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## Molecular data: clues to trace the origin of archaeological organic materials

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**Abstract:** Molecular studies of archaeological remains using a fractionation scheme of organic extracts and mass spectrometric techniques (GC-MS) allow identification of specific biomarkers. Such components are likely to provide information about the type of organic substances present and, more extensively on their history. In this paper, special emphasis has been put on the necessity for precise structural identification to distinguish beeswax and cuticular waxes. The results of the analysis of two unknown residues are also reported: the content of a pilgrim flask (Egypt, XXVI<sup>th</sup> dynasty, 664-525 BC) and the wall coating of Middle Age undergrounds (Corrèze, France).

**Keywords:** Biomarkers, GC-MS, beeswax, cuticular wax, honey, pitch, vegetal tar, charcoal .

**Résumé:** Les études moléculaires des résidus organiques retrouvés en contexte archéologique, basées sur le fractionnement rigoureux d'un extrait organique par classes de polarité et sur des techniques de spectrométrie de masse (GC-MS), permettent l'identification de biomarqueurs spécifiques. Ces composés sont susceptibles de fournir des informations sur la nature des substances organiques rencontrées et, de façon plus générale, sur leur histoire. Pour illustrer l'utilité des biomarqueurs ainsi que la nécessité d'une identification structurale précise, l'accent a été mis sur les esters linéaires à longues chaînes appelés « wax esters » présents dans les cires d'abeilles et les cires cuticulaires des végétaux. L'analyse de deux résidus inconnus montrera les contraintes liées au contexte archéologique : le contenu d'une gourde dite de pèlerin (Egypte, XXVI<sup>th</sup> dynasty ; 664-525 BC) et l'enduit des murs de souterrains du Moyen-Age (Corrèze, France).

**Mots clés:** Biomarqueurs, GC-MS, cires d'abeilles, cires cuticulaires, miel, poix, goudron végétal, charbon de bois.

### Introduction

Amorphous organic materials found in archaeological remains and artwork, precious remains of past history, can derive from various classes of raw organic substances: bitumen, animal fat, beeswax, resin, vegetal tar, etc. The most widely adopted analytical approach to assess their composition, their degree of

alteration and to get some insight into their history is their molecular and isotopic study (e.g. R. P. Evershed, 2008; A. Macke et al., 2002; J.S. Mills & R. White, 1994; K.E. Peters et al., 2005; A.M. Pollard & C. Heron, 1996; M. Regert & C. Rolando, 1996). The chemical investigation of natural substances, complex mixtures covering wide ranges of molecular weight, polarity and

volatility, is a real analytical challenge. It is even more complicated because of the wide range of materials used (nature of components and proportions in mixtures), the various preparation techniques and the alteration processes linked to both human handling (e.g. heating) and natural ageing (photochemistry, oxidation, biodegradation).

As in bioorganic geochemistry, chromatographic techniques in tandem with mass spectrometry (GC/MS, LC/MS, GC-C-IRMS) are methods of separation and characterization that really suit to the study of complex organic mixture. They enable the identification of a large range of molecular tools called biomarkers used to establish composition and origin of archaeological organic materials and to follow the molecular transformations induced by alteration processes. In the same way that a person has a unique genetic fingerprint, a product derived from naturally occurring organic substances is characterized by a specific molecular fingerprint which consists of an association of biomarkers. Typically, biomarkers are compounds which have a carbon skeleton specific enough to be related to their biological lipid precursors, to natural decay derivatives and to anthropogenic byproducts thus enabling the identification of the natural substances initially used and of their alteration processes. Gas chromatography-Combustion-Isotope Ratio Mass Spectrometry (GC-C-IRMS) which provides  $\delta^{13}\text{C}$  values of individual compounds is a valuable complementary technique to identify sources of archaeological organic matter (D. Damiani et al., 2003; J.A. Tripp, R.E.M. Hedges, 2004; B. Stern et al., 2008).

To illustrate the importance of chemical molecular data in archaeometry, this paper describes a specific class of components with a powerful biomarker potential: wax esters of different origins (beeswax, cuticular wax). This is exemplified by the study of wax detected in a coating made of alveola discovered in an Egyptian child coffin from the XVIII<sup>th</sup> dynasty and in organic remains stored in Egyptian containers from the Deir el-Médineh necropolis (XVIII<sup>th</sup> dynasty). Moreover, the molecular characterization of organic residues present on art and archaeological items is generally carried out on raw samples without or with limited pretreatment (G.A. Van der Doelen et al., 1998;

M.P. Colombini et al., 2000a; D. Scalarone, 2003). We will therefore show how extraction and fractionation can be of great help for a more in-depth material characterization especially by concentration of compounds often not detected by bulk techniques. Such minor compounds may have a key value to characterize a sample's origin or a degree of alteration (not discussed here). Moreover, this fractionation simplifies the complex molecular fingerprints and makes the identification of components easier.

Lot of works on archaeological materials show positive results thanks to biomarkers and underline the importance of precise structural identification of biomarkers to give *in fine* details about the history of these materials. However, in a second part, we will show that chemical analysis must be adapted according to the specific archaeological context. The molecular analysis of two unknown residues is discussed: the organic content of a pilgrim flask (Egypt, XXVI<sup>th</sup> dynasty, 664-525 BC, Fig. 1c) and a black coating spread on the walls of Middle Age undergrounds (Corrèze, France, Fig. 1d).

## Experimental

### Samples

### Reference material

In each case, there was no limitation in quantity.

Beeswax was provided by beekeepers after consolidation at moderate temperature without purification. They come from Witzenhausen (Deutschland, 2004) and Alsace (France, 2008). The  $\delta^{13}\text{C}$  value of the bulk samples is -28‰/PDB.

Commercial honeys (acacia, blossom, mandarin honeys), mead, figs, dates, pomegranate juice and vinegar were purchased to be submitted to the same analytical procedure as the archaeological samples.

Extracts of two charcoals are also isolated. Charcoals came from a production site in Auriac (commune de Rilhac Xaintrie, 45°13'08.24N, 2°11'00.34"E, # 2641, flotation sieving to give particles greater than 1 mm, Corrèze, France) and from a pitch kiln at La Font de Mars (Sainte Anne-du-Castellet, Var, France; (A. Gensel, 2005; J. Connan & M. Tengberg 2006)). The sample #2641 from Auriac, obtained by flotation sieving, is composed of particles of wood from beech and deciduous oak (Dr. A.

Durand, personal communication). The sample #2028 from La Font de Mars is made of *Pinus halepensis* wood.

### Archaeological material

*Egyptian coating made of alveoli from the XVIII<sup>th</sup> dynasty:* When opening an Egyptian child coffin made in a tree trunk and dated from the XVIII<sup>th</sup> dynasty, archaeologists discovered a coating made of hundreds of fragile alveoli which were interpreted as a beehive remain (Fig. 1a) (F. Janot, 2002). The  $\delta^{13}\text{C}$  value of the bulk sample, without any acid treatment to remove possible contribution of carbonates, is -17‰/PDB. The radiocarbon age determination of the coating gave:  $890 \pm 50$  yr cal B.C., i.e. the Third Intermediate Period (1070-712 BC). The organic substance is thus more recent than the coffin dated 1504-1450 BC which age has previously been estimated by typological observation of the terracotta jar lying close to it. Surprisingly no pollen was found in this sample though to be ancient beeswax. 100 mg of alveoli were used to prepare the organic extract.

*Epicuticular waxes in Deir el-Médineh containers :* Egyptian organic remains stored in an exceptional set of containers unearthed from the Deir el-Médineh cemetery (XVIII<sup>th</sup> dynasty) and put at disposal by the Department of Egyptian Antiquities of the Louvre Museum were analyzed as part of a PhD project (Fig. 1b). The samples were taken from twenty containers under the control of the curator G. Pierrat-Bonnefois (Louvre Museum). The substances were pasty to sticky, orange to brown. Approximately 1mg of sample was used for methanolysis and 30 mg for organic extract and fractionation.

*Pilgrim flask:* The seepage through the wall of a pilgrim flask (Egypt, XXVI<sup>th</sup> dynasty) was taken off by the curator G. Pierrat-Bonnefois (Louvre Museum). It represents only 5 mg of the whole material.

*Coating spread on the walls of Middle Age undergrounds:* Investigations were carried out on four black coatings (references LB01, LB02, LB03, LC01) scratched from the walls of undergrounds likely used as cellar during the Middle Age (La Borde, area of Saint-Cirgues-La Loutre,  $45^{\circ}04'49.88''\text{N}, 2^{\circ}06'06.08''\text{E}$ , La Combe,  $45^{\circ}04'42.94''\text{N}, 2^{\circ}03'18.59''\text{E}$ , area of Saint Geniez ô Merle, Corrèze, France; Fig. 1d) (H. Pigeyre, 2008). 1g of the raw material was

used to prepare an organic extract (0.7 to 3 % of organic extract depending on sample).

### Extraction and fractionation

The analytical procedure (Fig. 2) is directly adapted from the methodology used in petroleum geochemistry to analyze bitumen, source rocks and oils (J. Connan, 2002). All solvents were distilled in glassware before use, to avoid any contamination. The organic samples were extracted ultrasonically three times for five minutes with dichloromethane/methanol (60/40 v/v). The combined solvent extracts, forming the total organic extract, were concentrated by evaporation. The analyses were performed using GC-MS after splitting the total organic extract into fractions F1, F2 and F3, according to different polarities by  $\text{SiO}_2$  column liquid chromatography, fractions F1 and F2 being further split by thin layer chromatography (A. Charrié-Duhaut et al., 2007; A. Charrié-Duhaut et al., 2009a). This scheme allowed us to isolate aliphatic and aromatic hydrocarbons, esters, ketones, alcohols and acids.

### Methanolysis

The crushed sample was taken up in 0.5 ml of methanolic HCl solution (J. Bleton et al., 1996). Methanolysis was conducted at 80 °C for 24 h. Thereafter, methanol and HCl were removed using a nitrogen stream. The extract was then acetylated by a mixture  $\text{Ac}_2\text{O}/\text{Pyridine}$ .

### GC-MS

Compounds with hydroxyl and/or carboxyl groups have to be derivatised before being analyzed by GC-MS to improve their chromatographic behaviour on the apolar GC-column used in the laboratory.

### Acetylation

500  $\mu\text{l}$  pyridine and 500  $\mu\text{l}$  acetic anhydride were added to the dry alcohol and polyfunctionalised compounds fractions (about 2 mg) for two hours, at 60 °C (H.E. Innes et al., 1997). The fractions were then evaporated to dryness under a gentle stream of nitrogen. The alcohol fraction was purified by column liquid chromatography over silica before GC-MS analysis, to eliminate any trace of reagents.

Fig. 1



Figure 1 - Photographs of a) nest cells from Egypt, b) containers E16432, E14013, E16446 from Deir el-Médineh (Louvre Museum), c) pilgrim flask, d) Wall of the La Borde underground (Middle Age, © Henri Pigeyre).

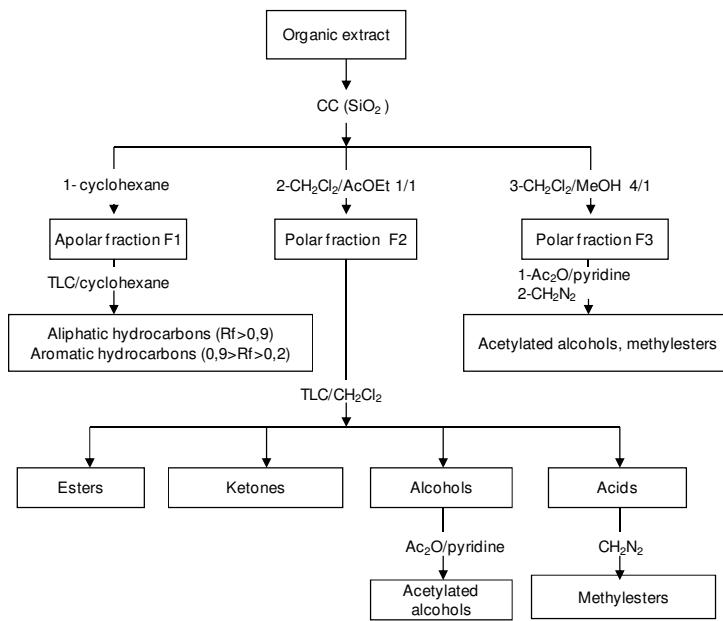


Fig. 2

Figure 2 - Fractionation scheme used for organic samples (CC: column liquid chromatography; TLC: thin layer chromatography).

### ***Methylation***

1 ml of etheral solution of diazomethane, prepared using *N*-methyl-*N*-nitroso-*p*-toluenesulfonamide (Diazald) as precursor (Technical Information Bulletin N°AL-180, Aldrich Chemical) (H.M. Fales et al., 1973; F. Ngan & M. Toofan, 1991) was added for two hours at room temperature to the dry acid fraction. The reaction mixture was then evaporated to dryness under a gentle stream of nitrogen.

### ***GC-MS***

GC-MS analyses were carried out on a triple quadrupole ThermoFisher TSQ Quantum spectrometer connected to a Trace GC Ultra gas chromatograph (PTV –on column mode- injector, injector initial temperature : 35 °C, HP-5 MS column, 30 m x 0.32 mm i.d., 0.25 µm film thickness; temperature program a: 40 °C (1 min), 40-100 °C (10 °C/min), 100-300 °C (4 °C/min), isothermal 300 °C, temperature program b used for fractions containing wax esters: 40 °C (1 min), 40-100 °C (10 °C/min), 100-320 °C (4 °C/min), isothermal 320 °C). Helium was used as carrier gas (1.7 ml/min). Mass spectra were produced at 70 eV, source 200 °C, in full detection mode over 50-800 amu.

### **Elemental composition**

The δ<sup>13</sup>C, TOC (Total organic carbon) measurements and elemental analyses (C, H, N, S) were performed at the Service Central d'Analyse of the C.N.R.S. (Vernaison, France).

### **Results**

#### **Discrimination between wax esters of different origin**

##### ***Beeswax***

Beeswax is a natural resource exploited as early as the end of the Ice Age which occurs in a wide variety of archaeological artifacts, such as Neolithic potteries (C. Heron, 1994), medieval ceramic vessels (S. Charters et al., 1995), Egyptian mummification balms (A. Charrié-Duhaut et al., 2009; J. Connan, 1999; M.P. Colombini et al., 2000b; S.A. Buckley & R.P. Evershed, 2001; J. Maurer et al., 2002), Minoan lamps (R.P. Evershed et al., 1997). Its specific molecular fingerprint is well established and recognizable when mixed with other natural

substances or even after alteration. It includes C<sub>21</sub>-C<sub>33</sub> odd-carbon-numbered *n*-alkanes, long-chain (C<sub>24</sub>-C<sub>32</sub>) alcohols, even-numbered free fatty acids (C<sub>22</sub>-C<sub>30</sub>), aliphatic monoesters derived from palmitic acid (C<sub>40</sub>-C<sub>52</sub> with an even over odd predominance) and hydroxyl wax esters (C<sub>42</sub>-C<sub>54</sub>) (A.P. Tulloch, 1973; P.E. Kolattukudy, 1976). Although alteration processes lead to the depletion of some of these biomarkers like *n*-alkanes, palmitic wax esters can still be identified (M. Regert et al., 2001) by its typical and specific distribution. This characteristic fingerprint was found in two present-day European beeswaxes used as reference for this work (Fig. 3a) and in other archaeological Egyptian materials like the coating of Osiris statuettes (A. Charrié-Duhaut et al., 2009a).

#### ***Egyptian coating made of alveoli from the XVIII<sup>th</sup> dynasty***

At the time of the opening of an Egyptian child coffin (XVIII<sup>th</sup> dynasty), archaeologists discovered a coating made of hundreds of fragile hexagonal alveoli (Fig. 1a). They visually identified it as a beehive (F. Janot, 2002). Consequently we expected to find similarities with beeswax previously described.

Preliminary information about the nature of the coating is given by its elemental composition (carbon 21.4 %, hydrogen 3.0 %, nitrogen 4.9 %, sulfur 0.6 %) and by the low organic extract yield (22 %). These data differ from reference beeswax which are totally soluble in organic solvents and where the percentage of nitrogen is almost zero.

The aliphatic monoesters derived from palmitic acid, ranging from C<sub>40</sub> to C<sub>52</sub> with an even over odd predominance described in beeswax are present in the analysed nest cells but occur with other esters: odd components corresponding to wax esters, long chain aliphatic monoesters derived from other fatty acids (stearic or arachidic), mixed monoesters between cholesterol derived components and the two major fatty acids (palmitic and stearic, Fig. 3b). The ketone fraction of alveoli is dominated by steroidic compounds derived from both cholesterol and stigmasterol in same proportion (Fig. 4a). These features are not found in beeswax. All these data point out that the origin of this enigmatic coating is not a hive from bees.

Discarding hive raised wasp nest as a possibility. Wasp habitat is mainly a paper nest and therefore may be identified by searching for cellulose degradation products namely sugars. After methanolysis and acetylation of the raw sample (J. Bleton et al., 1996), several sugar classes were indeed identified (Fig. 4b): glucopyranoses, galactopyranoses, galactofuranose s. Indicator of non-extractable polysaccharides, their presence explains at least in part the low yield of organic extract. Saccharides are not detected in beeswax. Several natural substances are likely to contribute to this mixture: fruits, chitine (identification of O-methoxy-2-acetamido-galactopyranoses), and cellulose. Some specific insects are able to produce building material after chewing a cellulose source and mixing it with their own excretes. This assumption was confirmed by Claire Villement (Museum of Natural History in Paris) who identified the insects on the basis of their alveoli. Alveoli are typical of a nest of social Hymenoptera. As cells are hexagonal and organised like honeycomb, it cannot be mason bees or wasps which build mud's nests. The only wasp species able to build paper nests is *Vespula Germanica*, the common wasp (Fabricius, 1793).

In conclusion, the molecular study of this specific coating leads to a conclusion completely different to the one based only on visual interpretation. Beeswax is present but admixed with wasp paper nest.

#### **Epicuticular waxes in Deir el-Médineh containers**

Organic remains found in an exceptional set of containers from Deir el-Médineh (XVIII<sup>th</sup> dynasty) were analyzed as part of this work (Fig. 1b). These containers, still full, were found in a necropolis located on the east side of the Valley of the Kings. The identification of the complex organic mixtures, via the biomarker analysis, may help to have some information about the population of the necropolis. The global molecular analysis indicates only the presence of a lipid base (animal fat or vegetable oil), less or more degraded. Half of the twenty samples analyzed still contained about 40 % of triglycerides. Other biomarkers appear only after fractionation. They correspond to odd numbered *n*-alkanes, phytosterols and co-elutions of wax

esters indicating complex mixtures with flowers or leaves cuticular waxes (E. Ribechini, 2008). Epicuticular wax occurs in almost all vascular plants and acts as a protective coating (J.H. Langenheim, 2003). Unlike beeswax whose biomarkers distribution remains relatively stable, the chemical composition of cuticular wax may differ with plant species, plant part (leaves, aerial parts, etc), plant history (age, season, local conditions, way of incorporation in the archaeological sample through extraction, heating,...). However, in each case, the major components are long-chain odd-carbon-numbered *n*-alkanes, long-chain alcohols, even-numbered free fatty acids and alcoholic esters of fatty acids ( $C_{40}$ - $C_{52}$ ). Other compounds such as sterols, terpenoids and saccharides may also occur (G. Rieley et al., 1991; G.A. Logan, 1995). This composition is relatively close to the beeswaxes one. Figure 5 shows the distribution of wax esters in actual beeswax and in an organic mixture from one of the Deir el-Médineh containers. The similarity may be misleading: strong even predominance from  $C_{40}$  to  $C_{50}$ . Not only their presence but also their contribution pattern is important for interpretation. In beeswax, wax esters are exclusively alcoholic esters of palmitic acids characterized by a specific fragment at  $m/z$  257 (figure 6a). In epicuticular wax, several fragments are detected:  $m/z$  257 and 285 and also  $m/z$  313, 341 (28 u.m.a. offset one relative to another, figure 6b). Depending on plants and where esters are synthesized, the acidic counterpart may vary: palmitic acid for  $m/z$  257, stearic acid for  $m/z$  285. Accordingly, in epicuticular waxes, it is possible to have coelution between esters of the same molecular weight but with different structures (M. Regert, 2005). As no diagnostic terpenic structures were detected thus excluding the use of natural resins, cuticular waxes are the only remaining indicators of a plant product input.

#### **Molecular studies of unknown residues**

##### **Pilgrim flask**

The terms "pilgrim flask" refer to faience containers with a round base and a neck-shaped umbels of papyrus, very popular in Egypt at the Saite period (XXVI<sup>th</sup> dynasty, 664-525 BC).

Molecular data: clues to trace the origin of archaeological organic materials

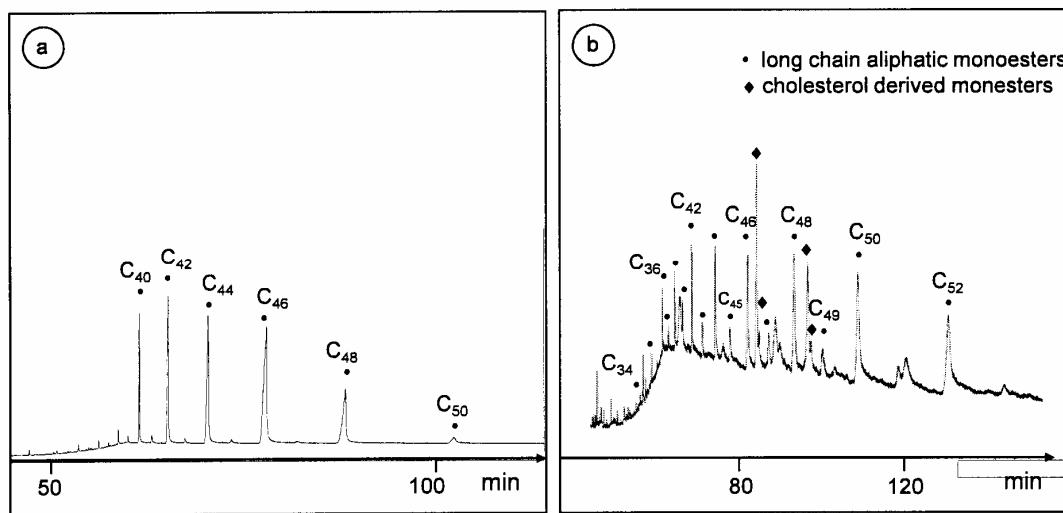


Figure 3 - RIC (GC-MS) of the ester fractions corresponding to beeswax (a) and to the analyzed nest cells (b).

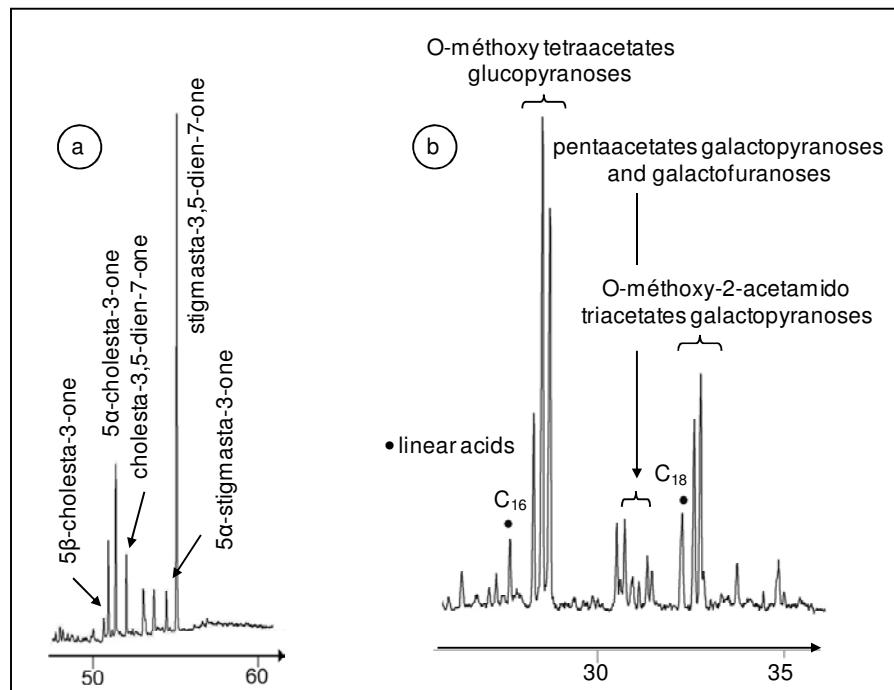


Figure 4 - RIC (GC-MS) of the ketone fraction (a) and of the fraction obtained after methanolysis and acetylation (b) corresponding to the analyzed nest cells.

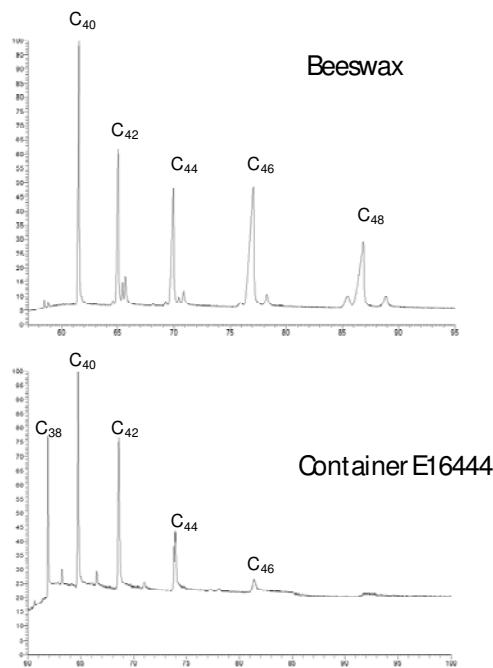


Figure 5 - RIC (GC-MS) of the ester fraction showing the distribution of wax esters in actual beeswax and in an organic remain from the Deir el-Médineh containers.

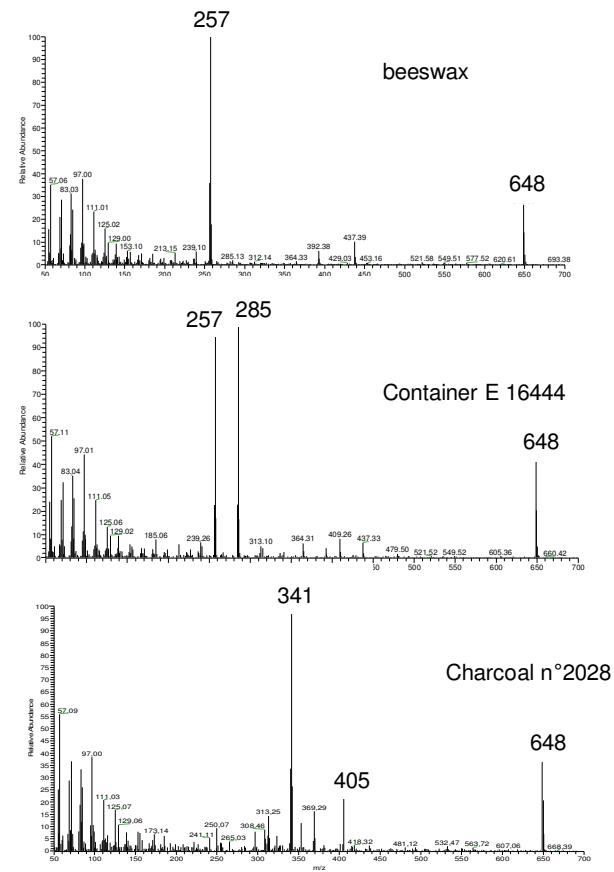


Figure 6 - Mass spectra (EI, 70 eV) of the ester (molecular weight 648, C<sub>44</sub>) detected in modern beeswax, in an organic remain from the Deir el-Médineh containers and in conifer charcoal #2028.

