more advanced form of the Basketmaker I or Basketmaker II complex, referred to as the Basketmaker III (Brown et al. 1999).

The oldest evidence of fiber artifact production from Asia, including late Pleistocene/Upper Paleolithic and so-called "Mesolithic" sites in China, Japan, and far eastern Russia, is presently no older than 13,500 BP (Derevianko, Medvedev 1995, Hurley 1979, R. S. MacNeish, personal communication 1994, Zhushchikovskaya 1996). No clear evidence of plaiting of either earthen or broadly comparable age are presently known from Africa or Australia.

In both eastern and western North America, the oldest basketry, textile, or cordage materials are attributable to the Archaic period, though very few such materials have been recovered in well-dated contexts. Indeed, North American sites with perishable fiber artifacts of any subclass or type older than ca 11,000 BP number fewer than 10. Eight of these localities are summarized below (see Andrews, Adovasio [1996] for a more extensive treatment of this theme).

As of this writing, the oldest bona fide basketry (or fiber matting) artifact from North America is a basket from the Archaic period, about 9,000 BP. This basketry artifact is found at the Snye site in the Peace River area of Alberta, Canada. The basketry is made of a single plant species, possibly birch (Betula pubescens). The basketry is a simple coiled basket, with a simple coil pattern. The basketry is a small, simple basket, with a simple coil pattern.

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MORAVIAN PERISHABLE TECHNOLOGY AND ITS IMPLICATIONS FOR UPPER PALEOLITHIC BEHAVIOUR

As noted in earlier treatments of the Pavlov I Impressions (Adovasio et al. 1995, 1996, 1997) and despite the much larger samples, the structure of the Moravian assemblages described above almost certainly do not reflect the entire range of perishable fiber technology known to the Gravettian weavers. They do, however, provide direct and relatively extensive evidence for the production and/or use of a very wide variety of twined textiles or basketry, cordage, and cordage byproducts by the Eastern Gravettian populations at that site. Significantly, the cordage byproducts apparently include knotted netting.

These textile and/or basketry impressions from Pavlov I and Dolní Věstonice II also represent well-made items and are in no sense "primary"-in-ways in the craft. Indeed, the typological diversity coupled with the general regularity and narrow gauge of the warp and weft elements used in all of the textile/basketry types (see "Analytical Results," above) suggest a high level of standardization and considerable adaptive development; both for these specimens and the fiber industry at large.

The same observations may be extended to the cordage specimens, which are not portions of textiles. Given the high quality and remarkable fineness of manufacture of the individual warp and weft elements comprising the textile/basketry specimens, it is scarcely surprising that cordage, generally speaking, exhibits a high level of standardization. The textiles and cordage specimens from Pavlov I and Dolní Věstonice II are clearly made of plant rather than animal fiber, though an exact identification of species, at present, is impossible. As noted elsewhere (cf. Soffer et al. 1996:532), pollen analyses at the Pavlovian sites indicate a mostly open landscape with both bast-yielding and other plants at the site (Klima 1955, Opravil 1984, Svoboda 1984, Svoboda et al. 1996). In other words, the materials produced by a given set of related but independent social groups should be more diverse the less time these groups are in direct contact with one another. Although this scenario does account for the variety of fibres represented as well as the volume and diversity of these exotic raw materials reported for the lithic inventories at these sites, where up to 97% of the tools were made from non-local material (Soffer et al. 1996), an unambiguous confirmation of this hypothesis awaits further research.

The hypothesis that these sites do represent residential locales, though, is supported by cross-cultural research which indicates that the production of textiles and basketry on one hand and cordage and cordage byproducts on the other, as well as the use of these perishable implements, is associated with both sexes (Murdock 1937, Murdock, Provost 1973). Given such patterns of production and use, the Moravian impressions appear to attest to the presence of both men and women. This observation supports the identification of these sites as residential locales.