They are rightly known as “flasks of the New Year” due to the presence of a form of greetings engraved on most of them (S. Guichard & G. Pierrat-Bonnefois, 2005). Present in many museums, they remain mysterious: what was their content? Why they became so widespread around the Mediterranean Basin? The assumption most often given is that pilgrim flasks, filled with water of the Nile, were exchanged as present on New Year’s Day. Exceptionally, one flask belonging to the collection of the Louvre Museum reveals a content which seeps through the wall (Fig. 1c). Hermetically sealed, it cannot be open without damage. Therefore only the seepage, presents as small patches, could be scratched. Molecular study of this residue was used to get some insight into the story of these pilgrim flasks.

Quantitative data, obtained by splitting the organic extract according to classes of polarity, already indicate a particular sample: organic extract representing 80% of the whole sample with a very low content (<5 %) of aliphatic and aromatic hydrocarbons, esters, ketones, alcohols but a high content of components with a polarity corresponding to acids (30 %). Indeed, the complete dissolution of the sample in water could be explained by the presence of sugar at the polarity of alcohols and acids. Sugars are abundant in gums, fruit juices and honey. Given the syrupy aspect of the product which seeps through the wall, the assumption of gums occurrence was less favored than fruit juices and honey. Different modern reference products (juices from figs, dates, pomegranates, vinegar of pomegranates, honey from several sources, mead) were analyzed to compare their molecular composition to the archaeological sample’s one. Each of these products is likely to have been used at the time of the flask. In the residue from the pilgrim flask, no terpenic biomarker was detected as in honey and mead, unlike fruit juices and gums (arabic for instance). The fingerprint of sugars present in the alcohol and acid fractions from the archaeological residue is different from the ones corresponding to fruit juices and mead but the similarity with the sugars distribution in honey is striking (fig. 7). This similarity is really noteworthy when one considers the fact that the comparison is made between a residue exposed to the atmosphere and necessarily altered and a

honey bought at random. However the similarity found for sugars does not extend to other molecular classes: oleic acid (18:1) is predominant in pilgrim flask while it is only weakly detected in current honey, perhaps because actual honey is heated. Is this linked to different botanical sources pollinated by bees and /or to treatments implemented on honey after harvest? To complete the data, methanolysis experiments were undertaken in order to identify sugar classes. The fingerprints of sugars in honey and fruit juices are similar. They differ from those of mead where some specific biomarkers were identified: glycerol, citric acid. The residue from pilgrim flask was not submitted to methanolysis due to the lack of material. Identification at several polarities of compounds derived from the stigmasterol points out a vegetable origin of the residue. Distribution of *n*-alkanes (C<sub>16</sub> to C<sub>25</sub>) without odd or even predominance, and detection of traces of pristane and phytane, hopanes and steranes are indicative of the presence of bitumen. However, the fact that bitumen appears only in traces in a single fraction is in favor of an environmental contamination of the sample exposed to a City atmosphere for almost a century without specific care rather than bitumen as historic component deliberately added. This contamination was already recognized in other samples stored in the Louvre Museum. As only small amounts of aromatics structures (alkylbenzenes, alkylphenanthrenes, etc) were identified, this contamination is low.

Chemical data reveal the presence of a sweet herbal substance. If presumptions in favor of honey are high, the study should be considered as not completed but the lack of material did not allow other further analysis like methanolysis, datation, pollen analysis. However, honey is a flagship product of ancient Egyptians. It is one of the most cited products in the medical Ebers papyrus (T. Bardinet, 1995): 248 times which corresponds to 23.5 % of the corpus, just before animal fats.

#### ***Coating spread on the walls of Middle Age undergrounds***

Investigations were carried out on four residues (references LB01, LB02, LB03, LC01) taken from the black coating spread on the walls of two undergrounds likely used as cellar during

the Middle Age (H. Pigeyre, 2008). This coating, particularly resistant to humidity present in the undergrounds, is a “soft and creamy” material, very slightly soluble in water and absorbs significantly organic solvents (experimental observations). The Total Organic Carbon (TOC) values are very low (1.8 to 2.3 %), as well as the percentages of organic extract (<3 %). The Rock-Eval pyrolysis (J. Espitalie, 1993), a classical screening tool used for the characterization of organic matter in petroleum source rocks (Tab.1), indicates the predominance of a highly carbonized organic matter (soot? or charred material? with HI between 85 and 88 mg HC/g of TOC), a very low S<sub>1</sub> (0.07-0.11 mg HC/g of TOC) and a very high Tmax (461-493 °C). In addition, the oxygen index (OI) is extremely high, due to the intense oxidation of the organic matter or to decomposition of mineral constituents; The X-Ray diffraction analysis (Tab. 1) did not show any carbonates therefore the hypothesis of oxidized organic matter is very likely. Petrographic analysis (Dr. F. Laggoun-Defarge, personal communication) confirms the absence of wood structures and the presence of a high reflectance maceral without any fluorescence in 99 % of particles. This maceral is similar to pyrobitumen. These samples are well differentiated from a chimney soot or charcoals from Auriac where classical particle of high reflecting particles of pyrofusinite are identified with remains of wood cells. Consequently archaeological samples from La Borde and La Combe are mainly composed of pyrobitumen-type materials with minor amounts of extractable organic matter.

In an attempt to find the source of these samples, their organic extracts were compared to vegetal tars made from the heating of conifer wood, i.e. pitch (A. Charrié-Duhaut et al., 2009b; J. Connan & A. Charrié-Duhaut, 2010) and to extracts of charcoals, one from the residue from a production site at Auriac (# 2641, mixture of wood from beech and deciduous oak) and the other from *Pinus halepensis* wood used to produce pitch (# 2028).

In samples of the La Borde underground (# LB01 and LB03) and Auriac (# 2641), the GC-MS traces of aliphatic hydrocarbons are dominated by *n*-alkanes with a strong odd predominance in the high molecular weight range (C<sub>29</sub> predominant, Fig. 8). Such distributions are

characteristic of a higher land plants and wood contribution. No terpenic structure was detected except in sample #2028 where traces of nor-abietane, a diterpenoid characteristic of Conifer species were detected.

Unlike samples LB01 and LC01 whose aromatic fractions are below detection limits, GC-MS of the aromatic hydrocarbons from LB03 shows the presence of abietic acid related to diterpenoid structures (Fig. 9). The occurrence of this molecular family suggests that the sample contain pitch, i.e.; a tar derived from conifer wood. Its distribution is indeed partly similar to that recorded in pitch (A. Charrié-Duhaut et al., 2009b; J. Connan & A. Charrié-Duhaut, 2010) and in charcoals (#2028) of a pitch kiln (Fig. 9). These diterpenoid structures were not identified in sample #2641 which does not contain coniferous wood but beech and oak. Polyaromatic structures were also detected in the three fractions: T-alkylbenzenes, naphthalenes, phenanthrenes, etc. The distribution of the naphthalene bulk with a molecular weight of 212 is the same in LB03 and Auriac samples. Polyaromatic components are usually not present in pitch and would rather characterize tars obtained at high temperature. However, samples #2028 and 2641 show a bulk of compounds corresponding to sterols and triterpenoids of plant origin, which is not detected in LB03. One should also notice the occurrence of fluoranthene, pyrene and benzanthracene, chrysene in the Auriac sample which are classical pyrolytic products, abundant in coal tars. To summarize, the aromatic fraction of LB03 sample suggests that the sample shows a dual contribution reflected by affinity with pitch, represented by *Pinus Halepensis* charcoal, but also with tar from other woods exemplified by the Auriac charcoal.

In the three archaeological samples, wax esters were present. Their occurrence had been revealed during a preliminary survey of the underground samples in another laboratory which led to suggest the possible presence of beeswax. This preliminary assumption turned out to be false as the wax esters identified herein correspond to those of cuticular waxes as presented in the part 2 of this paper. The distribution extends from C<sub>40</sub> to C<sub>48</sub> with a strong even predominance but odd esters are also present (Fig. 10).

Molecular data: clues to trace the origin of archaeological organic materials

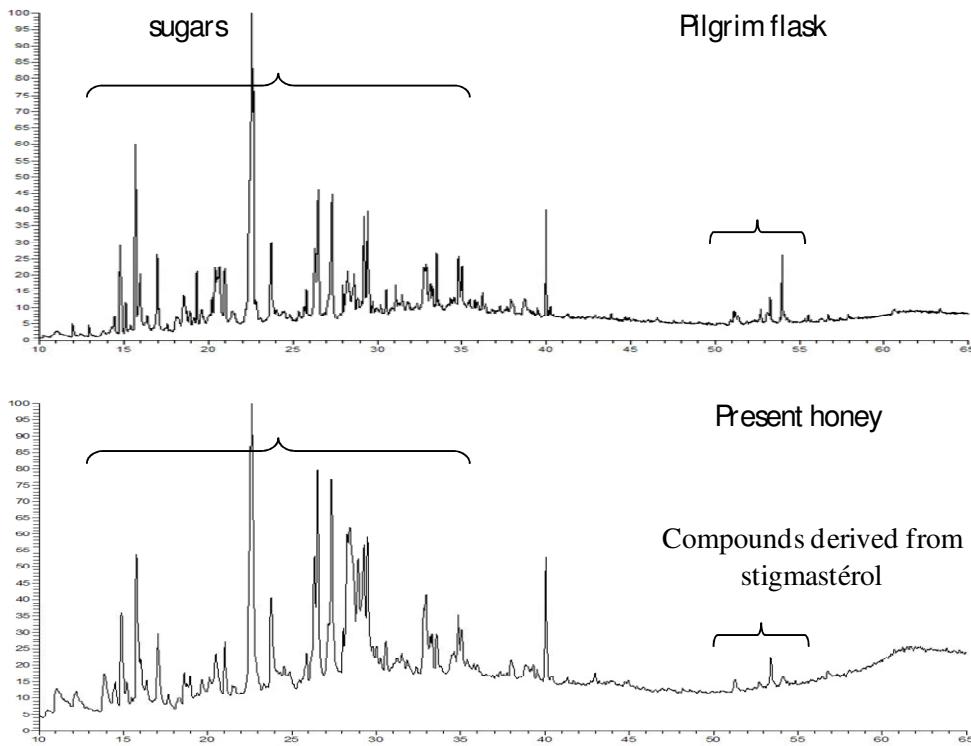


Figure 7 - RIC (GC-MS) of the alcohol fractions corresponding to the residue of pilgrim flask (a) and to actual honey (b).

sample number	location	reference	TOC (% by weight of sample)	S <sub>1</sub> (mg HC / g of sample)	S <sub>2</sub> (mg HC / g of sample)	S <sub>3</sub> (mg CO <sub>2</sub> / g of sample)	Tmax (°C)	HI (mg HC / g TOC )	OI (mg CO <sub>2</sub> / g TOC )	Mineralogy (RX analysis)
2527	La Borde	LB01	1.8	0.07	1.58	9.71	493	88	539	feldspaths, clay minerals (illite, muscovite?)
2528		LB02	2.0	0.12	1.77	10.49	461	87	514	
2529		LB03	2.3	0.11	1.98	11.96	475	85	516	quartz, feldspaths, clay minerals (illite, muscovite?, serpentine?)

Table 1- Data from Rock-Eval pyrolysis and RX analysis (HC: hydrocarbons, TOC: total organic carbon, HI: hydrogen index, OI: oxygen index, Tmax: temperature of S<sub>2</sub> peak maximum).

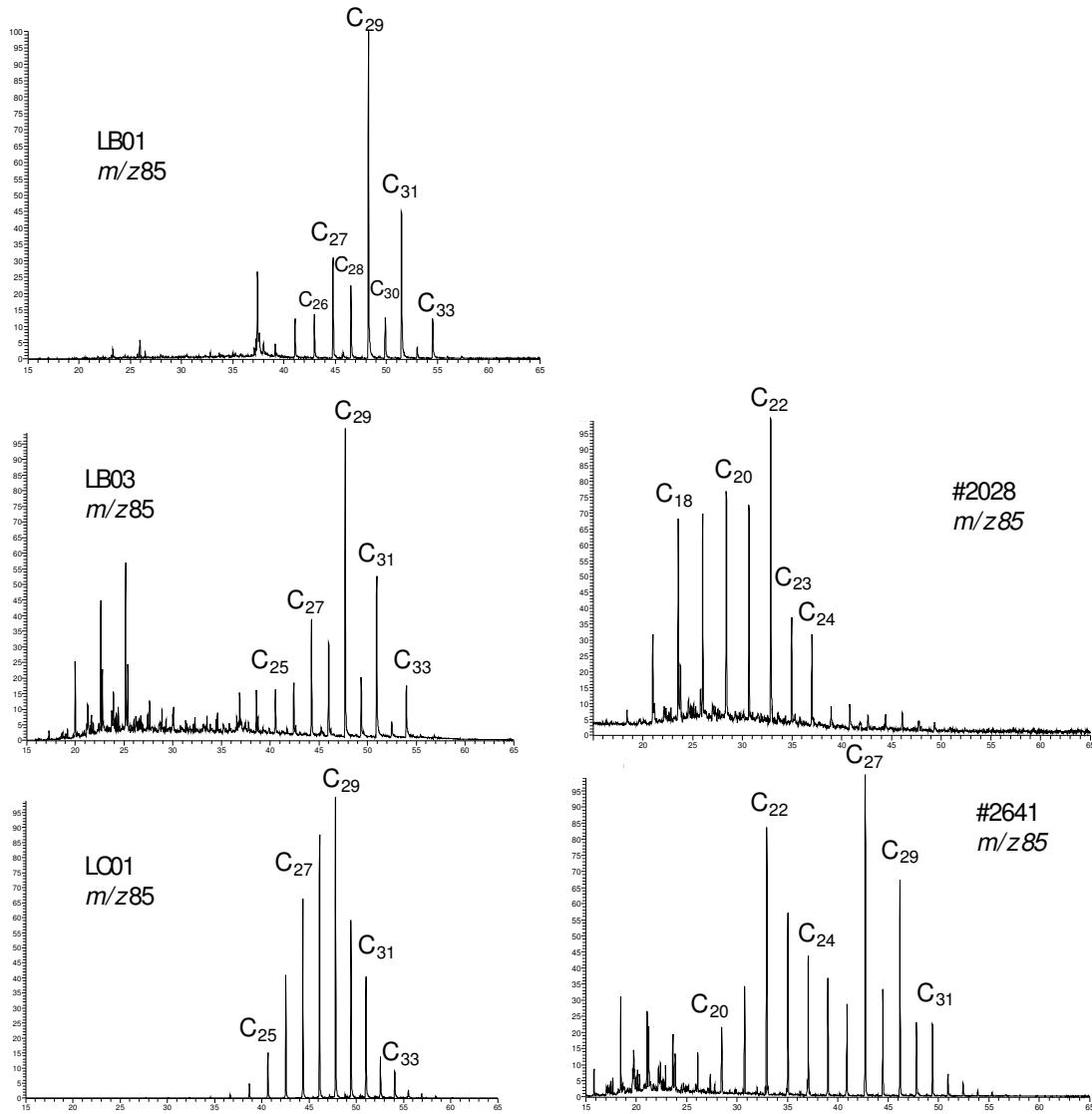


Figure 8 - Mass fragmentogram  $m/z$  85 showing the distribution of  $n$ -alkanes in LB01, LB03, LC01, # 2028, and # 2641.

Molecular data: clues to trace the origin of archaeological organic materials

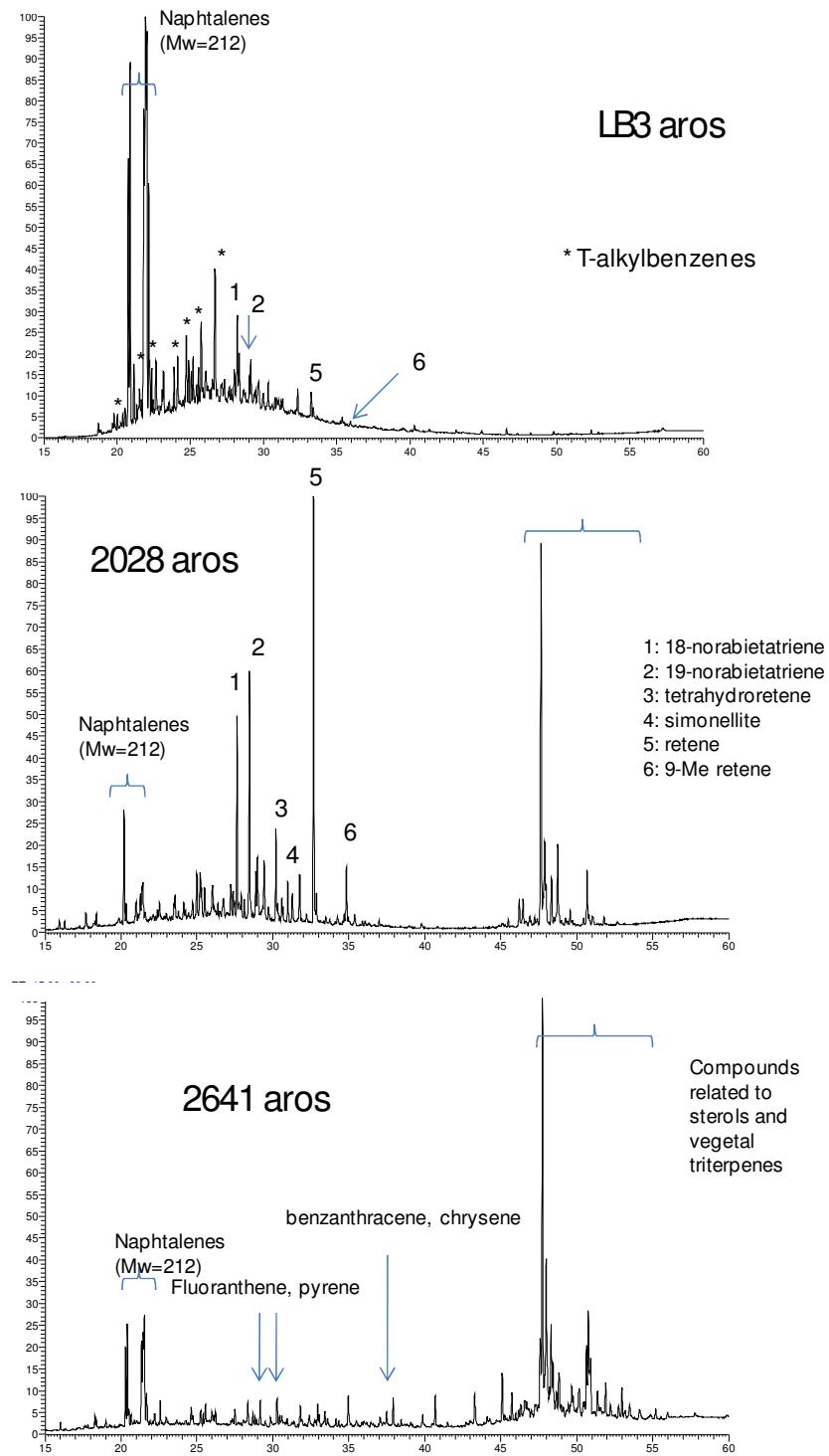


Figure 9 - RIC (GC-MS) of aromatic fractions from LB03, # 2028, and # 2641.

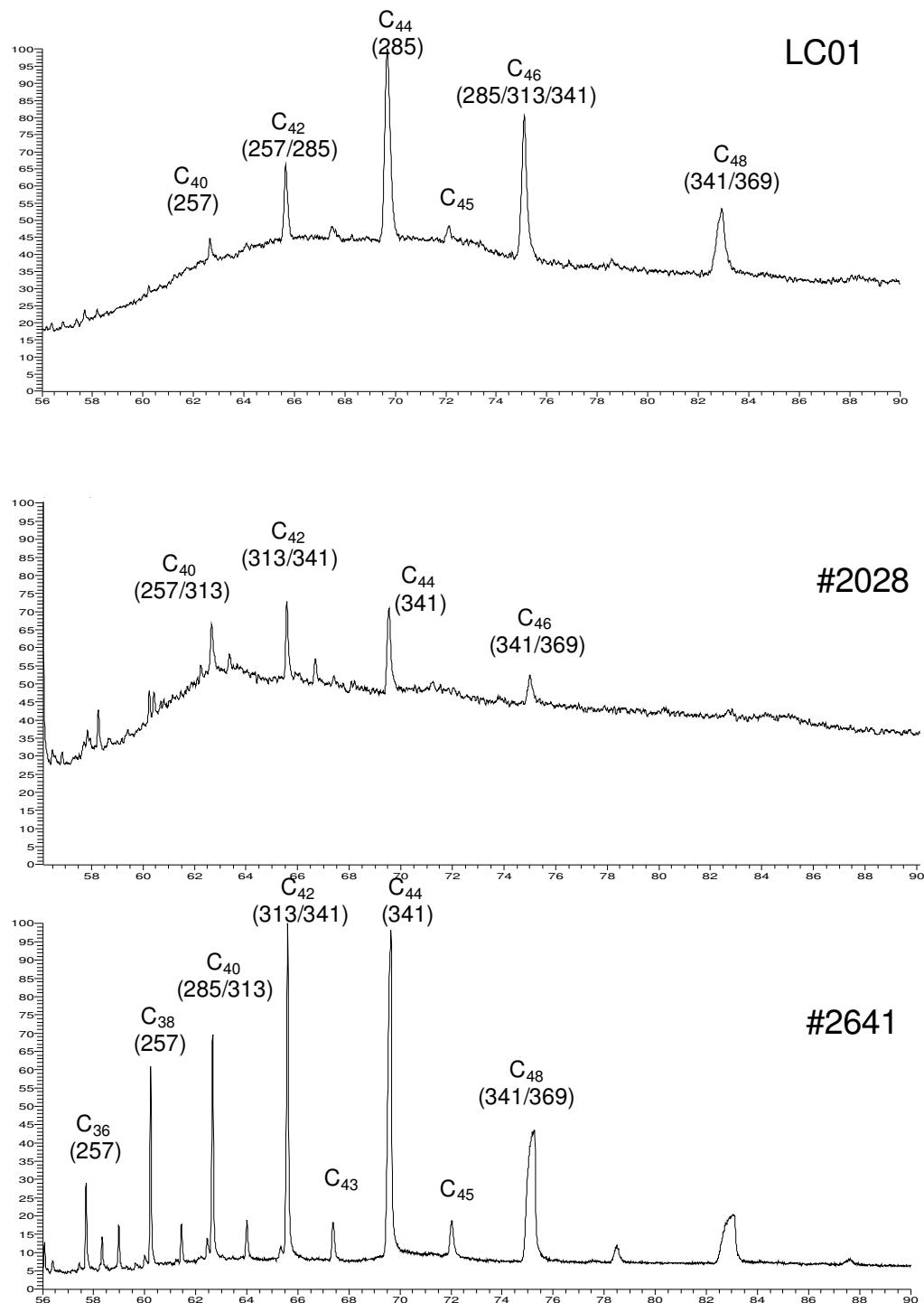


Figure 10 - RIC (GC-MS) of wax esters from LC01, # 2028, and #2641. Major fragments are indicated in brackets.

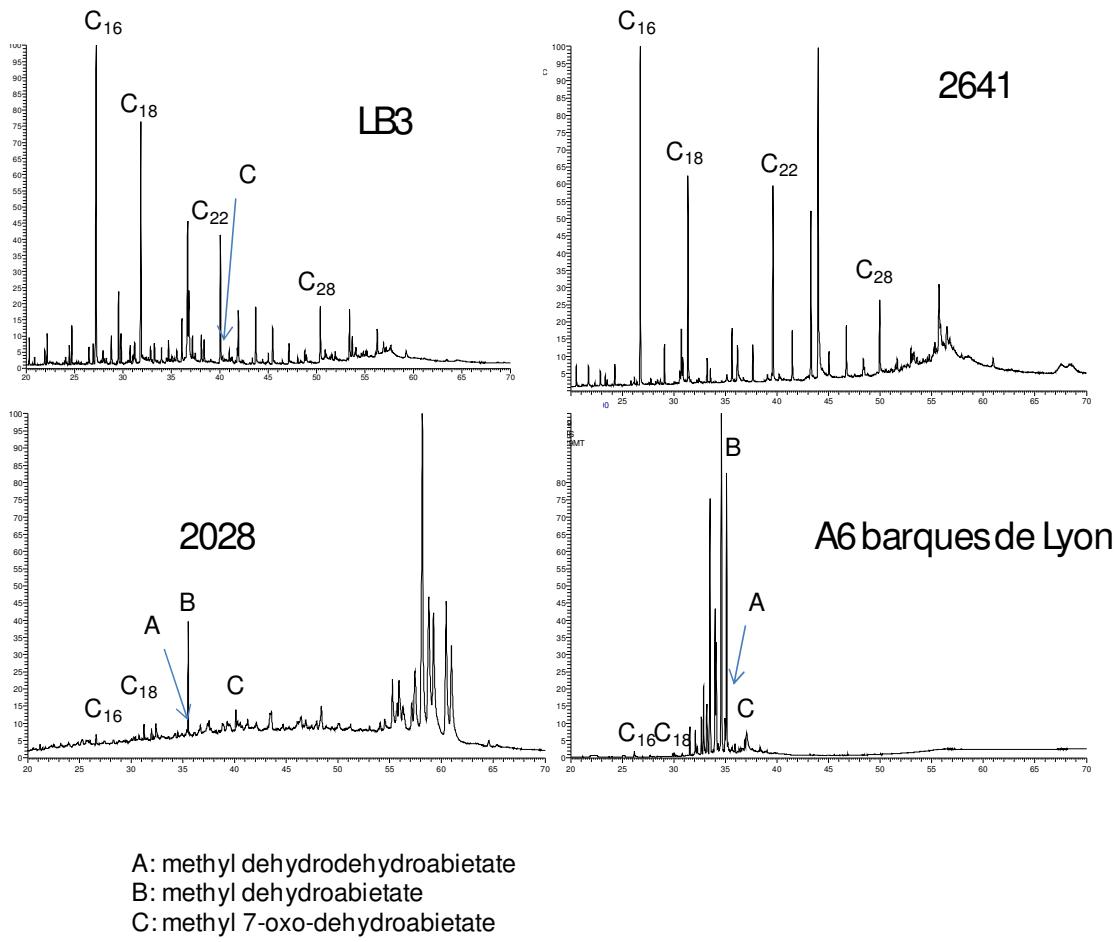


Figure 11 - (GC-MS) of acid fractions from LB03, # 2028, # 2641and of a classical pitch (Connan & Charrié-Duhaut, 2010).

The spectra show several specific fragments ( $m/z$  257, 285, 313, 341) as previously underlined. Such waxes were identified in samples #2028 and #2641 with distribution that looks similar but beware the spectra of each compound are different.

As in the Auriac sample (#2641), the polar fractions of the three archaeological samples are dominated by linear structures, for instance linear alcohols (C<sub>16</sub>-C<sub>28</sub>, even predominance), and linear acids (C<sub>14</sub>-C<sub>32</sub>, even predominance) (Fig. 11). This is not the case for the Font de Mars sample (#2048) or for pitch exemplified by a sample of the Roman boat of Lyon (J. Connan, A. Charrié-Duhaut, 2010) (Fig.

11). In each sample, compounds characteristic of biomass pyrolysis were detected: components related to sugars, and lignin pyrolysis products (e.g. B.R.T. Simoneit et al., 1993; C. Saiz-Jimenez, J.W. De Leeuw, 1986). In pitch, components related to the family of abietic acid are mostly detected even in degraded material, especially in the acid fraction. In the acid fraction from sample #2028, they exhibit important proportions but are only detected only as traces in the three archaeological samples.