Given the relatively stable climate and overall condition of the perishable assemblage described here, it is impossible to specify whether any of the seven named structural types represent twined bags, mats, or cloth fabrics. It is also virtually impossible to posit functions for most of these items or the bulk of the other perishables. If they are portions of bags or mats, they may have served the "normal" role of these items; that is, as flooring or sifting equipment and even as storage/transportation devices in the case of bags. They may also represent wall hangings. If they are portions of cloth fabrics, they could represent a wide diversity of forms ranging from blankets to clothing such as shawls, skirts, shirts, sack fragments, etc.

The presumed function of the associated free (i.e. not utilized as a component of a basketry or textile product) specimens of cordage is even more difficult to positulate. There is no doubt that these items performed the same functions as cordage in virtually all societies where it has been produced. Thus, it is highly likely that the cords from Pavlov and Dolní Věstonice II served a wide range of lashing, binding, and tying needs, and perhaps provided the production medium for other compound constructions in addition to textiles and basketry.

While it is admittedly highly tenuous evidence, the identification of a sheet bend or weaver's knot on eight of the impressions indicates, or at least strongly hints at, the production of knotted netting. Although this identification, in turn, implies the potential use of such nets for the capture of animals, it should be stressed that the mesh size of the putative Pavlov nets is quite small, making them suitable only for the capture of small-sized taxa. This observation is consistent with production by a fiber weavers like the drainage foxes and hares recovered from such sites as Dolní Věstonice, Pavlov, and Předmosti (Musil 1994). It is also in general accord with the published data which indicate the use of nets to capture small terrestrial fauna, including fur-bearers, throughout the world (Roscoe 1990, 1993, Sattwerth 1986, 1987, Steward 1938). Since this method of hunting does not select for particular age classes of prey but instead captures whatever is available in a given area, it has testable implications which can be examined with the extant zooarchaeological record. Specifically, it is anticipated that in many cases the use of both nets and the respective skeletal inventories should reflect catastrophic rather than attritional mortality profiles. While ethnographic literature also documents the widespread use of nets for fishing and fishing, the lack of fish remains and the paucity of avian skeletal elements at Moravian sites suggests that fish and birds were not an important component of the Upper Paleolithic diet in Central Europe (Musil 1994).

The fine gauge of virtually all of the Gravettian weaving strongly suggests that perhaps the coarser or larger gauge fraction of the perishable industry has not been preserved or recovered to date. Given the great skill of the Gravettian weavers in producing such small fabrics (certainly within their capability to produce more substantial perishable products which could well have included larger mesh hunting nets suitable for the capture of terrestrial mammals), ethnographic analogy suggests that in addition to capturing small-sized mammals in the 3-20 kg weight range, were successfully used to capture a wide range of larger-sized herbivores from kangaroos in Australia (Sattwerth 1986, 1987) to antelope, deer, and mountain sheep in North America (Frison et al. 1986). This suggests that the large, perishable industry may have served multiple, varied, and possibly even storage/transport functions. In other words, it may have served even larger-sized taxa in Upper Paleolithic Moravia, as well.

If netting was manufactured and used by Eastern Gravettian groups, it has potentially profound implications for our understanding of the organization because net-hunting is an entirely different kind of activity than the taking of individual animals or even the systematic predation of large aggregates of animals which constitute more than the usual incidental bycatch to most hunting techniques. As detailed above, net-hunting obviates a number of the skills and qualities required of the "traditional" hunting model (i.e. stalking and dispatching with lance or spear) and can yield a short-term windfall of food.

First, cross-cultural research indicates that net hunting is a communal effort, which, because of the relative lack of expertise necessary for success as well as the minimal danger involved in such a non-confrontational harvesting technique, can and does utilize the labor of the entire co-residential social unit (Sattwerth 1986, 1987, Steward 1938, Turnbull 1965, Wilkie, Currant 1991). Not surprisingly, it is in fact the one hunting method strongly associated with the labor of females and juveniles (Murdock 1937, Murdock, Provost 1973). Second, it is a hunting method associated with large harvests in short periods of time and, consequently, with much larger quantities of bone debris. As detailed above, net-hunting obviates a number of the skills and qualities required of the "traditional" hunting model (i.e. stalking and dispatching with lance or spear) and can yield a short-term windfall of food.

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