In summary the product coating the walls of the La Borde undergrounds still remains rather enigmatic. This product is composed of a dominant highly carbonized pyrobitumen phase

in which wood cells were not found. This homogeneous phase with a high reflectance has an unknown origin and is not clearly understood. Why this insoluble phase was incorporated if it was deliberately added? The most likely explanation is that the product used to cover the walls was a byproduct from the charcoal production which reached high temperatures leading to the production of mainly thermally degraded insoluble phase called pyrobitumen. The minor tar phase, extractable in organic solvents and associated with pyrobitumen, indicates that the whole product has been generated from a mixture of wood in which Conifer was present. The other woods were not identified.

### Conclusions

Molecular analysis, based on precise structural elucidation of biomarkers, often provides answers where archaeologists and curators can only make assumptions. This approach gives access to different information like identification of natural substances (pure or composite material), indication on manufacturing processes (e.g. heat treatment). The first part of this paper has been focused on identifying the well-known “wax esters”. Used currently as biomarkers of beeswax, they are characterized by a specific fragment  $m/z$  257. The study of antique insects nest cells, of organic material present in jars from Deir el-Médineh and of a coating from Middle Age undergrounds reveal a different source of the ester distribution namely the cuticular waxes from plants. They are characterized by coelution of esters presenting the same molecular weight but with different structures entailing specific fragments  $m/z$  257, 285, 313 and 341.

Characterization of a wide range of unknown materials is enabled by prior fractionation allowing simplification of molecular mixtures and concentration of minor compounds. In the collection of residues present in jars from Deir el-Médineh, bulk analysis only shows the presence of fatty substances. Fractionation allows to identify the biological origin of the fat (Bastien, PhD thesis in prep) and to highlight the presence of an admixed plant component. The extreme miniaturization of sample quantities (less than 1 mg) will not give so extensive information. This is especially true

in cases where the advanced state of degradation reduces the amount of organic extract. However, it should be born in mind that the samples from artworks and archaeological contexts are unique, precious and very valuable. The analytical approach depends on objectives of the study and final conclusions are not necessarily achieved. Thus the most likely hypothesis for the content of the pilgrim flask (Egypt, XXVI<sup>th</sup> dynasty) is honey. The black coating spread on the walls of Middle Age undergrounds (Corrèze, France) would be a highly carbonized tar, byproduct of the charcoal production from a wood mixture in which conifer timbers are present.

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**Nouvelles considérations concernant l'industrie lithique taillé du  
Néolithique ancien (culture Starčevo-Criş) de l'établissement de Copăcelu-Valea  
Răii (département de Vâlcea, Roumanie)**

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**Abstract:** New considerations on knapped lithic industry belongind to Early Neolithic (Starčevo-Criş culture) from Copăcelu-Valea Răii setting (Vâlcea County, Romania). In this paper, we will present a technological and techno-functional analysis of some knapped lithic industry of the settlement from Copăcelu-Valea Răii (Vâlcea County, Romania), attributed to the Starčevo-Criş (Körös) culture. The goal of our study is to determine the specific features of the lithic set, but also to try to impose a modern approach in the study of the lithic industries in Romania. In order to determine the traces of use, we have carried out a series of microscopic analyses. We hope that the results obtained will allow us to enrich the knowledge on the technical behaviors of the communities belonging to the Early Neolithic.

**Key-words:** Early Neolithic, knapped lithic industries, microscopic traces, sickle inserts

**Résumé:** Dans cet article, nous présenterons une analyse technologique et techno-fonctionnelle d'une industrie lithique taillée appartenant à l'habitat de Copăcelu-Valea Răii (dép. de Vâlcea, Romania), attribuée à la culture Starčevo-Criş (Körös). Le but de notre étude est de déterminer les caractéristiques spécifiques de l'ensemble lithique, mais aussi la tentative d'imposer une approche moderne dans l'étude des industries lithiques de Roumanie. En vue de déterminer les traces d'utilisation, nous avons effectué une série d'analyses microscopiques. Par les résultats obtenus, nous espérons enrichir le patrimoine de connaissances sur les comportements techniques des communautés encadrées dans le Néolithique ancien.

**Mots clé:** Neolithique Ancien, industrie lithique taille, traces microscopiques, armatures des fauille

### **Introduction**

Sans doute, l'étude de la culture Starčevo-Criş (Körös) représente un élément déterminant dans la connaissance des débuts du néolithique de l'Europe. Dans l'évolution de cette culture, un rôle particulier revient aux habitats de Roumanie.

Généralement, sur le territoire de la Roumanie, la majorité des sites Starčevo-Criş (Körös) sont concentrés en Transylvanie, Banat, mais des découvertes similaires ont été faites en Olténie et Moldavie. Parmi les sites du sud du pays, il y a aussi l'habitat de Copăcelu-Valea Răii. Du point de vue de la répartition spatiale des sites Starčevo-Criş (Körös) en Roumanie, cet

habitat est le seul de la région subcarpatique de l'Olténie, étant assez isolé par rapport aux autres sites. Pour cette raison, cet habitat peut offrir des informations importantes sur le type d'habitat et l'exploitation de l'environnement caractéristiques des communautés Starčevo-Criș (Körös).

L'habitat de Copăcelu-Valea Răii se trouve à 5 km dans la direction sud-ouest par rapport à la ville de Râmnicu Vâlcea, sur la terrasse alluvionnaire située sur le côté gauche du ruisseau de Sărata, voisinant au nord des collines riches en tufs volcaniques dacitiques provenant du Dendronian ancien, et au sud-est, le pré de la rivière d'Olt (fig. 1).

Du point de vue de l'unité géologique, la dépression gétique se présente comme une zone de molasse péri-Carpatische avec des dépôts quaternaires situés dans l'auge majeure de la rivière Olt. Dans cette région dominent les alternances de marnes et argiles dans lesquelles se trouvent aussi des couches sableuses-gréseuses. Les dépôts de sel, d'âge Dendronian ancien, constituent la grande richesse du sous-sol. On connaît des zones de circulation des eaux au contact entre le sel et les rocs en-dessus du sel, qui génèrent des sources salées dans la proximité de l'habitat. Les sources salées les plus importantes sont connues aussi aujourd'hui, surtout dans la vallée du ruisseau Gorunelilor. La présence des dépôts de sel de cette région a représenté probablement une motivation importante dans le choix de cette zone par les communautés préhistoriques.

Exceptant quelques catégories de matériaux archéologiques, les découvertes de l'habitat de Copăcelu-Valea Răii n'ont pas été publiées de manière très détaillée. Quelques archéologues ont mentionné ce site dans leurs travaux (D. Berciu, 1966; Gh. Lazarovici, 1979), et, plus récemment, l'art plastique de ce site a été publié par Claudiu Tulugea (2008). Le matériel lithique a été analysé de manière extrêmement sommaire du point de vue typologique par Al. Păunescu (1970), sans mettre en évidence aucun trait particulier de celui-ci. Heureusement, une des découvertes importantes, une faucille en corne qui garde les traces des insertions, a été analysée de manière détaillée selon des principes modernes par Cornelius Beldiman (2007; M. Nica, C. Beldiman, 1997). La faucille a été découverte en 1963, dans un grand vase de

provisions, identifié dans un coin d'une demeure. La faucille se trouvait sur le fond du vase, et au moment de la découverte, quelques fragments de lames en silex se trouvaient encore dans la rainure du manche en corne (D. Berciu, 1966).

Tenant compte de la localisation exceptionnelle de l'habitat par rapport aux sites Starčevo-Criș situés sur le territoire de la Roumanie, mais aussi de l'importance des matériaux archéologiques découverts à Copăcelu-Valea Răii, nous avons considéré qu'une analyse technologique et technofonctionnelle était nécessaire (l'analyse des outils et des traces d'utilisation) du matériel lithique taillé. Le but de notre étude est la détermination des caractéristiques spécifiques de l'ensemble lithique, mais aussi la tentative d'imposer une approche moderne dans l'analyse des industries lithiques de Roumanie, lesquelles, malheureusement, sont traitées seulement typologiquement à l'aide d'une méthodologie ancrée toujours dans les modèles lancés aux années 60-70.

#### Bref historique des découvertes archéologiques du site de Copăcelu-Valea Răii

L'habitat a été découvert par le grand archéologue Dumitru Berciu, lequel réalise en 1960 un sondage dans la cour de l'ancien SMT (Stațiunea de Mașini și Tractoare / Station de Machines et Tracteurs), et ensuite, entre 1962-1964, y effectue des recherches archéologiques systématiques.

D. Berciu publie en 1966 les résultats sommaires de la recherche, précisant que, à Valea Răii, le matériel archéologique découvert appartient au néolithique ancien (la culture Starčevo-Criș, avec deux niveaux d'habitation), et que, superposée par rapport à ce matériel, on a trouvé de la céramique appartenant à la culture Boian (phase II au début) du néolithique développé.

Des recherches archéologiques d'alors, dans la collection du Musée Départemental de Vâlcea, on garde 467 objets appartenant à la culture Starčevo-Criș, le seul indice étant seulement le marquage de chantier, lequel manque le plus souvent. Toujours suivant les recherches d'alors, une partie des objets se trouve dans la collection Gheorghe Petre-Govora.

## Nouvelles considérations concernant l'industrie lithique taillée du Néolithique ancien (culture Starčevo-Criş) de l'établissement de Copăcelu-Valea Răii (département de Vâlcea, Roumanie)

La faucille en corne ayant des dents en silex découverte en 1963 dans un grand vase de provisions, similaire à celles de Karanovo (Bulgarie) ou à celles du Natufien de l'Asie Antérieure (culture mésolithique répandue en Palestine, Syrie) et à celles de Haçilar, d'Anatolie, ainsi que la peinture avec du blanc (un seul fragment céramique dans la collection Gheorghe Petre-Govora) ont été des éléments essentiels conduisant à l'inclusion des découvertes de Copăcelu-Valea Răii dans la phase I du Milojcic. Les découvertes de Nova Vrsnik, Anzabegovo de l'Yugoslavie, Karanovo de Bulgarie et de Valea Răii (Roumanie), ont déterminé plusieurs chercheurs à préciser les relations entre Starcevo I, Vrsnik I, Anzabegovo I, Nea Nikomedea, Protosesklo, comme le remarquait Gh. Lazarovici (1979).

Le chercheur Gh. Lazarovici (1969, 1984; Gh. Lazarovici, Z. Maxim, 1995) encadre le premier horizon néolithique contenant de la céramique peinte de Valea Răii dans la phase I, étape IC, à côté des découvertes de Gura Baciului I, Cârcea I, Grădinile I, Ocna Sibiului. Les commencements des connexions avec la culture Sesklo, qui partent de l'étape II, phase IIA ou de la fin de celle-ci, déterminent le même auteur à inscrire les découvertes de Valea Răii aussi dans cette phase, à côté d'autres habitats: Beşenova, Cenad, Cârcea II, Cuina Turcului I, Grădinile I, Gura Baciului II, Ocna Sibiului, Uioara de Sus, Verbiţa. Dans la III<sup>e</sup> phase, étape IIIA de cet horizon s'inscrivent des stations, des matériaux et des niveaux de Arad-Grădişte I, Berghin, Beşenova, Buziaş, Dubova-Cuina Turcului III, la grotte Veterani (Maovă), Cenad, Cârcea, Galda, Ghimbom, Grădinile Fântâna lui Duțu, Giuvăz, Gornea Locurile Lungi, Căunița de Sus, Jupa, Sebeş, Lugoj, Gomila, Simnic, Verbiţa et Valea Răii. L'encadrement chronologique des découvertes de Copăcelu-Valea Răii, ainsi que toutes les références ultérieures sont dus au système proposé par le chercheur Gh. Lazarovici, devenu pratiquement un vrai système de référence.

Marin Nica (1971, 1977, 1981) a réalisé la première grande synthèse concernant la culture Starčevo-Criş sur le territoire de l'Olténie. Les découvertes de Cârcea (*Hanuri* et *Viaduct*), Grădinile, Basarabi etc., ont apporté d'importantes précisions concernant l'évolution des phases anciennes et tardives de la culture

Starcevo-Criş, en ce qui concerne leurs relations avec le monde balkanique et le Proche Orient. Se référant à l'habitat de Copăcelu-Valea Răii, il affirme que la céramique peinte découverte ici est caractéristique pour la phase Proto-Starcevo. La céramique encadrée dans la phase Cârcea IV, trouve des analogies à Copăcelu-Valea Răii, Trestiana et Leț.

En ce qui concerne la datation absolue, il y a une seule datation pour cet habitat, réalisée sur un échantillon contenant du charbon, lequel provient des anciennes fouilles effectuées par D. Berciu: 5485 – 5334 BC en données calibrées, conformément à l'échantillon de laboratoire KN -102. Cornelia Magda Mantu (1995), laquelle a vaqué à la chronologie absolue du néo-énéolithique, propose l'encadrement des découvertes néolithiques anciennes d'ici dans les phases III-IV de la culture Starcevo-Criş.

En 1969, D. Berciu (1976), M. Iosifaru et S. Purice, réalisent une fouille de sauvetage dans la cour du Centre Culturel (Căminul Cultural), où ils découvrent à la fois le niveau de culture appartenant au néolithique ancien et aussi un logement Verbicioara, appartenant à la phase finale du Néolithique.

Les recherches ont été reprises en 2002 par M. Iosifaru et C. Fântâneanu (2004), lesquels ont fait des fouilles à la limite de S de l'habitat dans les points *Centrala Termică*, *Govil*, *Drumul 2-2'* et *Căminul Cultural*, ce qui a permis la réalisation d'une stratigraphie. Sur la surface recherchée on a pu faire la délimitation du site vers le sud. On a constaté une habitation intense sur les lots P1, P2, P7, sporadique sur les lots P3, P9, P8, et enfin sur les lots P4, P5, P6, P10 et P11 est apparue une couche d'alluvions dont l'épaisseur varie entre 0,30 m et 1,90 m, ce qui nous a fait croire que probablement dans la période respective la rivière d'Olt avait un bras parallèle à l'auge et formait une série d'îles, parmi lesquelles on pouvait trouver aussi celle de Copăcelu.

La couche de culture néolithique a une épaisseur d'environ 0,90 m et deux niveaux d'habitation avec des huttes presque rondes, disposées probablement en des séries. Le niveau de culture néolithique apparaît à une profondeur de -1,60 m par rapport à la surface du sol, et en dessus de ce niveau se trouve une couche massive d'alluvions. Dans un seul point, dans la section réalisée dans le point *Drumul 2-2'* à une

profondeur entre -1,40-1,60m, on a découvert quelques fragments céramiques appartenant à la culture Coțofeni, sans pouvoir délimiter un niveau d'habitation proprement-dit.

Pour conclure, du point de vue chronologique, les découvertes néolithiques s'encadrent dans les phases IIIB et IVA de la culture Starcevo-Criș (selon la chronologie proposée par Gh. Lazarovici) et Cârcea III-IV (Viaduct I-II) selon M. Nica. En termes de chronologie absolue cela signifie environ 4530+75 B.C., sans pourtant absolutiser cette date.

Les recherches archéologiques ont continué en cette zone jusqu'en 2010 et ont apporté de nouvelles informations concernant l'habitation à partir du néolithique ancien jusqu'au début du premier âge du fer.

Dans le point *Căminul Cultural* (Centre Culturel), on a trouvé des matériaux de l'époque du bronze appartenant à la culture Verbicioara, phases IV-V, mais aussi une couche de culture néolithique ancienne ayant deux niveaux.

En 2003-2004, M. Iosifaru et C. Fântâneanu effectuent des recherches archéologiques systématiques en plusieurs points: *Curtea fostului SMT* (la cour de l'ancien SMT), à environ 20 m est par rapport aux anciennes fouilles des années 1962-1964 ; sur la propriété *Govil*, à environ 10 m nord par rapport aux fouilles de 2002, et sur les propriétés de *Sârbu Ana*, *Colța Ilie*, *Colța Elisabeta*, *Nițisor Vasile* et *Dogaru Ilie*, situées au nord de la route nationale Râmnicu Vâlcea - Târgu Jiu, où l'on a fait plusieurs cassettes pour analyser l'habitation successive dans ce site. On a pu constater que : l'habitat néolithique appartenant à la culture Starcevo Criș s'étend d'un côté et de l'autre de la route nationale Râmnicu Vâlcea - Târgu Jiu, jusque dans la proximité du ruisseau Sărata, seulement sur sa terrasse basse; l'habitation sporadique Glina et Gornea-Orlești, a été rencontrée seulement au sud de la route nationale Râmnicu Vâlcea - Târgu Jiu, dans S XII/2003; un niveau de culture Verbicioara, phases I et IV-V, a été rencontré en S XII /2003, sur les propriétés *Sârbu Ana*, *Colța Ilie* et *Colța Elisabeta*.

Les recherches archéologiques préventives des années 2004-2007 (M. Iosifaru, C. Fântâneanu) faites sur plusieurs propriétés, groupées autour du Centre Culturel, d'un côté et de l'autre de la route nationale Râmnicu Vâlcea -

Târgu Jiu, ont confirmé la présence des niveaux de culture Starcevo-Criș du néolithique ancien, mais on a trouvé aussi un niveau d'habitation Glina et Verbicioara sur les propriétés de *Gogiu Lucia*, *Marin Toma* et *Belbu Valerian*.

Les matériaux découverts pendant les dernières campagnes de fouilles s'encadrent dans les phases III B -IV A de la culture Starcevo-Criș.

En 2008, un collectif formé de M. Iosifaru, I. Tuțulescu et C. Tulugea a fait des recherches archéologiques préventives dans le point *Rue Ghoiceilor*; cette rue fait la connexion entre la route nationale Râmnicu Vâlcea-Târgul Jiu et Ocnele Mari, suivant la base des collines riches en tuf situées dans la direction N/E par rapport au Centre Culturel. A cette occasion, on a découvert partiellement une demeure Sălcuța devant la demeure n° 62, les restes d'une demeure Verbicioara I, à 30 m est par rapport au ruisseau de Valea Goruneilor et deux logements avec du matériel Verbicioara I et IV-V situées à environ 6 m ouest par rapport à la demeure mentionnée antérieurement. On peut dire que la terrasse moyenne du ruisseau de Sărata a été habitée seulement par des communautés appartenant aux cultures Sălcuța et Verbicioara.

En 2010, la recherche archéologique préventive sur la propriété de Madame Cocian Ștefănița, Rue Ghoiceilor, n° 68, a conduit à la découverte d'un niveau culturel appartenant au Hallstatt ancien.

Comme on peut observer, les recherches archéologiques de la ville de Râmnicu-Vâlcea ont conduit à la découverte d'un nombre impressionnant d'habitats préhistoriques. Parmi ceux-ci, l'habitat de Copăcelu-Valea Răii occupe une place importante à la fois dans le cadre des découvertes de la région, et aussi dans l'aire de la culture Starcevo-Criș (Körös).

Le matériel lithique taillé analysé provenant de l'habitat de Copăcelu-Valea Răii inclut 175 pièces. Celles-ci sont le résultat des fouilles effectuées dans les périodes 1962-1964, 2002-2004. Hormis un petit nombre de pièces découvertes dans deux demeures, les autres n'ont pas pu être associées à des structures d'habitation ou à d'autres complexes. C'est pour cette raison que l'étude a été effectuée séparément pour les deux demeures et globalement pour le reste du matériel.

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### Matière première

La matière première majoritaire est le silex (84%), suivi par l'obsidienne (13%) et, dans une tout petite mesure, par le jaspe (3%).

Selon les observations macroscopiques, la majorité des types de silex identifiés proviennent, le plus probablement, du sud (silex de Plateforme Balkanique). Les types de silex les plus utilisés sont le silex marron, marron clair et ce qu'on appelle le *silex miel* (*yellow-honey*), présentant souvent dans la constitution de la roche des tâches blanchâtres, caractéristiques du silex balkanique (M. Gurova, 2005, 2008). Certes, il est nécessaire de vérifier sur le terrain les sources de matière première, surtout que, souvent, diverses variétés de silex sont similaires, même provenant de régions très différentes. Sans analyses microscopiques détaillées on ne peut pas déterminer avec certitude la provenance d'une roche.

Impressionnant est le pourcentage de l'obsidienne trouvée dans les habitats (13%). Du point de vue macroscopique (couleur, transparence, cortex), l'obsidienne fait partie de quatre catégories:

- obsidienne noirâtre
- obsidienne grisâtre-noirâtre, presque translucide, cortex roulé de galet
- obsidienne grisâtre-noirâtre, presque translucide, cortex crayeux (une seule pièce)
- obsidienne couleur fumée rubanée, translucide

Il est possible que l'obsidienne provienne du sud du pays, de la vallée du Danube, mais, faute de plus d'informations, cette hypothèse doit être acceptée avec précaution.

Le jaspe a été utilisé extrêmement peu et, sans doute, il s'agit d'une roche locale. Les produits de débitage en jaspes sont des éclats simples ou corticaux. La majorité des pièces ne semblent pas avoir été débitées à l'intérieur de l'habitat, mais sont plutôt des pièces collectées et ensuite apportées dans le site. A la différence des matériaux en silex et obsidienne qui ont une surface très fraîche, certains éclats en obsidienne sont patinés, et sur la patine on observe des zones fraîches avec des retouches. Probablement ces pièces ont été collectées de contextes archéologiques plus anciens (un racloir semble être paléolithique), étant ultérieurement retouchées et réutilisées dans l'habitat.

### La hutte 1/2002, 2004

Dans la hutte 1 on a découvert neuf pièces en silex. Hormis un éclat, le reste des pièces sont des outils sur des fragments de lames (deux proximales, quatre mésiales et deux distales) (fig. 2).

Les deux fragments proximaux ont la même longueur, et leurs largeurs et épaisseurs sont similaires (7 cm/2 cm/ 4mm; 7 cm/1,80 cm/5mm). Tous les deux ont une section trapézoïdale, profil rectiligne, bords et nervures parallèles, étant débités par pression. L'une des pièces est brûlée et provient d'un nucleus qui a reçu un traitement thermique avant d'être débité, pour un meilleur contrôle de la percussion. Tous les deux côtés gardent des traces de lustre végétal, mais surtout la face inférieure de la pièce. Des similitudes très frappantes sont observables aussi dans le cas des deux fragments distaux de lames. Tous les deux sont retouchés directement, de manière abrupte, continue, l'une des pièces étant intensément modifiée. Tous les deux présentent des fractures causées par l'utilisation, et la base des pièces garde des traces d'emmanchement. Du point de vue technofonctionnel, ces outils ont été utilisés le plus probablement comme perçoirs, l'une des pièces ayant la pointe fracturée à la suite de l'utilisation. En plus, on a identifié aussi un outil à troncature double sur fragment mésial de lame retouché finement, directement, par pression.

Comme on peut observer, sauf une seule exception, le matériel lithique de la hutte 1 est représenté par des outils. Assez intéressante est la présence d'un fragment proximal de lame provenu d'un nucleus brûlé de manière intentionnelle (traitement thermique), qui garde toujours des traces de lustre, ce qui suppose son utilisation pour la coupe des céréales.

### La hutte 2/2004

Dans la hutte 2/2004 on a découvert 6 pièces. La matière première est représentée par le silex marron à taches blanches ou par le silex jaune pâle (5 pièces) et obsidienne (1 pièce).

Le matériel en silex inclut trois fragments de lame retouchés, un éclat et une lame (fig. 3). La lame est retouchée sur les deux côtés et sa partie distale est appuyée. Un fragment mésial à retouches fines marginales sur un bord est intensément brûlé (cupules thermiques très marquées).

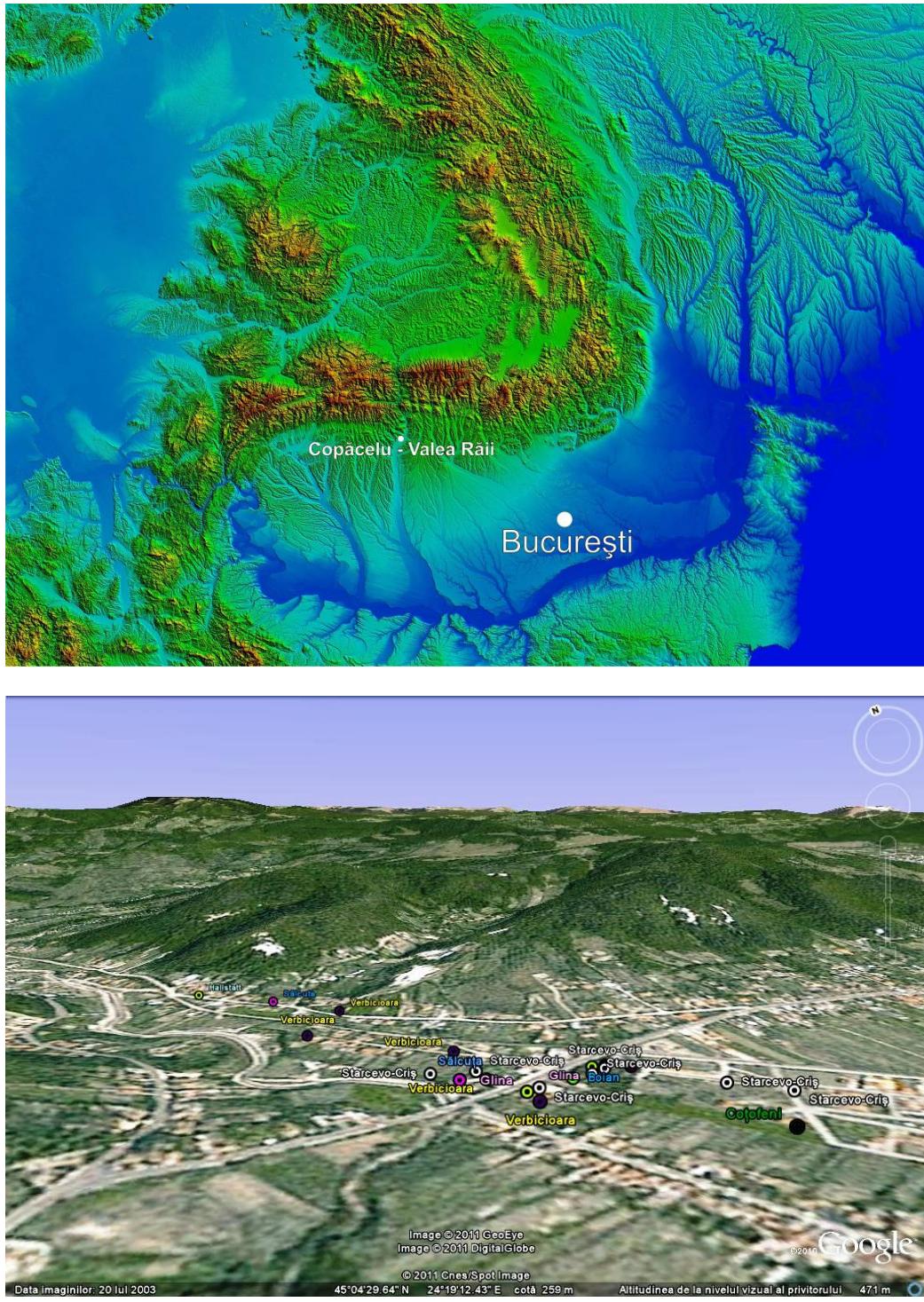


Fig. 1 - L'emplacement de l'établissement de Copăcelu-Valea Răii et la région de la ville Râmnicu Vâlcea avec découvertes préhistoriques

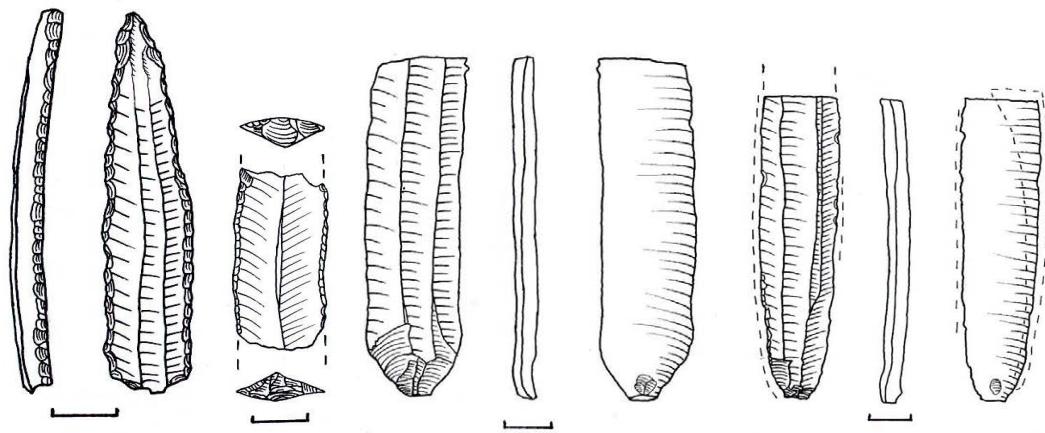
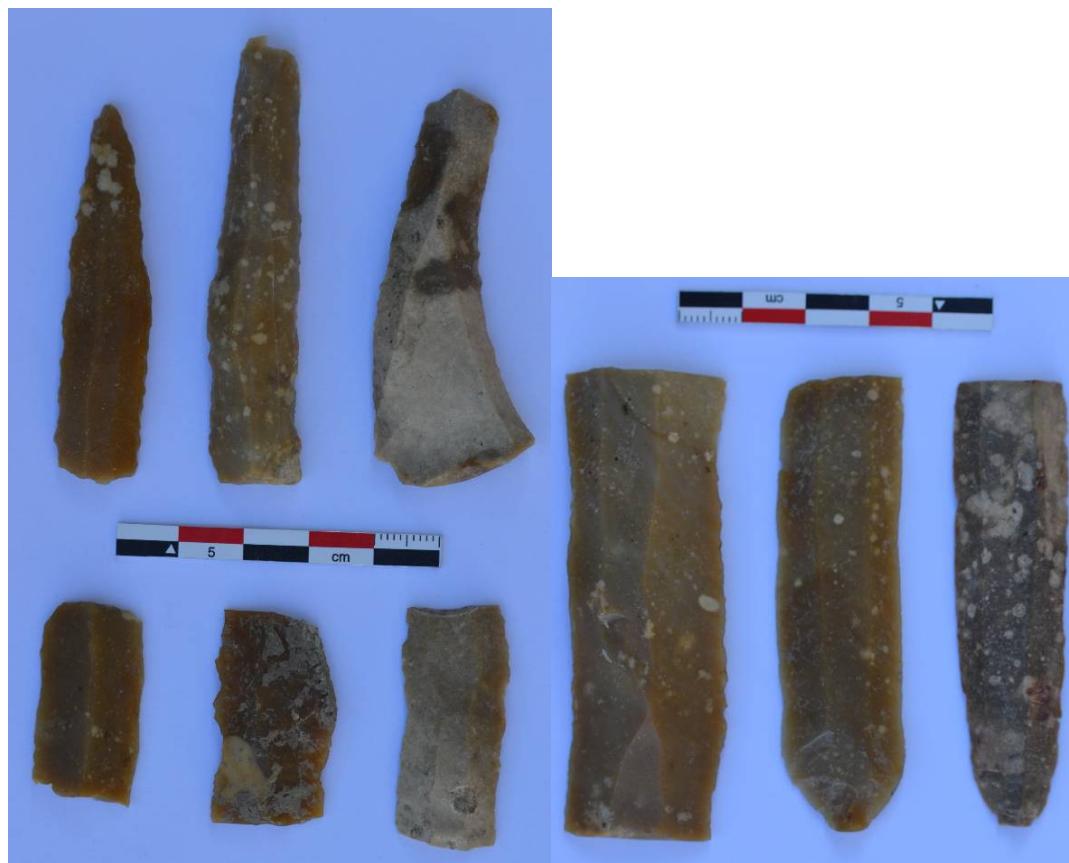


Fig. 2 – Fragments des lames et des outils de la hutte 1



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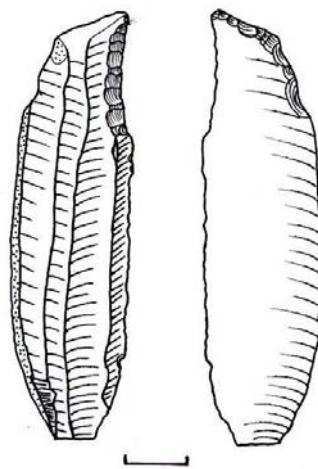


Fig. 3 - Outilage lithique de la hutte 2

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La lame en obsidienne est très émoussée sur le bord gauche. Par rapport à l'entier ensemble en obsidienne découvert dans cet habitat, cette pièce est la seule lame entière, et sa présence à l'intérieur d'une demeure est d'autant plus importante.

### **Le matériel lithique en obsidienne**

Un nombre de 22 pièces sont débitées en obsidienne (fig. 4).

Tout le matériel est représenté par des produits de dimensions réduites. La majorité sont éclats et fragments d'éclats. En plus, on a observé aussi quelques fragments de lame, un nucleus, une tablette et quelques cassons très petits.

Du point de vue technologique, ces pièces sont les derniers produits d'une exploitation maximale de la matière première, ce qui implique une importance spéciale de l'obsidienne pour la communauté de Copăcelu-Valea Răii. Un exemple en ce sens est le seul nucleus de la collection. Il a comme support un fragment de nucleus (il garde encore deux négatifs hérités de l'ancien nucleus). La dimension extrêmement réduite du nucleus a déterminé le débitage d'un nombre restreint de petits éclats, après quoi il a été abandonné. Son évolution s'inscrit dans le suivant schéma technique:

*Nucleus laminaire → percuteur → fragmentation du nucleus par une coupe transversale → fragment nucleus → nucleus dont on a débité des éclats → abandon*

La majorité des produits en obsidienne découverts peuvent provenir de ce système de débitage. Il s'agit d'éclats de dimensions réduites (en dessus de 3 cm en longueur), certains d'entre eux ayant sur leur surface des négatifs laminaires et lamellaires. Seulement deux produits ont été débités en vue d'aménager des nucleus: une tablette et un éclat de ravivage de la surface de débitage / plan de frappe. La tablette de dimensions réduites (32/26/10 mm) a été transformée en racloir. Elle a été débitée à partir d'un nucleus lamellaire (négatifs à largeurs de moins de 1 cm). Un éclat a été débité en vue du réaménagement d'une surface de débitage lamellaire (lamelles larges de 5-6 mm).

Les produits laminaires sont peu représentés, on n'en a que quatre fragments de lames et un fragment de lamelle.

Les types de percussion utilisés sont dure directe et, dans un seul cas, tendre. Une seule pièce a deux fractures complexes réalisées pendant le débitage (type languette).

Quelques pièces présentent des traces d'utilisation. Une partie des produits peuvent être inclus dans la catégorie des outils: un racloir simple sur tablette, des éclats retouchés (dont un par pression), les retouches étant associés à encoche (2 pièces) ou troncature et encoche (1 pièce). Les observations techno-fonctionnelles plaident, tout comme celles technologiques, pour l'utilisation maximale des supports débités en obsidienne, malgré leurs dimensions réduites.

### **Le matériel lithique en silex**

Les pièces taillées en silex sont représentées, dans un pourcentage significatif, d'outils sur lames ou de fragments de lames (dans cette catégorie étant inclus tant le matériel retouché que celui avec lustre) (tab. 1). Conformément aux caractéristiques techniques, il s'agit de produits apportés dans le site, utilisés et transformés en plusieurs étapes. Quelques nucleus, éclats de réaménagement et lames nous offrent des indications sur la dernière étape du débitage réalisé dans l'habitat.

#### *Systèmes de production*

Les nucleus entiers s'inscrivent dans les catégories suivantes: un nucleus pyramidal, deux prismatiques et un nucleus de petits dimensions dont on a enlevé des éclats. Les produits de ravivage sont représentés seulement par une seule tablette et deux éclats de réaménagement de la surface de débitage.

Tenant compte des dimensions réduites des nucléus par rapport aux produits de débitage, mais aussi du nombre très petit d'éclats corticaux et de réaménagement, les nucleus ont été faits atteindre une étape évoluée du débitage, étant éventuellement préformés.

Le nucléus pyramidal (56/25/25 mm) est taillé en silex, ayant subi un traitement thermique en vue de l'amélioration des qualités de la roche (fig. 5/1). Le débitage a été réalisé par pression, modalité unipolaire. Le plan de frappe est aménagé par enlèvement d'éclats, mais aussi par égrisage. Les négatifs ont une largeur d'environ

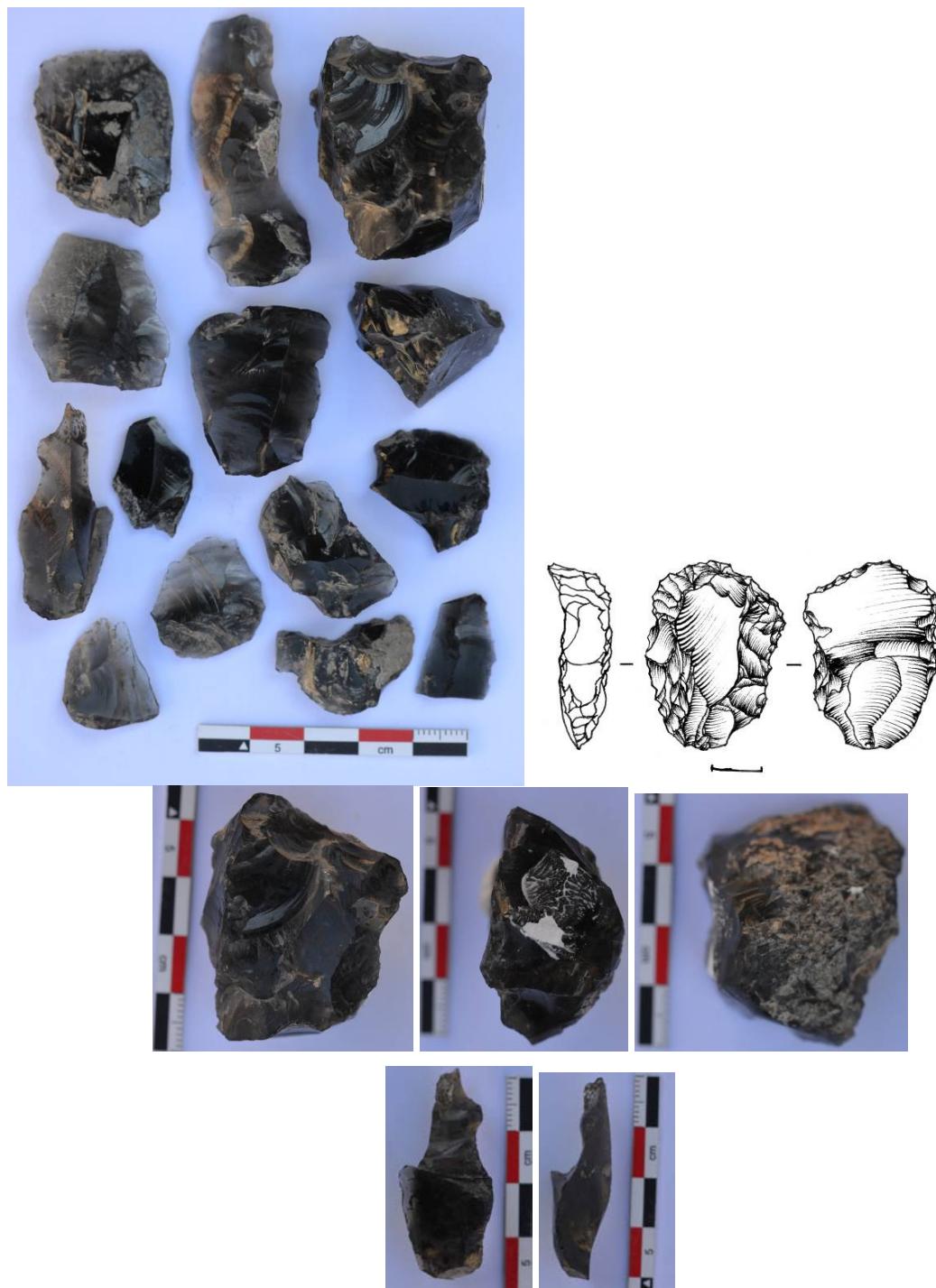


Fig. 4 - La matériel lithique taille en obsidienne: 1. la composante générale de l'assemblage; 2. tablette retouche (racloir); 3. nucleus; 4. accident de débitage



Fig. 5 - Les nucleus en silex (le première este brûlé): 1. nucleus pyramidal ; 2, 3. nucleus prismatiques

Types	Nombre
Nucléus	5
- fragments	1
Lames	78
- fragments	64
Lamelles (fragments)	9
Eclats	9
- fragments	2
Galet cassé	1
Débris, fragments indéterminés	7

Tab. 1 – La composante principale de l'industrie lithique

10 mm, donc ce sont des enlèvements presque lamellaires. Le nucleus a été abandonné à cause de la présence d'impuretés dans le bloc de matière première.

Les deux nucleus prismatiques appartiennent à des étapes d'abandon différentes (fig. 5/2, 3). L'un garde sur sa surface des négatifs robustes de lames courtes (de la longueur du nucléus, 6,50 cm), leurs largeurs variant de 20 à 25 mm. Les extrémités du nucleus ont été utilisées intensément comme percuteurs et broyeurs. Le deuxième nucleus primitif garde une partie avec des négatifs laminaires, le reste étant exploité par des plans orthogonaux en vue d'obtenir des éclats. Les dernières traces sont de percuteur et de broyeur.

Le dernier nucleus témoigne d'une exploitation maximale de la matière première. Il garde quelques négatifs laminaires sur lesquels sont superposés des négatifs d'éclats. Les dimensions de ce nucleus sont réduites, surtout son épaisseur (4,70/4,20/2,50 cm), ce qui a déterminé son abandon. Comme les pièces précédentes, malgré ses petites dimensions, ce nucleus a été utilisé comme percuteur et broyeur.

Nous n'avons pas réussi à réaliser aucun remontage de lames ou d'éclats avec ces nucleus, mais certaines caractéristiques des lames de l'ensemble nous font croire qu'elles peuvent provenir de noyaux prismatiques: lames courtes à nervures parallèles et profil droit.

#### *Caractéristiques technologiques des lames*

Comme nous venons de préciser, la majorité des lames sont transformées en outils. Les lames entières ou les outils sur des lames entières n'offrent pas d'image fidèle sur les caractéristiques techniques. Les quatre lames non-retouchées entières ont une régularité réduite des bords, des négatifs unipolaires convergents (probablement elles ont été débitées à partir de nucleus pyramidaux), des talons presque punctiformes. La percussion est indirecte avec chasse-lame (3 lames) et directe tendre (1 lame). Le plus grand produit est une lame outrepasse (73 mm en longueur).

Presque 90% des lames ont une section trapézoïdale, ce qui implique leur provenance d'une étape évoluée du débitage (fig. 6 c). Ayant en vue le fait que la majorité des lames sont des fragments, leur profil n'est révélateur que dans le cas de 21 pièces. Les lames ont des profils courbés et rectilignes dans des pourcentages égaux. En même temps, la longueur des lames n'est pas révélatrice, c'est pourquoi nous nous sommes appuyés sur le calcul des largeurs (à l'exception des pièces qui sont trop transformées par des retouches) et des épaisseurs.

La majorité des lames ont des largeurs entre 10-20 mm, étant suivies par la catégorie des lames dont la largeur est de 20-30 mm (fig. 7 c). Leurs épaisseurs s'inscrivent généralement autour de la valeur de 4-5 mm (fig. 6 a). Elles ont des marges et des nervures le plus souvent parallèles. Les caractéristiques morphométriques indiquent l'existence des lames régularisées, obtenues à travers des procédures techniques permettant le débitage à partir de supports très uniformes. Les talons les plus souvent rencontrés sont planes, de dimensions réduites, étant suivis par ceux punctiformes (fig. 6 b).

La technique de percussion observée dans la majorité des cas est indirecte avec chasse-lame. On a utilisé aussi la pression, la percussion directe tendre et dans une moindre mesure la percussion directe dure. L'existence

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des procédures de percussion indirecte avec chasse-lame ou pression explique la morphologie très régulière des supports.

### Les outils

Conformément à l'analyse technologique, les produits de débitage sont apportés déjà retouchés dans le site. Les lames non retouchées présentent des traces de lustre végétal ou des traces visibles d'usure.

Les outils représentent un pourcentage important de cette industrie lithique, ayant presque tous des lames en guise de supports. Malheureusement, 55% sont fragmentés. En même temps, il y a un nombre significatif d'outils sur fragments de lames, ce qui implique une utilisation maximale des supports.

Les outils les plus fréquemment rencontrés sont les lames retouchées (fig. 8), suivies par des pièces à troncature double ou simple (fig. 9, 10, 11). Très fréquemment, les lames à troncature ont pour support des lames ou des fragments de lames retouchés. Le plus souvent, les troncatures étaient aménagées sur des fractures. La multitude des pièces à troncature impliquent aussi un réaménagement des lames fragmentées, c'est-à-dire une utilisation maximale des produits de débitage. En ce sens, il y a quelques fractures qui semblent être intentionnelles.

Les retouches des lames sont le plus souvent fines, marginales, réalisées par pression (fig. 13). Sur quelques lames on a observé des retouches abruptes et semi-abruptes, écailleuses, relativement amples, qui témoignent d'une réduction maximale des supports. Parfois, les lames retouchées sont associées à des encoches et à des zones denticulées. La pièce la plus grande du set est un poignard fragmenté (10 cm longueur) (fig. 13).

Les grattoirs (13 pièces) ont comme supports des lames robustes, épaisses. Toutes les lames sur lesquelles les grattoirs ont été retouchés ont une section trapézoïdale. En même temps, leur front est abrupt ou semi-abrupt (fig. 10).

Des perçoirs, dans le sens de la typologie classique, on en a seulement deux, mais une série de lames retouchées appointées peuvent être encadrées aussi dans cette catégorie (fig. 12).

Les lamelles ne sont pas retouchées, mais un fragment mésial de lamelle a, aussi, traces de

lustre végétal (fig. 14 a). Un certain nombre de pièces sont brûlées et quelques-unes gardent traces de lustre (fig. 14 b, c).

### Des outils complexes

Dans cette catégorie nous avons inclus une série de pièces portant des traces particulières d'utilisation, parmi lesquelles il y a aussi les fragments de lames lustrées.

#### 1. Traces d'utilisation sur des pièces en obsidienne (fig. 15)

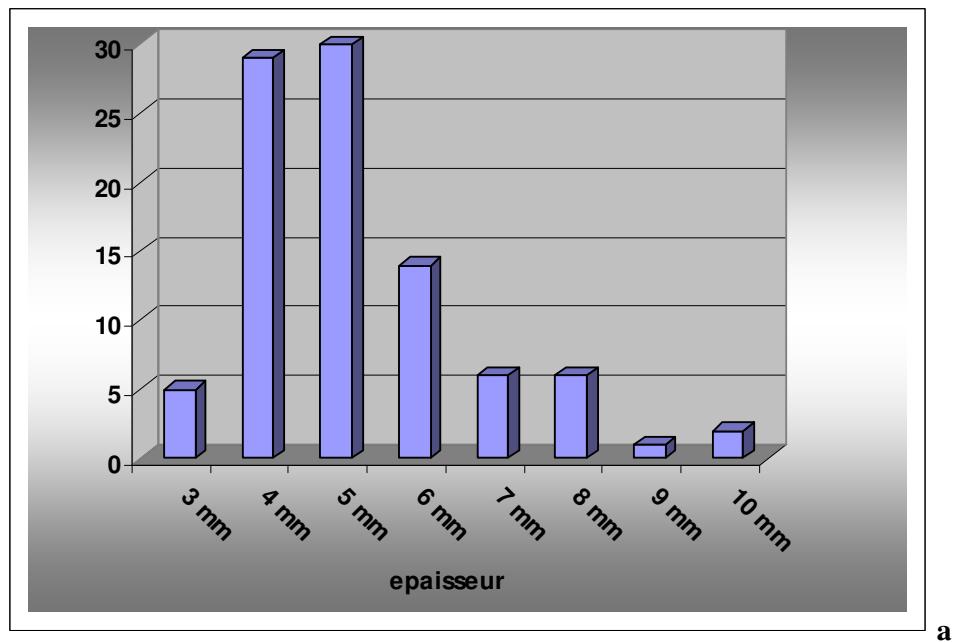
Un fragment proximal de lame en obsidienne présente des traces complexes d'emmanchement et d'utilisation. Sur la face de la pièce, surtout dans la zone proximale du fragment, on observe des traces d'écrasement accentué. Ces traces sont évidentes seulement au milieu de la pièce, les bords n'étant pas affectés. L'outil semble avoir été emmanché, en sorte que les bords puissent demeurer libres. Tous les deux bords sont fortement utilisés, les traces présentes étant particulières. Les bords ont acquis un aspect arrondi et sont totalement émoussés. L'outil a été utilisé pour polir un matériel semi-dur, qui n'a pas détruit ses bords, mais les a modélisés. Il est possible que cette pièce ait été utilisée pendant longtemps pour des matériaux similaires.

#### 2. Des pièces portant des traces de lustre

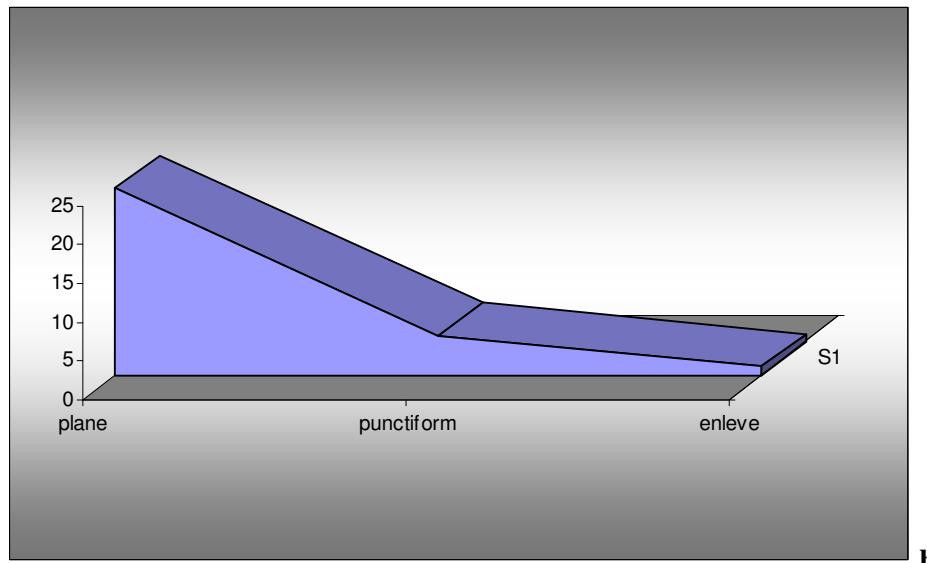
Des traces de lustre ont été observées sur neuf pièces : 1 fragment mésial de lamelle, 1 fragment distal de lame, un fragment proximal et cinq mésiaux, un outil complexe. Analysant attentivement l'ampleur du lustre végétal sur la surface des pièces, nous avons remarqué sa position différente d'une pièce à l'autre (fig. 16-20).

Deux des pièces lustrées sont brûlées (fig. 19). Au moins dans le cas de l'une d'entre elles, le lustre s'est formé après la brûlure. Il s'agit d'un fragment proximal de lame débitée par pression, découvert dans la hutte 1. Le type de brûlure, tel que nous venons de préciser, nous fait croire que cette pièce provient d'un nucleus ayant subi un traitement thermique en vue de l'amélioration des qualités de la roche et en vue du contrôle de la technique de débitage.

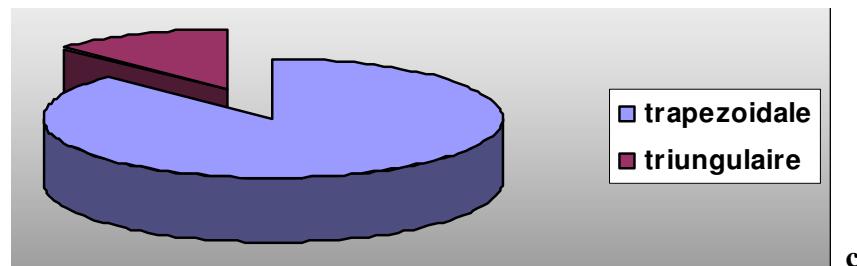
Dans le cas des fragments mésiaux, le lustre est situé obliquement sur une moitié de la surface des pièces, mais est visible aussi sur le côté opposé sous la forme de traces marginales (fig. 16, 17, 18). Conformément à leur morphologie, ces pièces sont des véritables



a

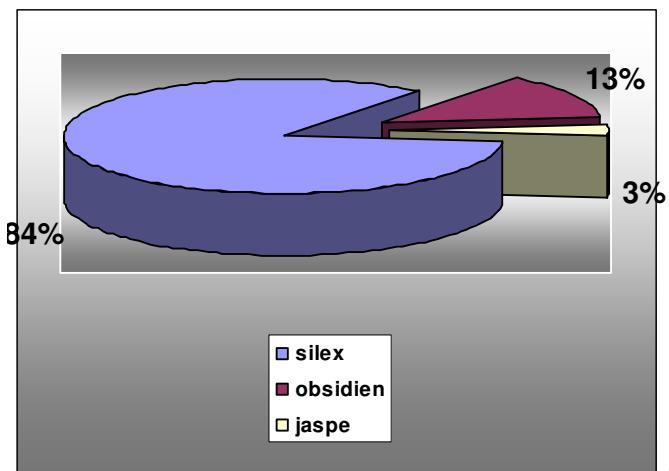


b

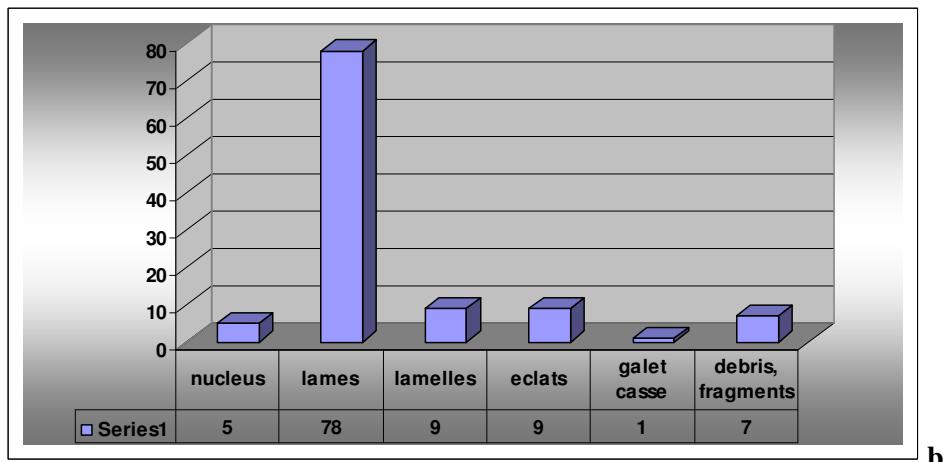


c

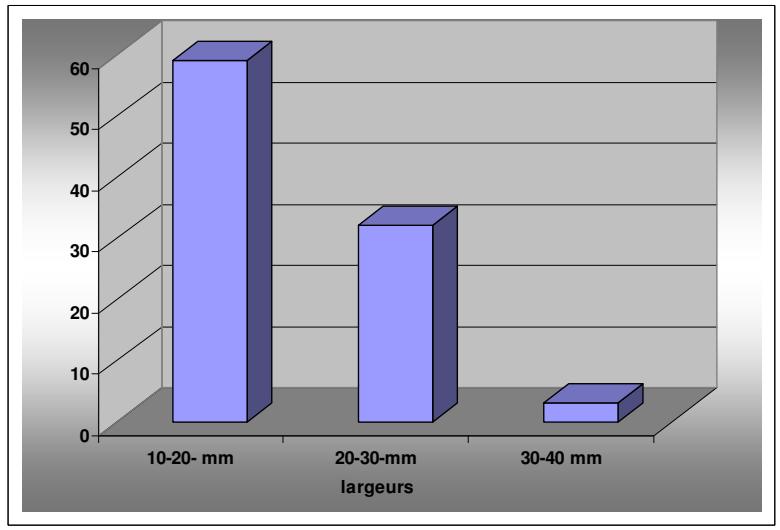
Fig. 6 - Caractéristiques des lames taille: a. épaisseur de produits laminaires ; b. les types des talons; c. sections des lames et des fragments de lames



a



b



c

Fig. 7 – Caractéristiques de la matières premier et des produits taille : a. les types de matières premières ; b. les types de produits de débitage ; c. largeur de produits laminaires

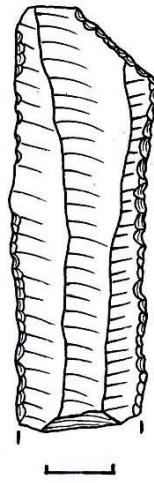


Fig. 8 - Fragments proximal et distal des lames retouché

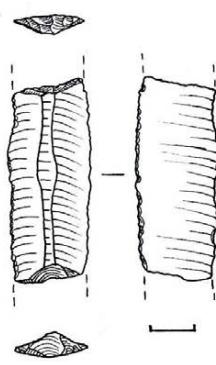
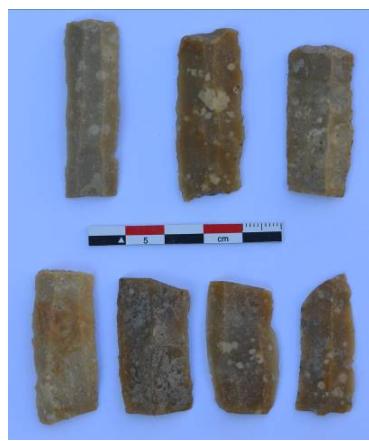
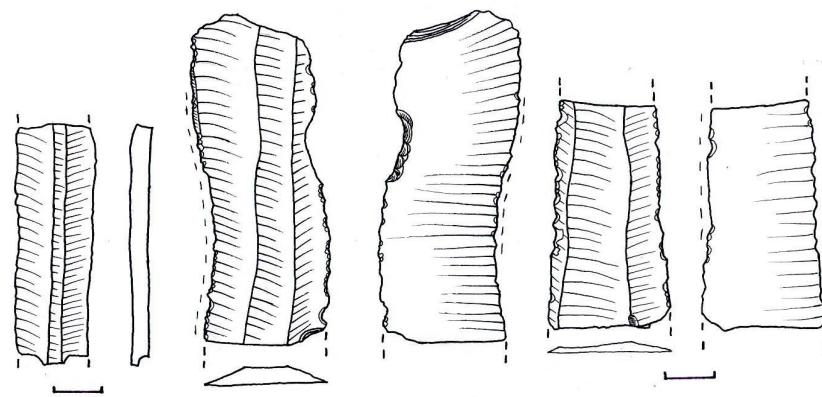


Fig. 9 - Fragments mésial des lames (quelques-unes ont des traces de lustre)

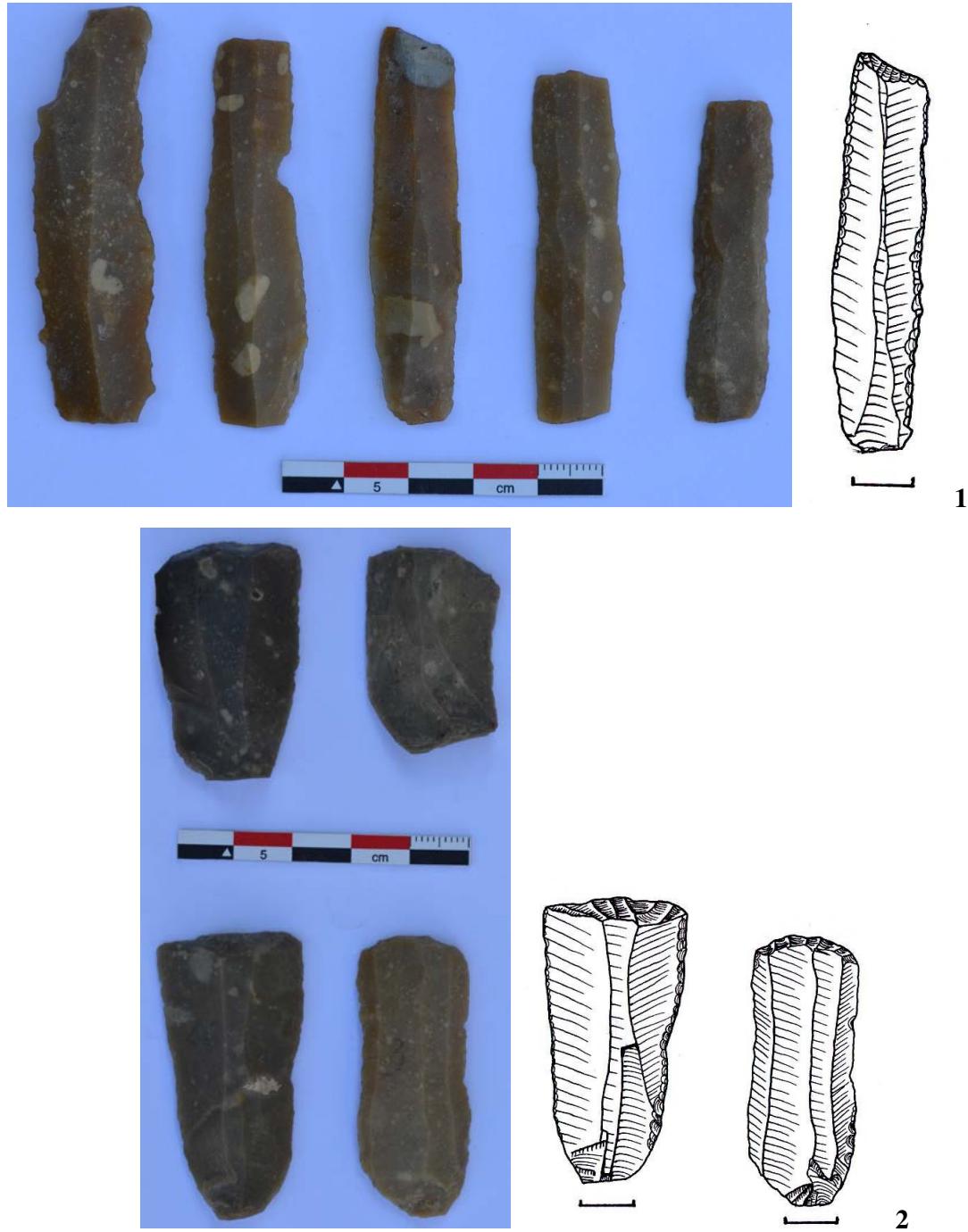


Fig. 10 - Divers fragments des lames simples ou avec troncature (1) et grattoirs (2)

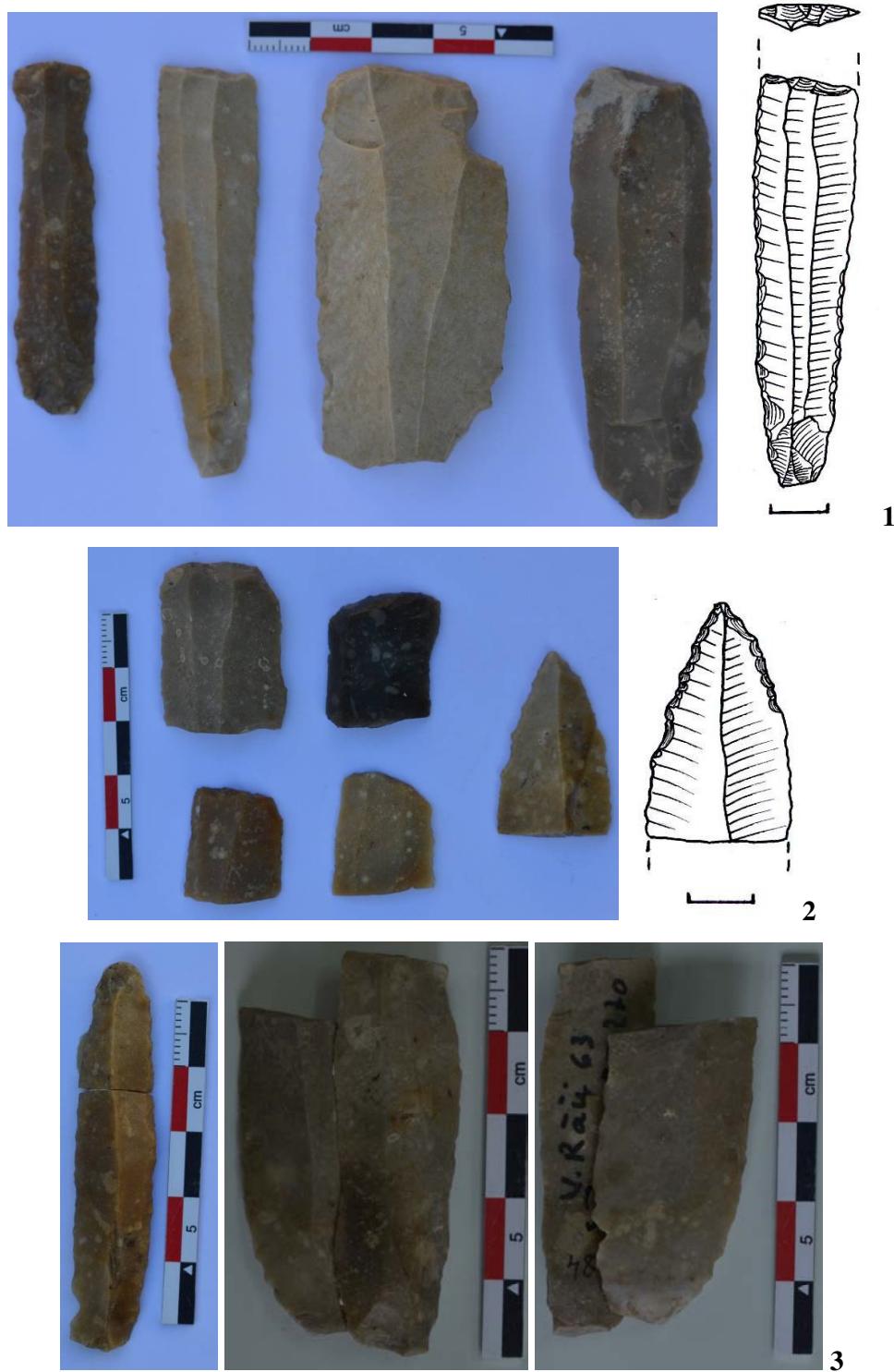


Fig. 11 - Outils et remontage: 1. lames avec troncature simple ou double; 2. fragments distaux des lames avec troncatures et un point; 3. racord et remontage

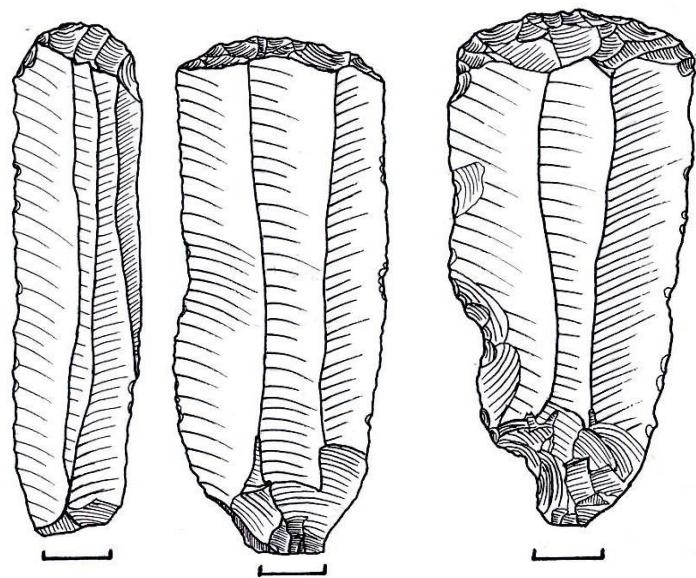


Fig. 12 - Grattoirs



Fig. 13 - Lames retouché convergente (la plus grande pièce c'est un poignard) et avec troncatures



a



b



c

Fig. 14 : Fragments des lamelles (a), pièces brûlées (b) et forts brûlés (c)

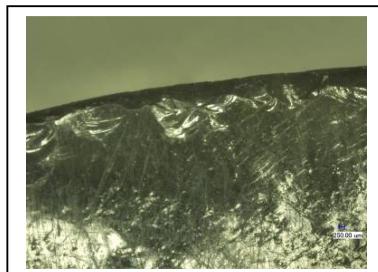
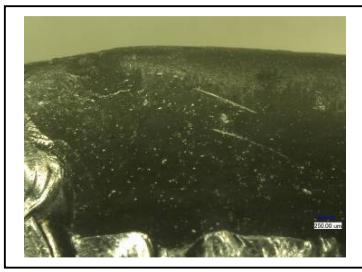
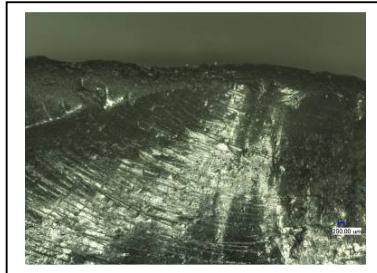
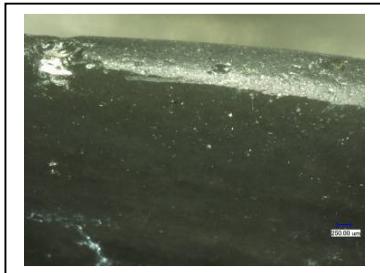
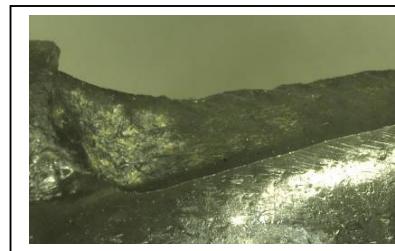
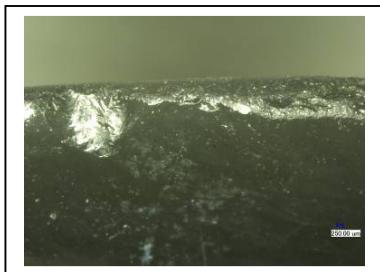
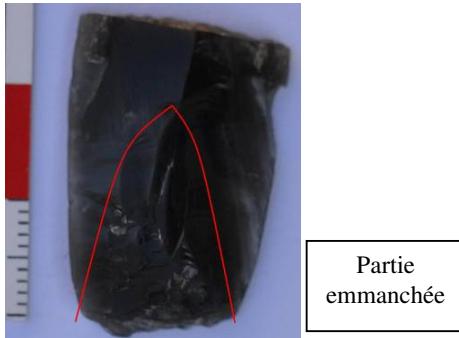


Fig. 15 - Fragment de lame en obsidienne avec traces d'emmanchement et d'usure

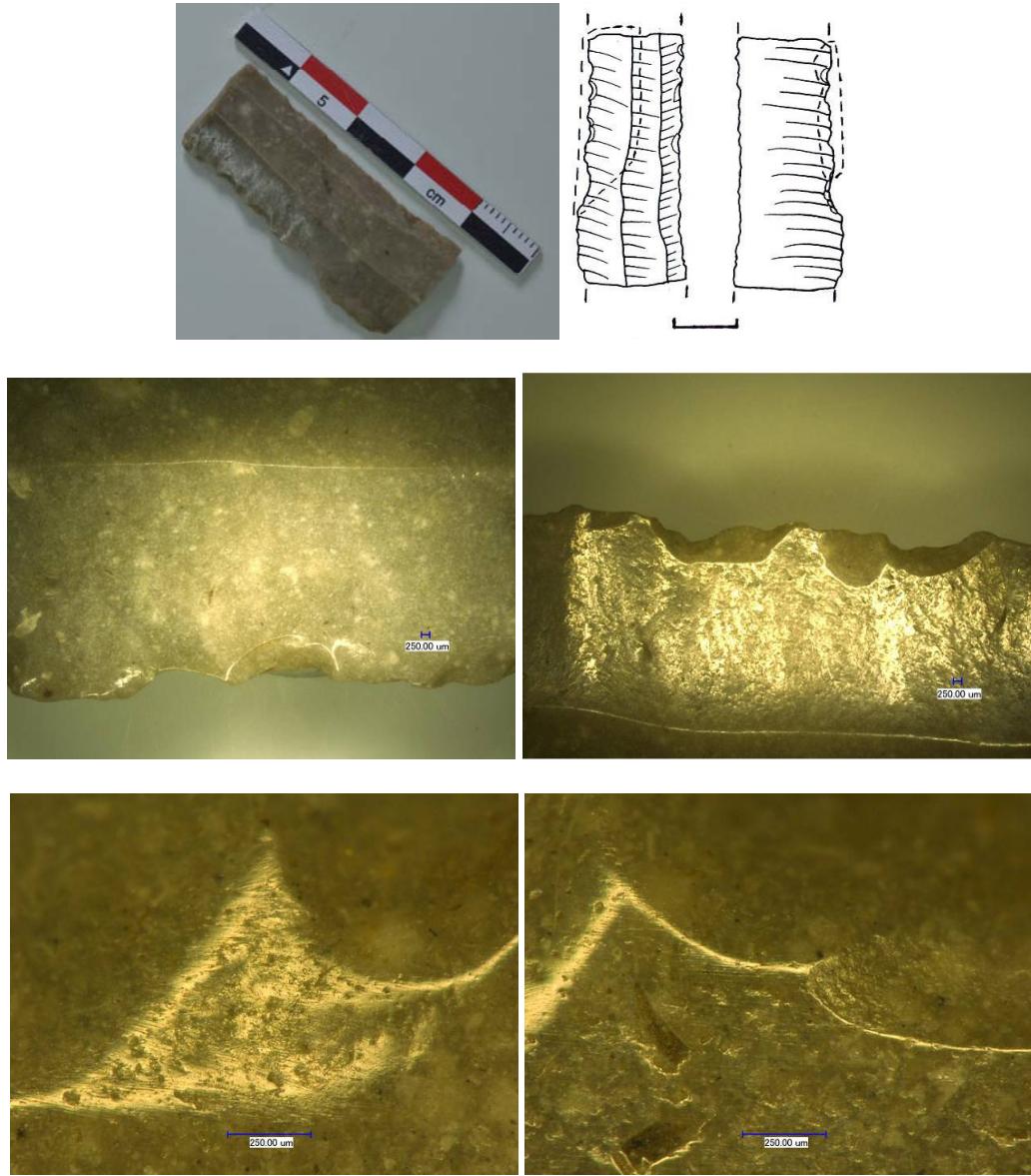


Fig. 16 - Armature de fauille ; détails microscopiques avec les zones lustrées

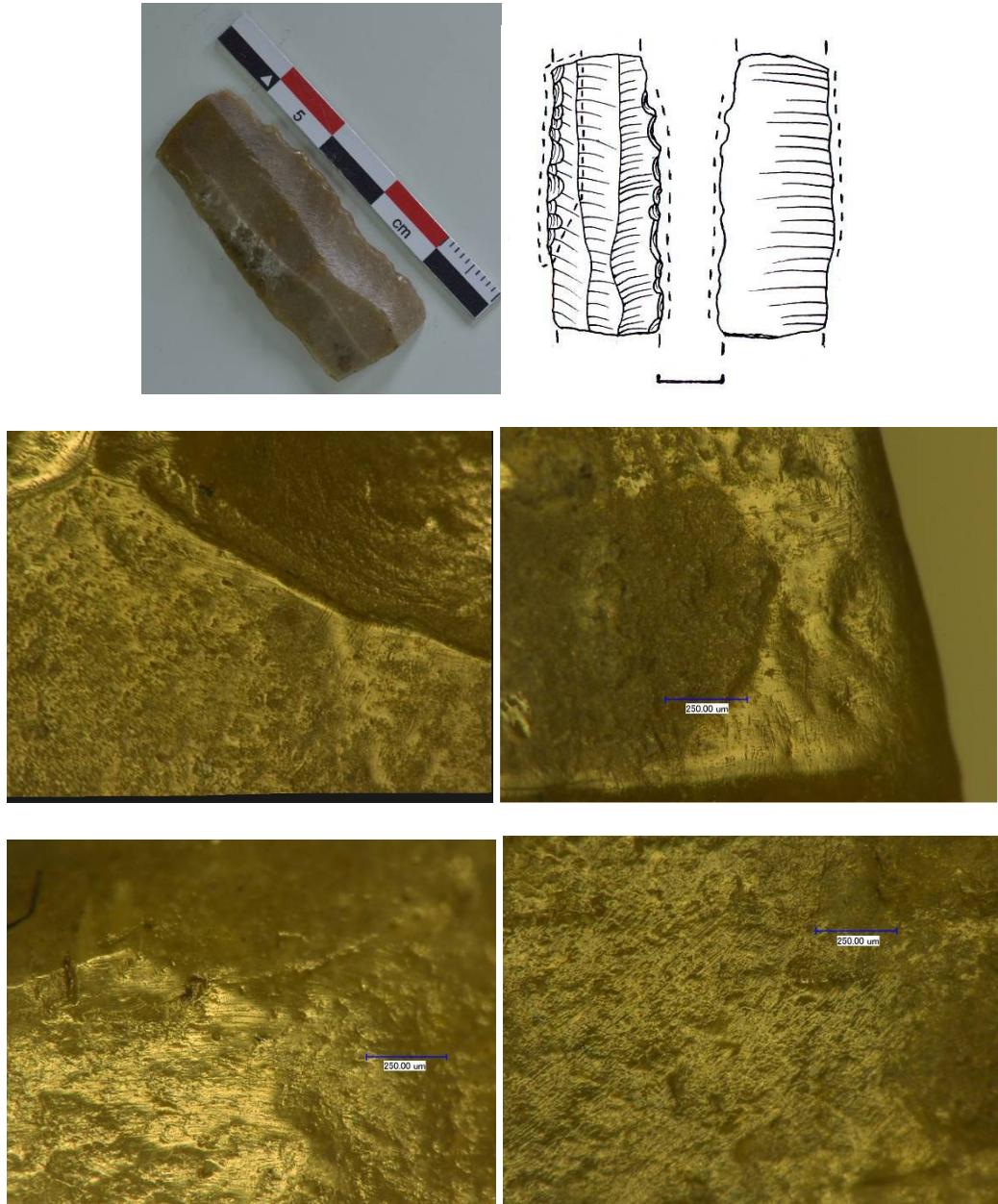


Fig. 17 - Armature de fauille ; détails microscopiques avec les zones lustrées

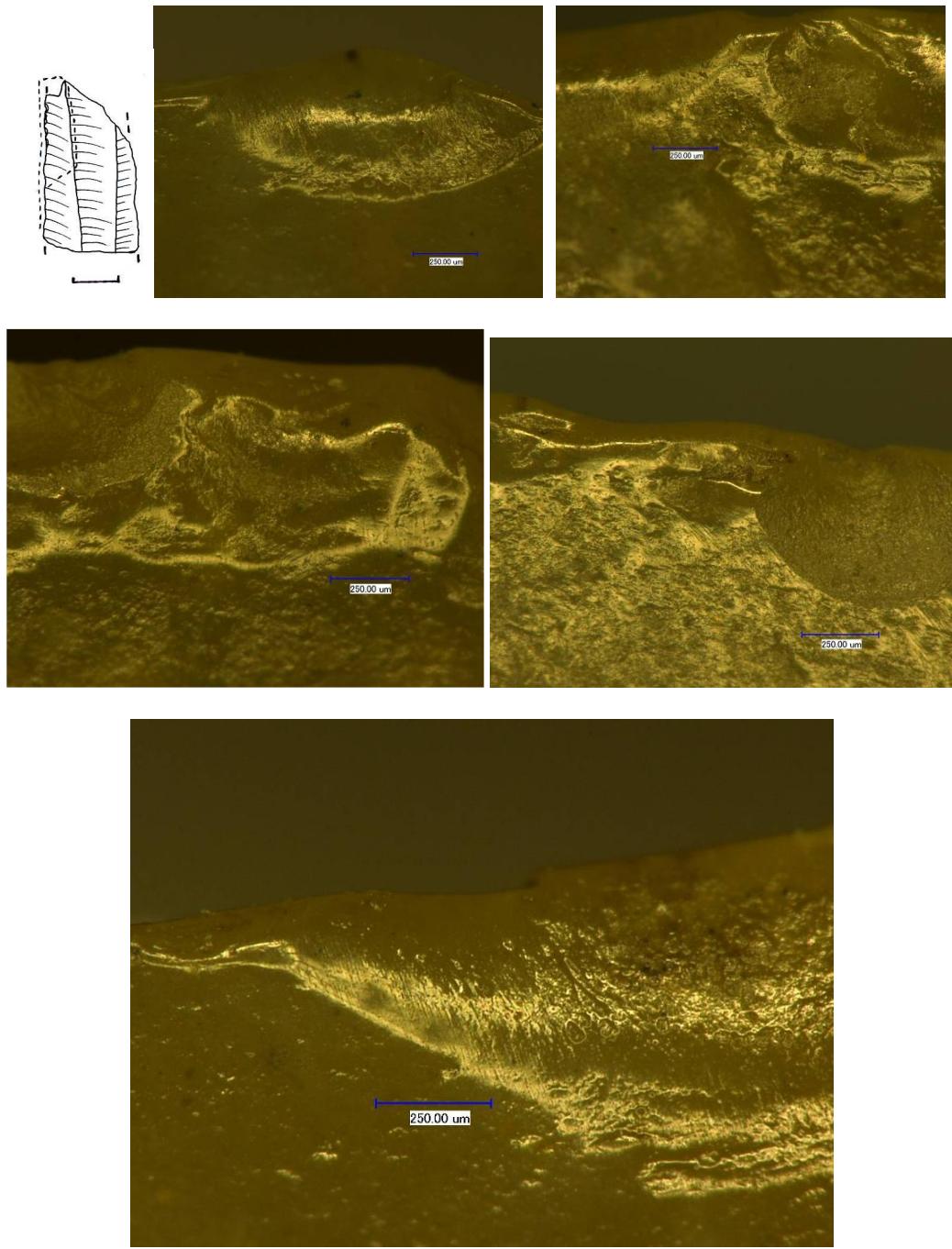


Fig. 18 - Armature de fauille ; détails microscopiques avec les lustre de céréales

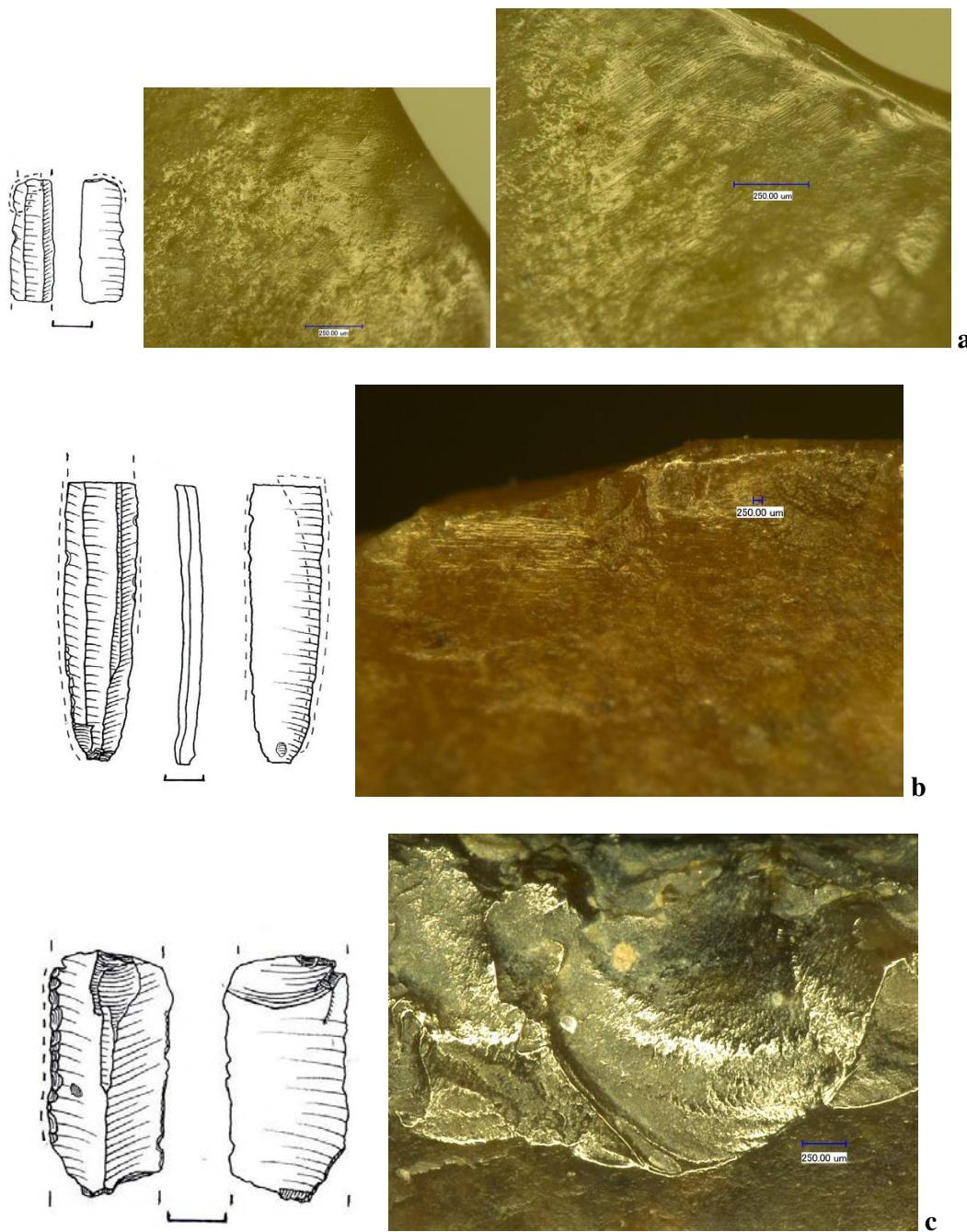


Fig. 19 - Armatures de fauille ; détails microscopiques avec les lustre de céréales (les pièces b et c sont brûlées)

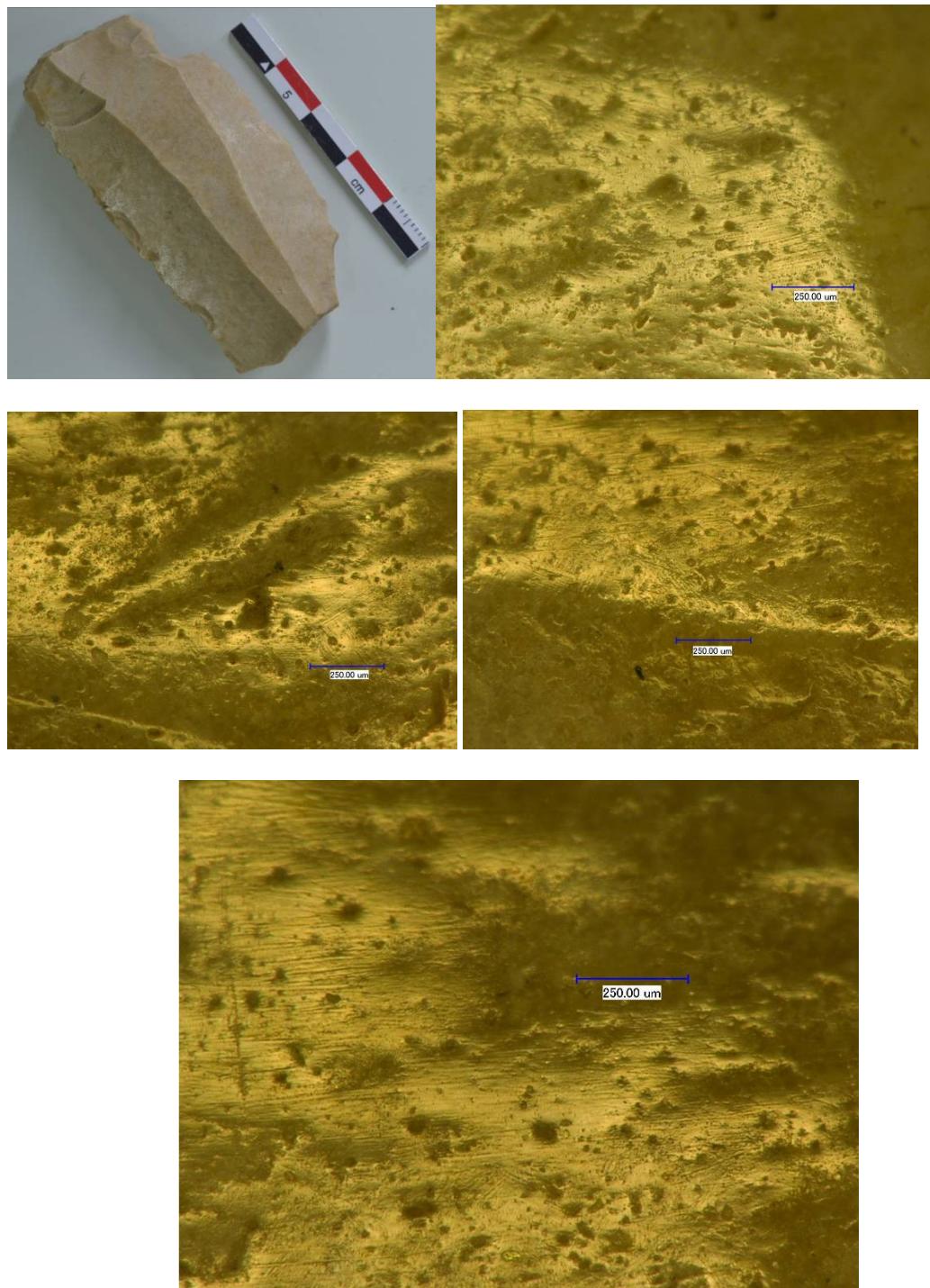


Fig. 20 - Fragment mésial retouché avec troncature double et détails microscopiques sur le bord avec lustre

## **Nouvelles considérations concernant l'industrie lithique taillée du Néolithique ancien (culture Starčevo-Criş) de l'établissement de Copăcelu-Valea Răii (département de Vâlcea, Roumanie)**

armatures de fauilles. Deux d'entre elles ont été insérées dans la fauille découverte par D. Berciu (1966) (fig. 16, 17).

Nous avons pu les reconnaître grâce à la description détaillée fournie par l'archéologue mentionné ci-dessus. Elles ont la même longueur, d'où l'on peut supposer que certains fragments de lame médiaux étaient fracturés intentionnellement. D'ailleurs, dans toute l'industrie nous avons observé beaucoup de stigmates de fractures par flexion. En plus, la majorité des fragments mésiaux ont des caractéristiques morpho-techniques similaires. Sur certains fragments mésiaux le lustre est très difficilement observable, étant disposé sous la forme d'une bande périphérique sur les deux côtés.

Microscopiquement, le lustre visible sur ces segments de fauille est disposé sous forme de lignes parallèles, orientées de manière très régulière, en harmonie avec la direction de manœuvre de la fauille.

L'une des pièces les plus intéressantes avec lustre est un outil complexe ayant comme support un fragment mésial de lame très robuste (fig. 20). Celle-ci est retouchée de manière différente sur les deux bords : le bord droit présente des retouches inverses abruptes et encoche, tandis que le bord gauche est denticulé. En plus, la pièce a une troncature double. Les traces de lustre sont observables seulement sur le bord denticulé, ce qui signifie que le bord opposé a été retouché abruptement en vue de l'insertion dans un manche. A la différence des armatures des fauilles classiques, les traces de lustre microscopique se présentent comme des lignes situées l'une en dessus de l'autre, en quelque sorte chaotiquement. Cela peut faire supposer qu'elle a été utilisée pour un autre type de plantes, riches en silicium, pas nécessairement pour les céréales.

### **Conclusions**

Vu les découvertes faites au fil du temps, l'habitat de Copăcelu-Valea Răii représente un site important pour la mise en évidence les caractéristiques de la culture Starčevo-Criş. Le matériel lithique taillé représente un pourcentage important des découvertes de cet habitat. Son analyse a relevé une série de comportements technologiques intéressants. La matière première

majoritaire est apportée dans le site de distances significatives (probablement il s'agit de silex de Plateforme Balkanique), largement déjà débitée. Le taux le plus significatif revient aux outils. En même temps, on a découvert un nombre important de pièces en obsidienne qui témoigne d'une exploitation maximale de cette roche et d'une importance spéciale pour la communauté néolithique d'ici.

Du point de vue technologique, les nucleus en silex ont été apportés dans le site déjà débités, et dans leur phase maximale d'épuisement, la plupart ont été transformés en broyeurs et percuteurs. Les lames fragmentées accidentellement ou pendant l'utilisation ont été réaménagées et transformées en un autre type d'outils (la majorité étant des pièces à troncature). Certains produits présentent des retouches successives qui ont réduit significativement les outils. Un taux important revient aussi aux armatures de fauille, surtout qu'elles peuvent être associées à la fauille en corne découverte dans ce site. Cela est une preuve de plus d'une activité économique particulière : la culture des céréales.

Tous les indices conduisent vers l'encadrement de ce site dans une étape développée de la culture Starčevo-Criş. Les pièces microlithiques manquent, et la dimension réduite de certains outils est due au fait qu'ils sont retouchés sur des fragments de lames. La production de supports laminaires de dimensions moyennes et grandes (par exemple le fragment de poignard ayant une longueur de 10 cm) implique l'existence de certains systèmes de débitage très évolués. En plus, il existe des preuves concernant l'utilisation du feu pour le contrôle de la qualité du silex. La technique utilisée fréquemment est la percussion indirecte avec chasse-lame ou pression. Toutes ces choses témoignent des comportements techniques bien organisés et évolués présents dans la communauté de l'habitat de Copăcelu-Valea Răii, qui peuvent compléter l'image générale en ce qui concerne les ensembles lithiques taillés du Néolithique ancien.

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## Gedanken zu einigen bronzezeitlichen Tei-Metallobjekte aus dem Bezirk Giurgiu, Rumänien

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**Abstract:** The archaeological investigations undertaken in two settlements of the Tei Culture in the Giurgiu County had resulted in the discovery of some copper, bronze and silver items. Some of them had been found in complexes, others in the cultural layer. The specific analyses had shown that the used copper was one originating south of the Danube, in Bulgaria and Serbia.

**Keywords:** Tei Culture, Romania, Giurgiu County, metalobjects, discussions.

Vor mehr als 20. Jahren hatten die archäologischen Forschungen in Mogoșești (C. Schuster, T. Popa, 1995a; C. Schuster, T. Popa, 1995b; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2002; T. Popa, 1998) und Mironești (C. Schuster, T. Popa, 1995a; C. Schuster, T. Popa, 2008), beide Ortschaften im Bezirk Giurgiu, auf der Hochterrasse des rechten Argeș-Ufers liegend, das Entdecken von mehreren Werkzeugen, Waffen und Schmuckstücken, die der Tei-Kultur zugeordnet werden konnten, zur Folge. In mehreren Publikationen (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010) setzten wir uns mehr oder weniger eingehend mit diesen auseinander. In unserer jetzigen Stellungnahme wird hauptsächlich den Fundumständen, den Analogien im Tei-Kulturmilieu und, das im Lichte der neusten metallographischen Analysen<sup>1</sup>, den

Herkunftsregionen der Rohstoffe die nötige Aufmerksamkeit geschenkt.

### Zu den Fundumständen

In Mogoșești, Gemeinde Gostinari, in der Siedlung der Unterstufe Mogoșești der Tei II-Stufe der Kultur (C. Schuster, T. Popa, 2000), sind ein Messer, eine Meißel, zwei Nähnadeln und ein Ring im Haus Nr. 1, eine dritte Nähnadel in der Kulturschicht des Schnittes 1, ein Dolch und ein Ohrring zwischen dem Haus Nr. 1 und der gebrannten Lehmplattform, eine Rollennadel im Haus Nr. 3 und mehrere einfache Röhrchen gefunden worden (C. Schuster, 1992; C. Schuster, 2007; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa).

Die meisten Funde konzentrierten sich im Haus Nr. 1, ein Bau der unseres Erachtens eine wichtige Rolle im Leben der Gemeinschaft – „Versammlungsort, Tempel oder Männerhaus“, spielte (C. Schuster, T. Popa, 2000, S. 27-28). Das Messer (mit einer Länge von 13.3 cm,

<sup>1</sup> Die Metallanalyse der Gegenstände aus Mogoșești und Mironești wurden von Dr. Bogdan Constantinescu, Cătălina Păuna und Mihaela Marica vom „Horia Hulubei“ Nationalen Institut für Physik und Atomenergie durchgeführt. Ihnen und Frau Dr. Anca Popescu (Archäologisches Institut „Vasile

Pârvan“), die uns hinsichtlich diesem Unternehmen behilflich war, sind wir großen Dank verpflichtet.

maximale Breite der Klinge von 1.40 cm und maximale Dicke der Rückenpartie der Klinge von 0.3 cm), verziert auf beiden Klingenseiten mit einer eingravierten Linie und einer Reihe von Halbkreisen (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010), wurde in der Ascheschicht zwischen dem Herd Nr. 1 und der wahrscheinlichen Ostwand des Hauses entdeckt (Abb. 1).



Abb. 1 - Mogoșești, Haus Nr. 1, bronzerne Messer. Foto Gheorghe Chelmec.

Es konnten keine sekundären Brandspuren am Messer beobachtet werden. Die Ascheschicht, mit einer Dicke von 6 cm, war eher das Ergebnis der Tätigkeit des Herdes (C. Schuster, T. Popa, 2000), als der Beweis des Feuers, welches das Haus abgebrannt haben soll.

Desgleichen im Haus Nr. 1 wurden weiter zwei der Nähnadeln gefunden. Beide lagen leicht parallel, dicht nebeneinander, auf der gestampften Lehmschicht (3 cm dick), ungefähr 15 cm vor dem Herd Nr. 2 (C. Schuster, T. Popa, 2000). Die eine Nadel, ganz erhalten, gebogen in ihrem Unterteil (Abb. 2a), hatte eine Länge von 10.9 cm und eine maximale Dicke von 0.25 cm (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Unbeschädigt erwies sich auch die zweite Nadel (Abb. 2b), 0.85 cm lang und 0.2 cm dick, diese aber wurde zickzackartig gebogen (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Beide Nadeln zeigten Verwendungsspuren.

Neben ihnen wurde ein kleiner Nadelaufbewahrungszyylinder, gearbeitet aus einem wahrscheinlichen Schaf/Ziegenknochen, gefunden (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010; C. Schuster, 2007). Das offene Ende des Behälters wurde mit drei (?) eingekerbten Ringen versehen. Am Unterteil des Zylinders gab es einen weiteren Ring.

Da wir die Problematik der Nähnadeln angeschnitten haben, muß unterstrichen werden, dass in Mogoșești, aber diesmal, wie schon erwähnt, in der Tei-Schicht des Schnittes Nr. 1, in einer Tiefe von 0.43 m, ein drittes,

beschädigtes, Werkzeug dieser Art entdeckt wurde (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Die Länge der Nadel betrug 7.00 cm und bestand aus einem 0.1 cm dünnen Draht (Abb. 2c).



Abb. 2 - Mogoșești, Haus Nr. 1, 2a kupferne Nähnadel, 2b bronzerne Nähnadel; Kulturschicht: 2c bronzerne Nähnadel. Foto Gheorghe Chelmec.

In der Ascheschicht (16 cm dick), 28 cm nördlich vom Feuerherd Nr. 3 des Hauses Nr. 1 (C. Schuster, T. Popa, 2000), in einer Tiefe von 0.38 m, wurde ein wahrscheinlicher Fingerring, gearbeitet unseres Erachtens aus dem Langteil einer ehemaligen Hülsenkopfnadel, deren Oberteil, die Hülse, abgebrochen wurde, gefunden (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Seine erhaltene Länge betrug 5.20 cm und die Dicke des Drahtes 0.15 cm (Abb. 3).



Abb. 3 - Mogoșești, Haus Nr. 1, bronzerner Fingerring. Foto Gheorghe Chelmec.

## Gedanken zu einigen bronzezeitlichen Tei-Metallobjekte aus dem Bezirk Giurgiu, Rumänien

Eine kleine Meißel wurde desgleichen im Haus Nr. 1 entdeckt (Abb. 4b).



Abb. 4 - Mogoșești, zwischen Haus Nr. 1 und Lehmplattform, 3a bronzer Dolch; Haus Nr. 1, 4b bronzer Meißel; Lehmplattform, Herd Nr. 5, 4c bronzer Röhrchen. Foto Gheorghe Chelmec.

Diese lag 0.42 m nördlich vom Herd Nr. 2 (C. Schuster, T. Popa, 2000), in einer Ascheschicht (11 cm dick), in einer Tiefe von 0.38 m. Die Maximallänge betrug 3.50 cm, die Maximalbreite 0.50 cm und Maximaldicke 0.40 cm (C. Schuster, 1992; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010).

Zwischen der Ostwand des Hauses Nr. 1 und der aus gestampften Lehm bestehenden Plattform wurde ein bronzer Kleindolch gesichtet (Abb. 4a). Dieser lag in 0.42 m Tiefe, in einer kleinen Anhäufung von Asche und Holzkohle. Sein Fundplatz befand sich etwa 0.30 m westlich vom Feuerherd Nr. 6, dar im Sudwesteck der Lehmplattform zu finden war (C. Schuster, T. Popa, 2000). Es muß aber unterstrichen werden, dass südlich, etwa 0.50 m, vom genannten Herd, die Abfallgrube Nr. 4 entdeckt wurde (C. Schuster, T. Popa, 2000). Diese kleine Waffe hatte die Form eines Rhombes und besaß ein einziges Annietungsloch (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Der eigentliche aktive Teil, d.h. die Schnittfläche des Dolches, hatte eine dreieckige Form. Die Maximallänge der Waffe betrug 8.10 cm, während die maximale Breite 2.20 cm war. Die dickste Stelle erreicht 0.20 cm. Der Dolch trägt klare Verwendungsspuren.

In demselben Zwischenraum zwischen der Ostwand des Hauses Nr. 1 und der Lehmplattform, ungefähr 0.70 m nördlich vom

Fundplatz des Dolches, in einer Tiefe von 0.35 m, neben zwei kleinen Flußsteinen, wurde auch ein Ohrring gefunden (C. Schuster, 1992; C. Schuster, 2007; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Dieser besteht aus einem 0.01 dicken Silberdraht, dessen Enden flachgeschlagen und dann durchlöchert wurden (Abb. 5).



Abb. 5 - Mogoșești, zwischen Haus Nr. 1 und Lehmplattform, silberner Ohrring. Foto Gheorghe Chelmec.

Im Haus Nr. 3 (C. Schuster, T. Popa, 2000; C. Schuster, 2005), 0.36 cm südwestlich vom Südrand der Vorratsgrube Nr. 3 (C. Schuster, T. Popa, 2000; C. Schuster, 2005), in einer

Tiefe von 0.33 cm, unter einen Lehmewurfbrocken, wurde eine Rollennadel ans Tageslicht gefördert (C. Schuster, T. Popa, 1997; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010). Ihre Länge reicht bis zu 9.30 cm, während das gerollte flachgeschlagene Oberende eine maximale Breite von 0.90 cm beträgt. Die Nadel ist 0.18 cm dick (Abb. 6).



Abb. 6. Mogoșești, Haus Nr. 3, bronzerne Rollennadel. Foto Gheorghe Chelmec.

Neben dem Herd Nr. 5 der Lehmplattform (C. Schuster, T. Popa, 2000; C. Schuster, 2005), aber 9 cm östlich außerhalb dieser, in einer kleinen Ascheanhäufung, in einer Tiefe von 0.35 m, wurden vier einfache Röhrchen entdeckt (C. Schuster, 1992; C. Schuster, 2007; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa). Das längste dieser hatte 4.50 cm und einen Durchmesser von 0.04 cm (Abb. 4c). Die weiteren waren 2.40 cm (mit einem Durchmesser von 0.06 cm), 3.30 cm (mit einem Durchmesser von 0.05 cm), 2.70 cm (mit einem Durchmesser von 0.06 cm) lang.

Im Schnitt nr. 8, in dessen Kulturschicht, 0.40 m tief, wurde ein fünftes, leicht beschädigtes, Röhrchen gefunden. Alle Röhrchen wurden aus je einem einmal oder einmal und ein halb gerollten flachgeschlagenen Blech ausgearbeitet.

Die Forschungen in einem der Häuser (Nr. 1) in Mironești-La Panait, ein Bau, 1.97 x 1.36 m groß, den wir als Steinbearbeitungswerkstatt betrachteten (C. Schuster, T. Popa, 1995a; C. Schuster, T. Popa, 2008; C. Schuster, 2005), wurde neben dem Feuerherd, d.h. 15 cm nördlich von ihm, in einer Tiefe von 0.29 m, ein Armreif gefunden (C. Schuster, 1992; C. Schuster, 2007; C. Schuster, T. Popa, 2008; C. Schuster, T. Popa, 2010). Dieses wurde aus einen im Schnitt halbmondförmigen Draht gearbeitet. Er hat einen Durchmesser von 6.20 cm und seine beide Ende wurden zugespitzt (Abb. 7).



Abb. 7. Mironești, Haus Nr. 1,  
bronzerner Armreif. Foto Gheorghe  
Chelmeac.

### Chemische Metallanalysen

Die chemische Zusammensetzung des Metalls zeugt davon, dass das Messer von Mogoșești, aus dem Haus Nr. 1, 89% Kupfer, 10% Zinn, 0.5 % Zink, 0.2 % Arsen und leichte Spuren von Blei enthält (C. Schuster, T. Popa, 2010). Die Meißel aus demselben Bau besteht aus 94% Kupfer, 3% Zinn, 0.5% Zink und wenige Spuren von Nickel und Arsen (C. Schuster, T. Popa, 2010). Die längere Nähnadel auch aus dem Haus Nr. 1 wurde aus 99.5% Kupfer, 0.1% Arsen und 0.1% Nickel und die zweite Nadel 98.2% aus Kupfer, 0.4% Zinn, 0.4% Blei und 0.2% Nickel angefertigt. Das heißt, dass die erste Nadel eigentlich aus Kupfer erarbeitet wurde, während die zweite schwer in eine der Kategorien Kupfer oder Bronze einzustufen ist (C. Schuster, T. Popa, 2010). Diese Feststellungen korrigieren unsere ersten Einschätzungen, in denen wir beide der Nadeln als Bronzewerkzeuge betrachteten (C. Schuster, 1992, S. 83; C. Schuster, 2005, S. 47; C. Schuster, T. Popa, 2000).

Die dritte Nähnadel aus Mogoșești, bestehend aus 43% Kupfer und 5% Zinn, erlaubt das Aufstellen von zwei Hypothesen. Die erste, erwähnt die Möglichkeit, dass die Nadel anfangs ein Kupferobjekt war, welches dann durch Erosion das Kupfer stark abbaute. Eine zweite Erklärung spricht von einer intentionellen Zinn haltigen Legierung, das mit dem Zweck, der Nadel eine hellgelbe Farbe zu vermitteln, verwendet wurde (C. Schuster, T. Popa, 2010).

Der Fingerring aus dem Haus Nr. 1 besteht aus 88% Kupfer, 11.5 Zinn, 0.15% Blei, 0.05% Arsen, 0.2% Nickel und einige Spuren von Zink (C. Schuster, T. Popa, 2010).

Nur das größte der Röhrchen von Mogoșești wurde der chemischen Metallanalyse unterzogen (C. Schuster, T. Popa, 2010). Es wurde festgelegt, dass es aus 94% Kupfer, 4.7% Zinn, 0.1% Arsen und Spuren von Blei und Zinn besteht. Als Abstammungsort des Kupfers wird auf Serbien hingedeutet.

Für den Osten Bulgariens spricht das Kupfer im Prozentsatz von 88% des Armreifes von Mironești (C. Schuster, T. Popa, 2010). Zum Kupfer gesellten sich noch 11.8% Zinn, 0.3% Arsen, 0.1% Blei, 0.1% Nickel und Spuren von Sb.

Der Silberohrring von Mogoșești erwies folgende Zusammensetzung: 93.83% Silber,

5.93% Kupfer und 0.10 Eisen (C. Schuster, T. Popa, 2010).

### Besprechung

Die in den zwei Tei-Siedlungen am Argeș-Fluss gefundenen Metallobjekte, ermöglichen einige Schlußfolgerungen. Die meisten Metallgegenstände unserer mittel- und spätbronzezeitlichen kulturellen Äußerung wurden aus Bronze angefertigt. Es wurden Waffen (Kampfäxte, Dolche, Schwerter), Werkzeuge (Messer, Äxte, Beile, Meißeln, Nähnadeln, Sicheln) und Schmuckstücke (Ohr-, Lockenringe, Nadeln, Anhänger u.s.w.) entdeckt (C. Schuster, 2007).

Für fast alle Metallartefakte aus Mogoșești und Mironești gibt es Analogien. In Frătești-Duduța und Popești-Nucet, beide Ortschaften im Bezirk Giurgiu, aber auch in București-Tei, Vâlcele und in der Höhle von Devetaki, in Bulgarien, wurden Messer gefunden (G. Trohani, A. Oancea, 1976; V. Leahu, 1988; V. Leahu, 2003; C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010; C. Schuster, 2007).

Auch die Dolche sind gut vertreten. Zwei der Exemplare wurden in Izvoarele und Greaca, beide Dörfer des Bezirks Giurgiu, und das dritte in București-Băneasa (V. Leahu, 2003; C. Schuster, 2007; C. Schuster, T. Popa, 2010) ans Tageslicht gefördert. Alle diese sind aus Bronze angefertigt worden. Es wurden aber auch Golddolche oder Hallebarden (A. Vulpe, 1997), zwölf Stück, Teile des Schatzes von Perșinari, gefunden (über den Hort siehe A. Vulpe, 1997).

Die Meißeln sind keine Seltenheit im Tei-Gebiet. Sie sind mehreren Stufen der Kultur eigen und wurden sowohl in Muntenien, als auch südlich der Donau angetroffen. Im Bezirk Giurgiu wurden Werkzeuge dieser Gattung in Frătești und Daia entdeckt (V. Leahu, 1988; V. Leahu, 2003; C. Schuster, 2007; C. Schuster, T. Popa, 2010). Weitere Meißeln wurden in Otopeni, București-București Noi, Strada Ziduri între Vii, Băneasa und Giulești-Sârbi gefunden (V. Leahu, 2003; C. Schuster, 2007). In Bulgarien wurden sieben Stück in Emen geortet (V. Leahu, 2003).

Für den Armreif von Mironești gibt es im Bezirk Giurgiu in Ghimpăți ein Gegenstück (C. Schuster, T. Popa, 2010). Ein weiteres Schmuckobjekt dieser Kategorie wurde auch in

Cernica gefunden (V. Leahu, 1988; V. Leahu, 2003; C. Schuster, 2005). Alle drei Armbänder gehören der III. Tei-Stufe an.

Rollennadeln waren nicht nur in Mogoșești Fundstücke, sondern auch in Otopeni, București-București Noi und Strada Ziduri între Vii (V. Leahu, 1988, 2003; C. Schuster, 2005). Wenn für die Nadel in Mogoșești die Tei II-Mogoșești-Unterstufe zu nennen ist, zu müssen für jene aus Otopeni die III. Stufe und für die aus București-București Noi und Strada Ziduri între Vii ebenfalls die III., wenn nicht die IV. angedeutet werden.

Wie wir schon erwähnten, stellt der Fingerring von Mogoșești sehr wahrscheinlich das gewundene Unterteil einer jetzt abgebrochenen ehemaligen Hülsenkopfnadel dar. Eine Nadel dieser Gattung, aber unbeschädigt erhalten, wurde im Bezirk Giurgiu in Novaci entdeckt (V. Leahu, 1988, 2003; C. Schuster, 2005; C. Schuster, T. Popa). Für diese letzterwähnte Nadel wurde von den Stufen II oder III geredet (V. Leahu, 2003).

Einfache Röhrchen wurden auch im Bukarester Raum, in Cățelu Nou, Tei, București Noi und Strada Ziduri între Vii, identifiziert (V. Leahu, 1988, 2003; C. Schuster, 2007).

Für alle Waffen, Werkzeuge und Schmuckstücke der Tei-Kultur die aus Bronze gearbeitet wurden, gibt es Analogien in anderen zeitgleichen Kulturen – Wietenberg, Vatina, Verbicioara, Mureș, Otomani (C. Schuster, 2007).

Objekte aus Kupfer sind eher eine Seltenheit für die Tei-Kultur. Außer der einen Nähnadel von Mogoșești, ist noch die Axt von Bungetu zu erwähnen (V. Leahu, 2003).

Der Silberohrring von Mogoșești scheint bis zurzeit ein Unikum für die Tei-Kultur zu sein. Anderseits wurden im Verbreitungsraum dieser kulturellen Erscheinung (C. Schuster, 1994, 1997, 2005) mehrere Silberartefakte entdeckt. Gut bekannt sind die sechs (?) Kampfäxte (A. Vulpe, 1997; V. Leahu, 2003; C. Schuster, 2010), Teile des Hortes, von Perșinari. Aus demselben Edelmetall soll auch ein möglicher Anänger, welcher in der Höhle von Emen in Bulgarien gefunden wurde, sein (V. Leahu, 2003).

Alle Metallgegenstände aus Mogoșești und Mironești wurden, wie schon des öfters angesprochen, in Siedlungen gefunden. Einige

davon in der Kulturschicht, andere in Häuser, die eine schlichte Wohnfunktionen hatten. Genauso wahr ist es aber, dass der Armreif von Mironești-La Panait in einem Bau spezieller Art entdeckt wurde, u.z. ein Steinbearbeitungswerkstatt. Dafür, dass das Haus diese Sonderfunktion hatte, spricht die große Anzahl der Silexwerkzeuge, -abschläge und -kerne die hier gefunden wurde (C. Schuster, T. Popa, 2008).

Eine Sonderstellung nahm, wie oben erwähnt, auch das Haus Nr. 1 von Mogoșești ein (C. Schuster, T. Popa; C. Schuster, 2005). Es hatte eine Größe von 14.50/14.30 x 10.24/10.46 m, die eigentlich für die Tei-Kultur eine Ausnahme ist. In ihr wurden drei Feuerherde (Nr. 1-3) entdeckt. Diese waren in Form eines Dreiecks, je einer auf jeder der Langwände des Baus und der dritte etwa 4 m von der nördlichen Seite, aber ungefähr in der Mitte des Nordteils des Hauses. Die Dimensionen, die Bautechnik, die gefundenen Pfostenlöcher, Tatsache die nicht üblich im Tei-Milieu ist, die Feuerherde, sondern auch der weitere Inventar weist auf eine Sonderstellung des Hauses hin. Es wurden 101 ganze und fragmentarische Klein- und Miniaturgefäß (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010) – Tassen, Becher, Schalen – und mehrere Ton-, Knochen-, Horn- und, wie schon erläutert, Metallobjekt entdeckt. Unter diesen nennen wir eine fragmentarische Knochenflöte (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2003; C. Schuster, 2007; C. Schuster, T. Popa, 2010), zwei tönerne Modellwagenräder mit Nabens auf beiden Seiten (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010) und ein fragmentarisches Wagenmodell mit einem bootsförmigen Kasten (C. Schuster, T. Popa, 2000; C. Schuster, 2007), die alle neben dem Herd Nr. 1 zum Vorschein gekommen sind, entdeckt. Im Westteil des Hauses, d.h. südlichwestlich von den Feuerherden Nr. 1 und 2, wurden eine tönerne Spule (C. Schuster, T. Popa, 2000; C. Schuster, T. Popa, 2010) und der rechte, in der Stichkannaltechnik reichverzierte Fuss, eines wahrscheinlich fast 40-50 cm großen Idols, gefunden. Hier wurde weiter ein hohler Tonstiefel, desgleichen für den rechten Fuss, auch in der Stichkannaltechnik verziert, ausgegraben (C. Schuster, T. Popa, 2000; C. Schuster, 2007).

Der Großteil der Metallobjekte Tei-Kultur wurde, genauso wie in Mogoșești und Mironești, im Bereich von Siedlungen identifiziert. Eine Ausnahme soll die bronzerne Pfeilspitze, die Teil des Grabinventars aus Puieni, Bezirk Giurgiu, gewesen war, darstellen. Während einige Wissenschaftler mit Sicherheit oder mit einem Zögern den Fund der Tei-Kultur zuweisen (V. Leahu, 1987; V. Leahu, 2003; C. Schuster, 2003a; C. Schuster, 2005; C. Schuster, A. Comşa, C. Semuc, 2005), bringen andere Zweifel auf, und reden von einer Zimnicea-Plovdiv-Entdeckung (D. Șerbănescu, 2001).

Weitere Ausnahmen bilden die Horte/Schätze, die auch auf dem Gebiet des Bezirks Giurgiu, in Mihăilești-Tufa, Oinacu und Izvoarele, entdeckt worden sind. Der erstgenannte Hort bestand aus zwei Bronzeäxten und zwei Goldlockenringe (A. Vulpe, 1959). Er gehört wahrscheinlich der Tei I-Stufe an. Es muß aber gesagt werden, dass in Tufa nur eine Tei III-Siedlung erforscht wurden konnte (C. Schuster, T. Popa, 1995a; C. Schuster, C. Fântâneanu, 2005).

Eine Anzahl von 15 Beile, wenn nicht sogar mehr, wurde in Oinacu gefunden (C. Schuster, T. Popa, 2010). Wahrscheinlich muß dieser Hort der letzten Stufe der Kultur, Tei V, zugeordnet werden. Derselben Stufe gehören auch die drei Beile von Izvoarele an (C. Schuster, T. Popa, 2010). Weitere Horte wurden im süddonauischen Gebiet in Bulgarien, in Dicevo, Gorsko Kosovo, Suvorovo, Vărbita, gefunden (V. Leahu, 2003).

Als Herkunftregionen des Kupfers wurde von dem Team, welches die chemischen Metallanalysen durchführt hat, Bulgarien und Serbien genannt. Für Nord- und Nordostbulgarien spricht das Kupfer der Rollennadel und des Fingerring von Mogoșești und jenes des Armreifes von Mironești (C. Schuster, T. Popa, 2010). Von dieser Regel scheinen die einfachen Röhrchen von Mogoșești abzuweichen. Für diese wird auf das Kupfer aus Serbien, es ist wahr, sehr zaghaft hingewiesen (C. Schuster, T. Popa, 2010). Das Kupfer des Dolches aus dem Haus Nr. 1 soll wahrscheinlich aus Westbulgarien oder Ostserbien stammen (C. Schuster, T. Popa, 2010).

Hinsichtlich des Silbers, aus dem der Ohrring in Mogoșești gearbeitet wurde, gibt es

keine klare Angaben bezüglich dessen Herkunft. Interessant ist aber, dass der Prozentsatz der Metallzusammensetzung des Silberohrrings mit den Prozentsätzen der Silberschmuckstücke (Locken- und Ohrringe) aus dem frühbronzezeitlichen Gräberfeld bei Zimnicea sehr ähnlich sind (C. Schuster, T. Popa, 2010). Das könnte bedeuten, dass das Silber der Schmuckstücke von Zimnicea und Mogoșești aus derselben Region stammen.

Wenn auch nicht außergewöhnlich reich, so zeugen die Metallobjekte der Tei-Kultur, dass die Gemeinschaften dieser mittel- und spätbronzezeitlichen Erscheinung Munteniens, Südostsiebenbürgens (V. Leahu, 1997; C. Schuster, 1997; C. Schuster, A. Comşa, 1998) und Nordbulgariens (T. Hristova, 2002; I. Zmeikova, 2002), sich u.a. auch mit der Metallbearbeitung beschäftigten. Das es so war, ist auch durch die tönernen und steinernen Gußformen von Cernica und Frătești (V. Leahu, 2003; C. Schuster, 2007; C. Schuster, T. Popa, 2010) belegt. Diese Gußformen haben Analogien auch südlich der Donau, in Emen, im gleichen Tei-Milieu, aber auch in der Wietenberg-Kultur, in Siebenbürgen, bei Simionești (V. Leahu, 2003).

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## The relations between Hungary and the principality on the right side of Olt River during the second half of the 13<sup>th</sup> century. Brief observations

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**Abstract:** The Romanian extra-Carpathian area during the second half of the 13<sup>th</sup> century is insufficiently known on the level of its political evolution, of its relations with the main power of the area, Hungary. The major event mentioned in documents is the revolt from Oltenia of voivode Litovoi, which triggered a Hungarian military campaign led by magister Georgius. There are still unelucidated aspects concerning the chronology and the consequences of this event on the process of territorial unification.

**Key words:** voivode, revolt, vassal, military campaign, diploma

The middle of the 13<sup>th</sup> century and the first decennia after that present an area south of the Carpathians under two spheres of influence: Hungarian and Mongolian. The Olt River continued to be the demarcation line between Cumania, under Tartar leadership, and the region known as “Banatul de Severin”, “Tara Severinului” (Severin Country), under the political control of the Transylvanian Dukedom. (Sergiu Iosipescu, 1980)

The possible Transylvanian-Tartar agreement, concluded in the year 1261, sharpened this situation, prolonging the control exerted by the Transylvanian Dukedom over certain South-Carpathian territories at least until 1264, the year of the decisive military confrontation that took place at Breaza, between the armies of Bela IV and those of the freshly appointed Duke of Transylvania, Stephan V.

Within these areas situated between the Southern Carpathians and the Danube, “**Terra Lytua**” or the land ruled by Litovoi voivode represents, from our viewpoint, a particular case.

It seems to be safe from the tumultuous events of the second half of the 13<sup>th</sup> century, consequently being able to continue its political evolution undisturbed.

According to the Diploma of the Johannite Knights, issued towards the end of the 5<sup>th</sup> decennium, the formation of Litovoi appears included in the Hungarian feudal system, which is proved by the fact that the voivode had to provide military support to Hungary. Yet, the dominion relationship should be analyzed, nevertheless, only on the level of the power exerted by King Bela IV at the moment when the diploma was issued, around the year 1247.

The fact that Transylvania was taken over by the claimer of the Arpadian crown, Stephan V, changed, from our viewpoint, this status, going even to its elimination. In this situation, a hypothesis that should be considered is the idea that the Transylvanian duke extended his influence south of the Carpathians only over the Country of Severin, which he actually defended from the Bulgarian aggression, and not

over the political formation led by Litovoi.

At the same time, it is not impossible that the principality of Litovoi may have continued to function, maybe rather on a declarative level, in a regime of dependence in relation to Hungary, the tendency of the Arpadian kingdom to pretend to have a series of rights over different formations or zones where its authority had either vanished a long time ago or had never been an effective one being well known (S. Brezeanu, 1999). The closest comparison can be found in the same well-known Johannite Diploma awarded by Bela IV, in which another South-Carpathian principality, that of Seneslau and even the entire Cumania constituted, from the viewpoint of the status of vassalage, an aspiration and not a reality for the Hungarian kingdom.

The dependence may have been limited, in the case of the principality of Litovoi, to the payment of certain financial obligations, especially as one of the reasons, mentioned in documents as well, that led to the military intervention of magister Georgius, during the last decennia of the 13<sup>th</sup> century, was represented by the non-payment of the financial debts to the kingdom.

So, freed from the Hungarian tutorship, the principality of Litovoi, which already included other political structures of a lesser extent, had the possibility of experiencing an ascending trend, accumulating enough power to extend its authority over new territories situated on the right side of Olt River as well.

The enthronement in Hungary of the minor king Ladislau IV in the year 1272 did not bring, from the very first moment, significant changes, as the Hungarian kingdom continued to impose its influence over certain territories south of the Carpathians.

Even since 1274, in the position of ban of Severin, is mentioned the nobleman Ugrinus, who, a year later, will also obtain the dignity of voivode of Transylvania, being plausible among others the hypothesis that the dominion over Făgăraș may have been obtained even before the great Mongolian invasion by the father of Ugrinus, Posa, of the Csak family.\* From this position, the ban of Severin was able to consolidate a certain authority over the extra-Carpathian political formations, especially as, by means of his family, his dominion also covered a

part of the Country of Făgăraș (Țara Făgărașului) as well (Antal Lucaks, 1999).

The ethnic tensions were going to push Hungary towards a new period of crisis, just as deep as the one recorded after the moment 1241-1242. The stake was given by the removal of the Cuman nobility from public life, in a context in which the Hungarian dynast himself had Cumanian origins on the side of his maternal relatives. The massive access of the Cumans among the leadership of the political life had occurred even since the short reign of king Stephan V (1270-1272), married to queen Elisabeth, a noblewoman of Cumanian origin. Her son, Ladislau IV, while he was still minor, continued this process of consolidation of privileges and even adopted the Cumanian lifestyle.

The first signs of the period of political instability are felt, first of all, in Transylvania, where the Saxons of Transylvania, apparently without a clear justification, devastate the town of Alba-Iulia and set the Church of the Holy Archangel Michael on fire. The event is recorded in two documents, of 1277 and 1278, respectively, from which we find out about the destructions caused by the Saxons of Transylvania, the reason of the revolt remaining unclear.\*\* The other moment will occur south of the Carpathians, where the voivode Litovoi annexes certain possessions dependent on the Hungarian State.

The moment when the two actions were triggered (1277 ?) cannot be a random moment; it has to be judged in the context of the war between Hungary and Bohemia\*\* and, why not, even in the context of the revolt of the Bulgarians from the Banat of Macva, against the Hungarian nobility. The document confirms the help provided by Ladislau IV, to the Roman-German king Rudolf I, against Bohemia, and also the fact that the Hungarian army was made up of no less than 16000 Cumans, a number that is eloquent, in a way, for the balance between the different forces of the kingdom as well.

The considerations concerning voivode Litovoi are, even at present, far from reaching a satisfying level for the historical research. The explanation resides in the fact that the information on this character are extremely scarce, being grouped in two diplomas, emitted

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by the Hungarian Chancery several years after the events occurred. For this reason, in historiography there continues to persist a long series of questions, such as: is voivode Litovoi one and the same person as the Litovoi mentioned in the Diploma of the Johannite Knights three decennia before?; when and under what circumstances did the confrontation between the extra-Carpathian voivode and magister Georgius (the representative of the Hungarian power) exactly take place?; can his action be considered as the first landmark of the territorial unification process in the area south of the Carpathians?; did the Hungarian restoration actually occur “de facto” over the territories annexed by Litovoi?

Concerning the first issue, the hypotheses formulated have not been able to reach a common denominator. The opinions focused on the age of Litovoi can incline the balance in favor of the supporters of the idea we are dealing with another voivode, bearing the same name, maybe even a direct descendent of the one mentioned as well by the Diploma of the Johannite Knights, by the middle of the 13<sup>th</sup> century. The lack of precise information, confirmed by documents, obliges one to adopt a reserved attitude, which should take into account both of these variants.

Another very important problem that has not yet been fully elucidated is that of the date when Litovoi's revolt and implicitly the punishing action led by magister Georgius occurred.

The Diploma emitted in 1285 by king Ladislau IV confirms only that the action of the voivode south of the Carpathians took place when he was still minor, so during an interval comprised between 1272 and 1278\*\*, the main reason of the conflict being the occupation by Litovoi and his brother of certain territories that belonged to the kingdom.

In general, the Romanian historiography accepted the interval 1277-1279 for the deployment of the Hungarian expedition on the other side of the Carpathians, although the period itself still continues to deal with a series of chronological uncertainties. In this case we have in view two aspects, which cannot be omitted from the framework of our debate.

The first is related to the real age of the

dynast Ladislau IV. Born, according to all the possibilities, in the year 1262, he was no longer a minor at the moment of the conflict with Bohemia (S. Iosipescu, 1980). So, if we respect *ad litteram* the information provided by the document emitted in 1285, then, the action of voivode Litovoi and, implicitly, that of magister Georgius can be looked for also before the year 1278.

The second relevant aspect is represented by the nomination in 1276 of a Hungarian administrative leader for the comitat (country) of Hațeg\*\*, territory considered as belonging, for several decennia, to the political formation led by Litovoi. A series of opinions, expressed in the Romanian historiography (Ștefan Pascu, 1971), situate the main confrontation between the two parties in the country of Hațeg, based on the fact that in the respective area there is a water, namely Bărbat River, and a village by the same name (the most probable it has been attributed in honor of the Romanian voivode taken prisoner by the Hungarian army, in the very area of this territory). The last decennia have brought into actuality this issue, a new hypothesis being formulated, which indicates as starting point for the expedition of magister Georgius the area of Severin (T. Sălăgean, 2003).

So, it is necessary to highlight that the chronological elements related to the deployment of the Hungarian expedition south of the Carpathians, are not, not even to this day, fully clarified. For this reason, we consider that the actual military action could have taken place even after a series of diplomatic negotiations, covering a shorter or longer period, which finally failed, especially as this could explain, to a certain extent, the ambiguity present in documents concerning the exact date when the event occurred.

By establishing such a context, even the mention of Petru as administrative leader of the comitat of Hațeg, at 1276, can be regarded, not necessarily as the direct result of the victory of magister Georgius against Litovoi and Bărbat, but as a response reaction to the aggression triggered by the two against certain areas dependent on the Arpadian crown. It is not impossible that Hațeg itself may have been the territory disputed by the two parties, especially that the term used by the document to designate the area over which Litovoi had extended his

influence “**ultra alpes**”, is quite unclear from a geographic viewpoint.

The action led by magister Georgius is a successful one, at least from the perspective of the military victory that caused as well the death of Litovoi, stopping, in this way, one of the revolt acts begun in the territories from the margin of the kingdom.

In exchange, the political and territorial consequences of the victory obtained on the battlefield seem to be much less significant. Even though both of the leaders of the action of non-submission are annihilated, the elite of the local society south of the Carpathians manage to ransom the one remained alive: Bărbat, the brother of the former voivode.

The Hungarian documents do not provide any mentions concerning the sum paid to bring Bărbat back to the extra-Carpathian territories. Even though this seems to have occurred after ample diplomatic negotiations, the financial contribution rather represents a significant war reimbursement, which included the freeing of Litovoi's successor and his reinstallation as leader of the formation south of the Carpathians. The Hungarian authorities do not manifest any particular interest in the territories occupied by Litovoi, which are actually not mentioned precisely. The Hungarian royalty does not seem concerned by recovering these possessions, but rather by obtaining some revenues from them from the vassal Bărbat (T. Sălăgean, 2003).

Important is the fact that the two documents do not refer to any modifications introduced by the Hungarian crown in the formation situated on the right side of Olt, similar to the ones contained in the Diploma of the Johannite Knights. The territory annexed by the voivode Litovoi may have been part of those territories entrusted by the royalty, according to the medieval custom, as gift to some noblemen, other than their own subjects. Consequently, if Litovoi had presented the king with the revenues he was entitled to, implicitly recognizing his sovereignty over the respective area, there would have been no more conflict (Aurelian Sacerdoteanu, 1957).

Both in the document of 1285, as well as in the one of 1288, is presented a relationship of vassalage, rather formal, of the principality of Bărbat, translated in the payment of a tribute,

without mentioning any other military or political obligations.\*\*

The fact that there is no precise information on the territories of the kingdom taken over by Litovoi, which had caused the start of the military conflict, can be interpreted as a victory for the extra-Carpathian formation, as an important step in the process of politico-territorial unification carried out south of the Carpathians.

Going along the same line of reasoning, we can advance the idea that the victory obtained by magister Georgius was not followed by a complete restoration of the Hungarian rights over the area; such an evolution might rely on at least two arguments.

First, a few decennia ago, in the Romanian historiography, there appeared a new theory related to the events in which the south-Carpathian voivode was involved (P. P. Panaiteescu, 1969). It tried to prove that Litovoi relied, when triggering his action, on a Tartar military support as well, provided by prince Nogai himself. In our opinion, Litovoi must at least have hoped for a Tartar support, especially as the extension of the power of Nogai becomes a reality from the moment when the bans of Severin disappear from the documents and the Mongolian prince obtains the protectorate of Vidin. The obvious Tartar dominion instituted in the area of the Lower Danube during the second part of the 13<sup>th</sup> century agrees with this hypothesis, especially as, for the above-mentioned period, at least on the left side of Olt, the Mongolian influence must have played an important role.

The comparison with the situation of the first decennia of the 14<sup>th</sup> century, when the alliance between Basarab I and the tsar Mihail Şişman may have been completed by a Tartar support, may be perfectly plausible in the present context as well, especially as a less important political formation, such as the one of Litovoi, would have found in the alliance with the Mongolian power the only way of freeing itself from the tutorship of the Hungarian crown. Back then, just like now, the reopening of a conflict with the Golden Horde represented a sufficient reason for Hungary to adopt a compromise solution that would not involve, in the case of the political formation led by Bărbat, anything else

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but the simple recognition of the Hungarian suzerainty.

The second motivation could have been represented by the ample process of decumanization of Hungary, in which a leading role was to be played by the Holy See itself.

The first step was made in the year 1278, when Pope Nicholas III appointed bishop Philip as apostolic envoy of Hungary, Poland, Lodomeria, Galicia, Rama, Croatia, Dalmatia and Cumania.\*\*

Obviously, the main mission this high official had been entrusted with regarded Hungary, but, besides solving the problem of the Cumans of the kingdom, the apostolic envoy had the task of consolidating Catholicism as well, especially in the margin territories, directly menaced by the Mongolian force. A good example, concerning this duty, was preserved in documents. The letter of Pope Nicholas III to Bishop Philip, of October 7, 1279, highlights the very interest of the papal institution for the former bishopric of Milcovia and for the Franciscan brothers living in the region, as well as the desire of recreating the important local religious forum (G. Moisescu, 1942). It is not impossible that this religious propaganda itself may have postponed the taking of firm measures south of the Carpathians.

The obvious involvement of the Holy See in the internal Hungarian problems is also recorded by several documents, of which we will select three.

The first includes the demand of the sovereign Ladislau IV (probably also as a result of some pressures coming along a religious line) to gather the Cumanian population and to situate in on the middle course of Tisza or around Mureş and Criş on condition that they receive the Catholic religion\*\*. The second act (also dating from 1279) contained a reproach made by Pope Nicholas III against the Hungarian king, who had not respected his oath about the Cumans. In reality, the context of the arrival of the papal letter was much more serious, the papal nuncio Philip of Fermo had been imprisoned, given in custody to the Cumans, and even his assassination was plotted. The Hungarian nobility will also take action, by sequestering the king who in this way sees himself forced to accept the reconciliation with the papal nuncio (Ş. Turcuş,

2001).

Finally, the last document marked the victory of the papal institution in front of the royal crown, as, within it, Ladislau the Cumanian promised to the apostolic envoy of Hungary that he would execute all the orders of the Holy See against the heretics. The document comes on the background of an older promise made by the mother queen herself, originally a noble Cumanian, to the apostolic envoy, that she would drive away the heretics from her lands. For this reason, it is not impossible that the pressures for the solution of the Cumanian problem may have come, for the Hungarian dynast, starting from the year 1280, from within his own family.\*\*

Such a development naturally imposed the triggering of the military hostilities. The duplicity of the Hungarian king, during the last few years, in front of a Cumanian nobility too little inclined to cede the privileges they had obtained, was preparing such an outcome. About the triggering of the Cumanian revolt within Hungary (the Cumans being led, according to all possibilities, by duke Oldamyr), as well as on the victory obtained by the royal armies, in the battle from lake Hod (1282) we find out from several donation documents awarded by king Ladislau IV and queen Elisabeth, to the diverse Hungarian noblemen who took part in this war during the period 1283-1285.\*\*

Even after the victory obtained, the serious problems Hungary was faced with did not end. The military success was to bring only a short period of relative peace, interrupted, a few years later, by Ladislau IV himself, who rejected the Catholic religion, adopting the Cumanian lifestyle. A suggestive episode for the political oscillations of the Hungarian king can be found as well in the relationship between the latter and the Transylvanian voivode Roland Borşa. Although he was among the noblemen who contributed the most to the victory from lake Hod, Roland Borşa will be demitted from the leadership of Transylvania, shortly after these events. Reappointed in his former position beginning with 1284, he will enter a new conflict with his sovereign, who replaced him a year later (T. Sălăgean, 2007). Coming back to power in 1288, possibly without the support of the royalty, Roland Borşa will be one of the noblemen who plotted the assassination of Ladislau IV at

Cheresig, in 1290.\*

In the extremely tense context depicted above, we are convinced that the transformations appeared in the extra-Carpathian area did not represent a priority for the kingdom, even under the circumstances of the defeat of the revolt triggered by Litovoi. The mention of the very victory of magister Georgius from the other side of the Carpathians appears in documents only a few years after the actual deployment of the events, which makes us believe that the true impasse was represented by the tension generated by the Cumanian nobility, the entire Hungarian politics being focused on the solution of these conflicts.

The serious internal problems present in Hungary could only have come in support of the political formation led by Bărbat, who consequently benefited of an undisturbed evolution, in the very direction of the accomplishment of the territorial union in the area on the right side of Olt.

So, the Oltenian core, the dynasty Litovoi I-Litovoi II-Bărbat, along with the much vaguer Muntenian core, Seneslau-Tochomerius-Basarab I, were going to give birth to the great principality of Wallachia (Ioan Aurel Pop, 2011). The identification of the evolution of the formation on the right side of Olt River, both internally and in relation to the Hungarian power, remains the key of the deciphering of an essential stage in the process of appearance of the first Romanian Medieval State. A period characterized by documentary scarcity, for the historical writing, means a mixture between real and imaginary, between documentary logic and the use of deductive methods. So, any contribution becomes useful for the reconstruction of such a historical “puzzle”. The south-Carpathian territories, during the second half of the 13<sup>th</sup> century, perfectly match these coordinates.

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## Arts et Pensées au Paléolithique supérieur européen

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**Abstract:** The European Upper Paleolithic possesses this close relationship between esthetic feeling and religious thinking. Under its different appearances, art makes its way onto all types of supports, from tool to cathedral-cave, putting its mark on all categories of materials. The almost exclusive calling towards an art representing animals indicates the existence of myths, reproduced through the image and combined in space. Religious finesse joins the elaboration of the abstract thinking in which the forces of nature are mastered by means of mythical cycles.

**Key words:** Upper Paleolithic, Religious thinking, Prehistoric art, Animals in art, Myth

**Résumé :** Le Paléolithique Supérieur européen possède cette relation étroite entre le sentiment esthétique et la pensée religieuse. Dans ses différents modes d'expression, l'art glisse sur tout support, de l'outil à la grotte-cathédrale, il imprègne toutes les catégories de matérielles. La vocation presque exclusive vers un art animalier indique l'existence des mythes, reproduits par l'image et agencés dans l'espace. La finesse religieuse rejoint l'élaboration de la pensée abstraite où les forces de la nature sont maîtrisées par les cycles mythiques.

**Mots-clé:** Paléolithique supérieur, Pensée religieuse, Art préhistorique, Art animalier, Mythe.

### Arts et religions

L'émotion, née d'une harmonie plastique, forme à la fois le témoin et le moteur d'une pensée poussée vers ses extrémités existentielles : que pourrait-il y avoir au-delà de cette sorte de vérité ultime qu'est la beauté, inexplicable et pourtant évidente ? Toute velléité d'emprise par la raison sur l'émotion se heurte à cette absurdité: aucune loi n'y est décelable, en dépit du ressac incessant produit par une conscience avide de signification. Dans ce cercle sans issue, le sens se trouve aboli, il cède la place à l'irrationnel où se rejoignent l'appel désespéré à une justification de sa propre conscience et l'asservissement total à laquelle elle est elle-même réduite par l'émotion qui l'agit. Là où la

pensée lâche les brides du comportement alors, s'ouvre le gouffre de l'absurde que l'art vient alors voiler. Dans cette illusion, l'esprit se précipite sous les forces conjuguées de l'appel au merveilleux et à la cohérence. L'art est ainsi le support à un aveuglement de l'esprit: il lui donne un sens supplémentaire afin qu'il s'étourdisse dans l'émotion et dans le mythe. Sous cette forme, l'art paléolithique relève autant du mystère primordial dont il est l'expression que des attitudes patentées, déjà mises à la disposition de l'humanité, pour le surmonter (fig. 1).

### L'Art total

L'observateur actuel pourrait être tenté d'écarteler cette création spirituelle en catégories

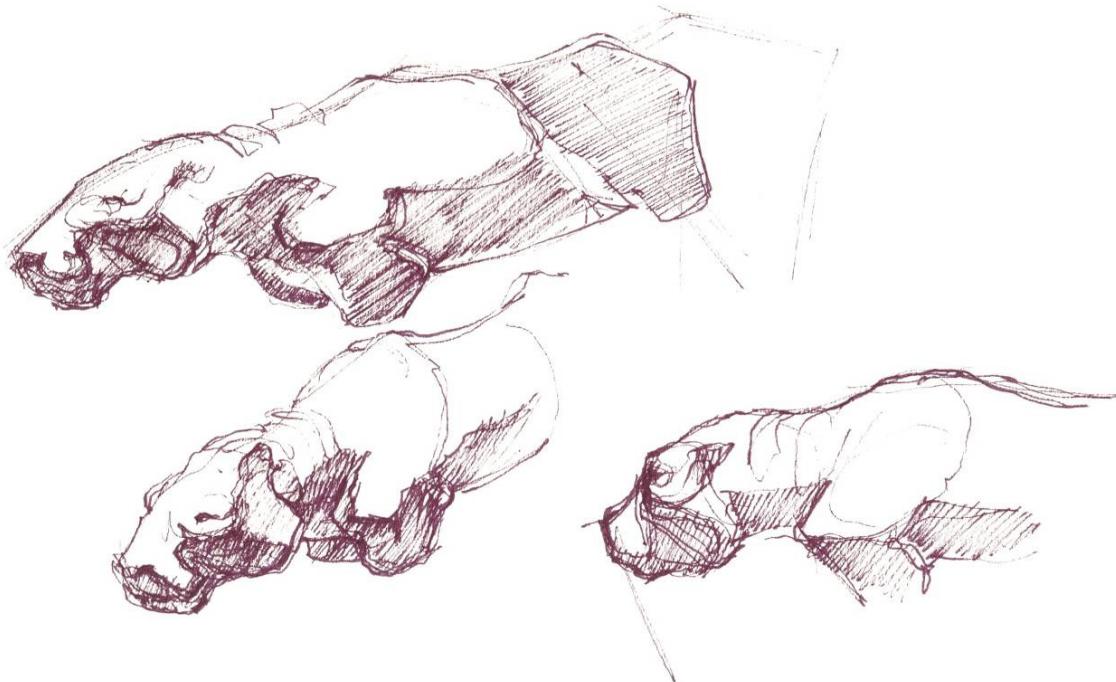


Fig. 1 - Une relation trouble s'installe entre la réalité vécue et l'image qui l'évoque. Dans cet espace mystérieux se glissent à la fois l'émotion esthétique, toujours active actuellement, et un reflet de la pensée religieuse qui l'avait fait naître. Dans la perte de sens à laquelle l'esprit aboutit, l'harmonie plastique se substitue à l'inconnaissable.

matérielles, comme quelques siècles d'histoire moderne l'y ont habitué, comme on se prête à distinguer les codes de grammaire plastique, par exemple utilisés dans la peinture, l'architecture ou la sculpture. L'ampleur totale prise par une pensée globalisante nous a désormais échappé. Or, tous les peuples traditionnels témoignent d'une complète cohérence spirituelle qui réunit, dans un seul jeu de significations ce qui pourrait relever autant des règles de partage alimentaire que des cycles saisonniers ou des modes de rééquilibrage des contraintes magiques par des expressions esthétiques, établies de la cuisine à la danse, de la parure à l'œuvre monumentale. Il n'existe pas de gestes « gratuits » dans de telles sociétés: tous se trouvent profondément imprégnés de la même valeur spirituelle, accordée du quotidien au cérémoniel, de l'individu à son ethnie. Ainsi nous paraît-il surprenant de retrouver des codes d'expression

parfois identiques quelque soit le support matériel et quelque soit la région considérée où a régné un système de valeurs traditionnelles. Les codes plastiques se retrouvent aussi étroitement respectés dans la peinture de Lascaux que dans la gravure du Gabillou, les sculptures gravettiennes traversent toute l'Europe, surmontant les contraintes mécaniques de tous les matériaux pour leur imposer leurs propres lois, directement transcrites, du mythe à la forme. Il en va de même dans ce qu'on pourrait désigner par « l'esthétique technique » qui entraîne des analogies structurelles entre tous les procédés mécaniques adoptés par une ethnie traditionnelle: la conformité présentée par certains modes d'action sur la nature vis-à-vis d'une ensemble de valeurs implicites, est à la source d'une satisfaction, visuelle puis gestuelle, que chacun ressent lorsqu'il en « reconnaît » l'adéquation (fig. 2).

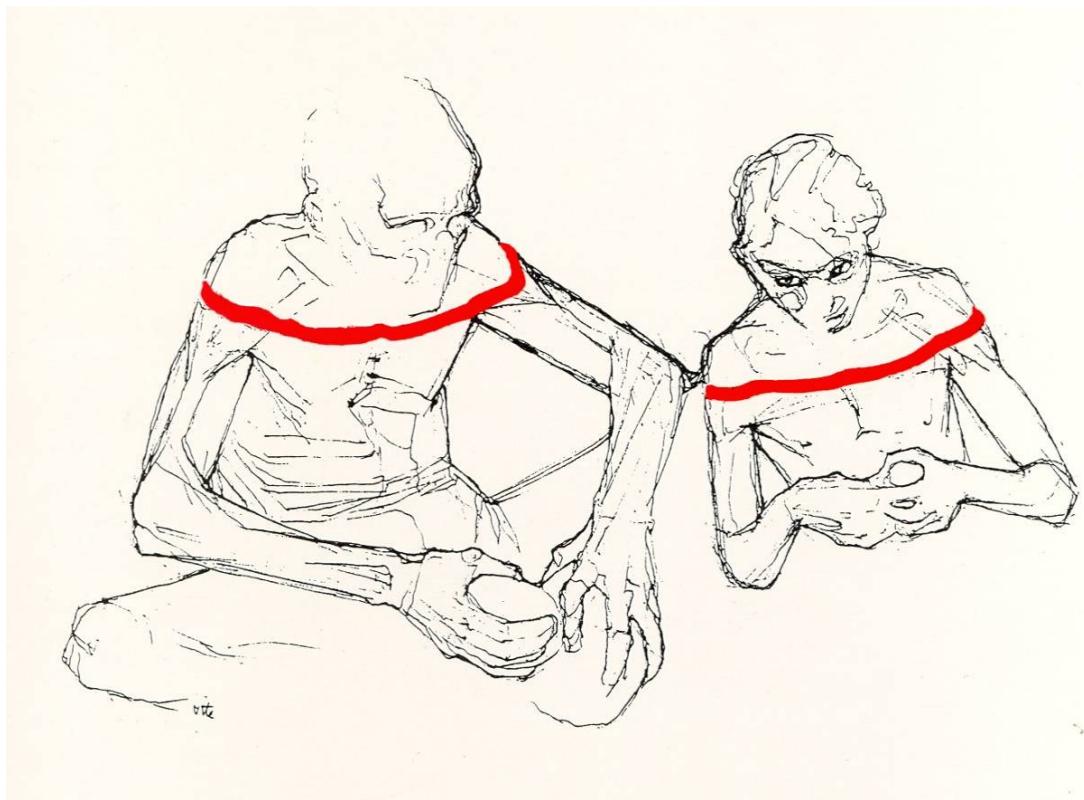


Fig. 2 - L'esthétique technique produit de l'harmonie intellectuelle par la concordance exprimée dans les gestes agencés par rapport aux règles sociales: les « styles » en sont issus, autant dans leur expression plastique que par la satisfaction issue de ces concordances.

### Mythes et Espaces

Considérée comme un point de départ, cette réflexion permet de focaliser l'observation rétrospective portée sur un peuple et sur sa gamme de valeurs. Entre l'emploi de la sagaie, pour la chasse ou pour le prestige, et l'incarnation d'un rituel chamanique dans l'image, furent tissées de telles toiles de cohérence, autant sur le plan spirituel que dans le domaine affectif, là où se glisse une justification métaphysique globale propre à assurer la cohésion et la permanence d'un groupe ethnique. Transposée dans les temps actuels, cette inhibition de la pensée devant la coutume, se trouve nourrie d'une infinité d'exemples cruellement vécus par tous dans son quotidien le plus ordinaire. Privés de l'aptitude à la comparaison dont nous jouissons néanmoins, les peuples paléolithiques se trouvaient, eux, en totale dépendance de la pensée collective, et seuls

des soubresauts cataclysmiques pouvaient les en faire changer. Migrations massives, contacts brutaux, acculturations dévastatrices, basculements climatiques ou ces divers facteurs souvent mêlés ébranlèrent seuls des pensées religieuses et artistiques, spontanément conçues pour maintenir une rassurante permanence. Là aussi, les exemples actuels se pressent au portillon de notre vécu, hélas habituel. Comme le préhistorien lui-même, le préhistorique disposait de la capacité d'envelopper d'un même regard autant l'outil à manche décoré que la cathédrale naturelle, choisie et délimitée dans les « entrailles » rocheuses. Alors, intervenait la coïncidence entre une structure spatiale et une structure mythique, dont les produits nous fascinent encore, précisément par la finesse de cette adéquation (fig. 3).



Fig. 3 - Aux confins d'immenses territoires continentaux, les expériences Spirituelles se superposent, s'entre-fécondent et se stimulent. La pensée religieuse ne fonctionne plus seulement dans l'abstraction orale: elle s'intègre aux parois rocheuses comme si elles y étaient contenues depuis toujours.

### L'Art et la Pensée

Dans le cas particulier du Paléolithique européen, nous jouissons de situations extrêmement favorables pour observer le déploiement de la pensée mythique via ses matérialisations esthétiques. Acculées aux océans, les populations européennes d'alors subirent comme un tassement ethnique dans cet Extrême-Occident, où les mythes et les arts s'auto-fécondèrent exactement sous le même modèle que les ethnies elles-mêmes. Il s'agit alors d'une sorte de « zoom avant », d agrandissement, de caricatures de toutes les expériences spirituelles qui balayaient alors l'immensité des steppes eurasiatiques, là où par ailleurs elles restèrent essentiellement mobiles, orales et mises en questionnement. Lorsque les peuples se resserrent, leurs lois se durcissent, leurs valeurs morales sont défiées, mises à l'épreuve les unes aux autres. De ces contraintes spirituelles jaillissent alors les meilleures formes de justifications, les meilleurs modes d'assujettissement d'une pensée religieuse mise à mal : ses exsudations matérielles que constituent, à nos yeux, les œuvres d'art. Alors surgissent des pensées qui nous choquent: toutes faites d'hommages à la nature sauvage, à sa beauté, à sa puissance, au respect que lui vouent des peuples envieux de son harmonie, produits tangibles d'un équilibre enfin trouvé, en apparence, entre le destin et la vie.

Des dizaines de millénaires virent se renouveler ces expériences, déclinées sous toutes leurs formes, en constant échange exclusif entre la pensée humaine et la nature sauvage, et à la poursuite des infinités formules permises à l'intérieur de cet espace mythique. Par l'image déjà, on voit poindre l'ambition fatale qui rongeait l'aventure humaine : mise au service de la volonté par le défi que la beauté plastique opposait à la crainte de la nature, l'image progressant dans cette emprise, y substitua finalement celle de l'homme lui-même comme s'il y désignait ainsi son seul maître (fig. 4).

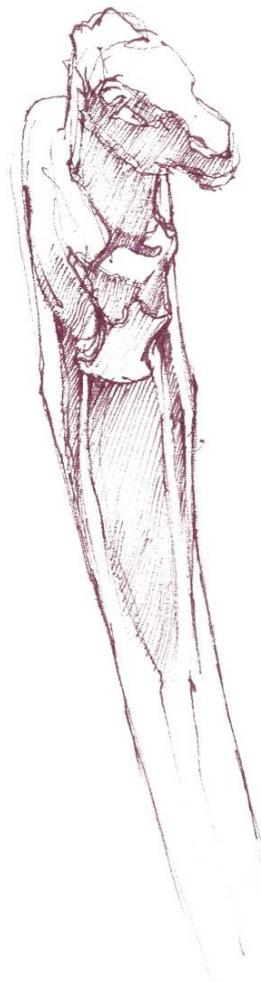


Fig. 4 - Dans sa globalité, la pensée ethnique ne connaît pas les découpages catégoriels auxquels notre histoire récente s'est habituée. Comme les fresques décorant des salles immenses, le moindre outil personnel participe à la pensée du groupe et traduit sa sensibilité, selon une seule codification, étalée de la danse à la musique, du récit à l'outil, des règles de migration aux lois du mariage. Seule, la conduite respectueuse de tels codes y sera vécue comme « harmonieuse ».

## From classical to 3D archaeology

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**Abstract:** This paper aims to mark some of the possible applications of the engineering CAD software in the field of archeology. The archaeological information, which is usually stored in classical format, can be digitized in 3D by using CAD software. The result of this process can be used for multiple purposes: conservation, dissemination, research, etc.

**Key words:** CAD, CatiaV5, digital, 3D modeling

### Introduction

Archeology is the science that studies human history and prehistory through the excavation of sites and the analysis of artifacts and other physical remains [www.1, 2011], and telling us the story of the past and stories about the past.

Digital Archaeology explores the basic relationships that archaeologists have with Information and Communication Technology (ICT) and digital technology to assess the impact that such innovations have had on the very basic ways that archaeology is performed and considered (T. Evans 2006).

According to Graeme E. (www.3, 2011) (Archaeological Computing Research Group, University of Southampton) and (D. Lu, 2009) archaeological computer modeling can be summarized as:

- Mathematical – statistical analyses
- Landscape modeling – networks, geographic information systems, geophysical data
- Data modeling – models of relations, hierarchies, objects
- Artificial intelligence and expert systems
- Textual modeling – semantics and linked data

- Computer graphic modeling – simulation and representation

For 3D modeling there are minimum two big category of software which can be used in archeology: CAD (Computer-Aided Design) software used by engineering and the second alternative is software used in movies and game industry for modeling, animation, and rendering, used by artists, and graphic designers.

This paper will present some possibilities to use CAD software in the digitization of archaeological information for creating virtual artifacts and virtual environments, for building visual interpretations of the excavations, buildings, pottery, and other component of the ancient world which can help to improve knowledge about the antiquity. This paper presents a series of case studies regarding the Dacian civilization (focused on the fortresses from Orăştie Mountains), developed in the framework of the project Virtual Ancient Dacia, that were realized together with a specialist from the National History Museum of Transylvania, Cluj-Napoca<sup>1</sup>.

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All the case studies are intended to be integrated at the end of project in *Europeana*, a European Union initiative, that aims to enable people to explore the digital resources of Europe's museums (www.3, 2011).

The citadels within Orăştie Mountains have been the center of the Dacian world for over a century and a half. In an area covering ~ 200 km<sup>2</sup> there have been built strong fortresses with Elenistic walls, tens of temples with monumental architecture, workshops, living quarters and annexes, and systems for water catchment and distribution. Thousands of iron made objects, fabulous thesauruses uncovered during time, but also the fine pottery or the imported objects are proof of the exceptional development that this area has had in the antiquity. These vestiges form a cultural patrimony of high significance both on the national and international level: starting with 1999, the capital of the Dacian kingdom - Grădiștea de Munte – Sarmizegetusa Regia – and the surrounding citadels (Costești, Blidaru, Piatra-Roșie, Căpâlna, Bănița) have been included in the UNESCO patrimony.

The systematic archeological research in the Orăştie Mountains has started in the period between the two world wars and has continued, almost uninterrupted, until the present times. During time, numerous pieces of archeological information have been gathered, which, using the modern digitization techniques, provide a new research instrument and as well as the chance to represent history in a much more accessible and exciting way (C. Daicoviciu, 1951; G. Gheorghiu, 2005; H. Daicoviciu, 1972; H. Daicoviciu, 1989).

### Archaeological Information

Much of the information produced by archaeological research over the past century exists in technical, sometimes lengthy, limited-distribution reports scattered in offices across the country (P. Francis, 2010). The solution for avoiding this problem is to digitize the archaeological information and use it in electronic format within digital libraries that allow for a controlled access.

According with (A. Chalmers, 2009), the digitization of archaeological information can encompass the following fields:

- documenting the current state of existing artifacts or works of art,
- measuring, dissecting, or visualizing objects and sites to gain new insights, and
- educating students and the general public about cultural heritage.

This information can be processed using different methods that provide for its transformation in (G. Lock, 2003):

- Images – drawings, maps, pictures and images in 2D or 3D
- Texts – manuscripts, books, newspapers, letters, diaries and archive documents
- Phonograms – music and spoken text from cylinders, cassettes, vinyl or from radio shows
- Video clips – movies, news broadcasts and TV shows
- 3D models – patrimonial objects, reconstructions, etc.
- Modele 3D- obiecte de patrimoniu, reconstituiri,etc.

In the UNESCO vision, “cultural heritage is our legacy from the past, what we live with today, and what we pass on to future generations”<sup>2</sup>, and in our opinion the digitization of archaeological information is a way to contribute to this desiderate.

### Using Cad Software in Archeology

For illustrating the possibility to use CAD software in archeology the authors have chosen one of the most complex solutions: CATIA V5, which is addressed to all manufacturing organizations; from OEMs through their supply chains, to small independent producers.

CATIA can be applied to a wide variety of industries, from aerospace, automotive, and industrial machinery, to electronics, shipbuilding, plant design, and consumer goods. Today, CATIA is used to design anything, from an airplane to jewelry and clothing [www.4].

In conjunction with ENOVIA for collaborative product lifecycle management, SIMULIA for engineering quality and DELMIA for production performance, CATIA V5 is a key component of V5 Product Lifecycle Management from Dassault Systèmes.

<sup>2</sup> Available: <http://whc.unesco.org/en/about>

In the following case studies, there can be identified two distinct uses for 3D digitization:

- the digitization of a real object
- the 3D digitization of information that already exists in electronic format

By using the solutions related to Catia V5 (3DVia, 3DViaStudio, 3D ViaComposer), all the 3D models can be transformed into formats compatible with stereoscopic projection, thus creating a virtual reality environment that offers a full experience in visualizing and interacting with the 3D models.

### Modeling archeological excavation sites

Archaeological research requires the elaboration of a documentation that includes general and detailed site plans, pictures, drawings, topographical maps, etc. This data and its precisions represent a major problem when the results of the archaeological excavation need to be explained to other specialists or to those less familiar with this science: a three dimensional past is reconstituted in a two dimensional form, thus losing both important information and the reader's appeal.

A three dimensional representation of an archaeological excavation would eliminate this problem, and, moreover, it would open up new research directions. Among the advantages of applying 3D techniques to archaeology, one can mention: the visualization of successive archaeological layers, repositioning of the discovered artifacts in their original settings simulated with high fidelity, the possibility to rapidly correlate pieces of information gathered during several research campaigns, increased interactivity with the "image" of an excavation, etc. Basically, the situation in the ground before the excavation can be recreated faithfully in the virtual environment.

Information taken using the classical method from archaeological excavation sites can be used for 3D modeling of the excavation. Using surface or solid body in Catia V5, the excavation can be build at 1:1 scale with all necessary details, without any limitation from the part of software. With the help of *Material Library*, *Photo Studio* and *Real Time Rendering*, the 3D model of the excavation can be rendered with texture extracted from pictures taken on site. In figure 1 is presented an excavation made in 2010 at Gradiste de Munte (Caprareata II),

modeled using 2D drawings (Fig.1b) made by archeologists on site.

The 3D digitization of archaeological digs may lead to the creation of databases with information, that could be used for establishing various correlations or for placing of the digitized objects on a GIS model in order to help plan future digs. Other uses of digitization are to virtually recreate the initial archaeological context and allow for possible interactions with the 3D model in virtual reality environments.

### Reconstructing a fortress

The proposals for reconstruction for the Dacian citadels in the Oraștie Mountains in 2D format exhibit a series of disadvantages generated by the working method which, most of the times, only offers a single perspective, making impossible the representation of certain details.

Accurate and detailed 3D model for fortress and building can be made with modules from Catia V5, even if this software with its modules is not specifically designed for architectural modeling. The advantage for 3D reconstruction in Catia is the possibility to work with assembly and subassemblies for a big model.

With the rendering facility, a picture or areal time rendered scene can be obtained at high quality.

In the figure 3b we have a classical 2D reconstruction proposed in (www.5), and in 3c a 3d reconstruction proposal made in Catia V5, at 1:1 scale with materials and a possible configuration of relief.

Modeling at 1:1 scale offers a real perspective on the proportions of the site, the possibility to model in detail any element – from the stone blocks that make up a wall and up to the objects discovered in the area, and also the possibility to present the evolution of a fortress.

### Relief modeling

The relief is essential in understanding an ancient site, even more so when talking about a fortress.

Using surface modeling from the *Shape* group of modules, the actual relief can be modeled and can be used in combination with building and excavation for a better understanding of the history of the place.



Fig. 1 - Catia V5 industry solutions

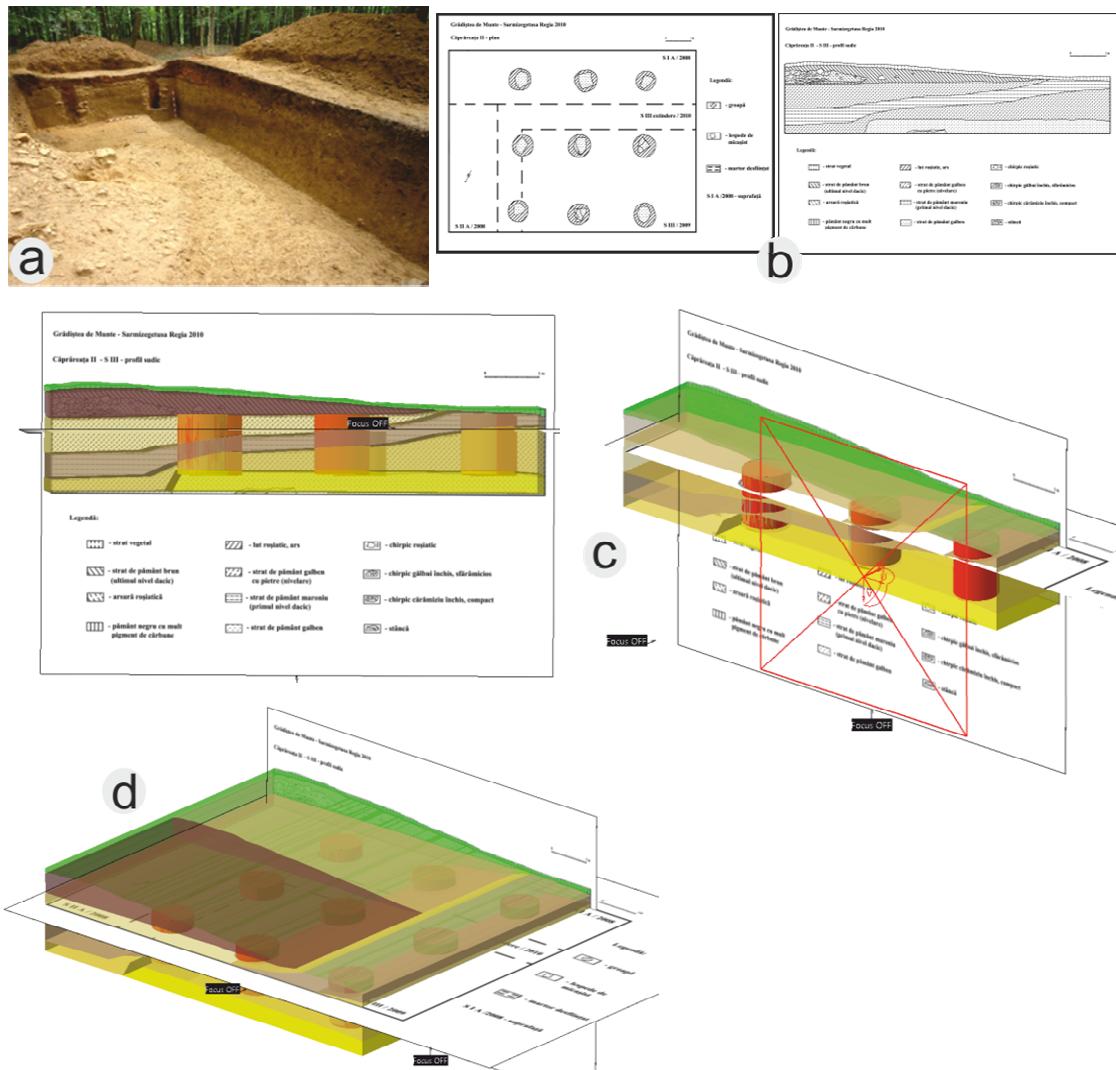


Fig. 2 - Gradistea de Munte – Site Crapareata II: a-picture taken during the excavation; b-classical archaeological documentation; c-sections through the 3D model; d-isometric vie

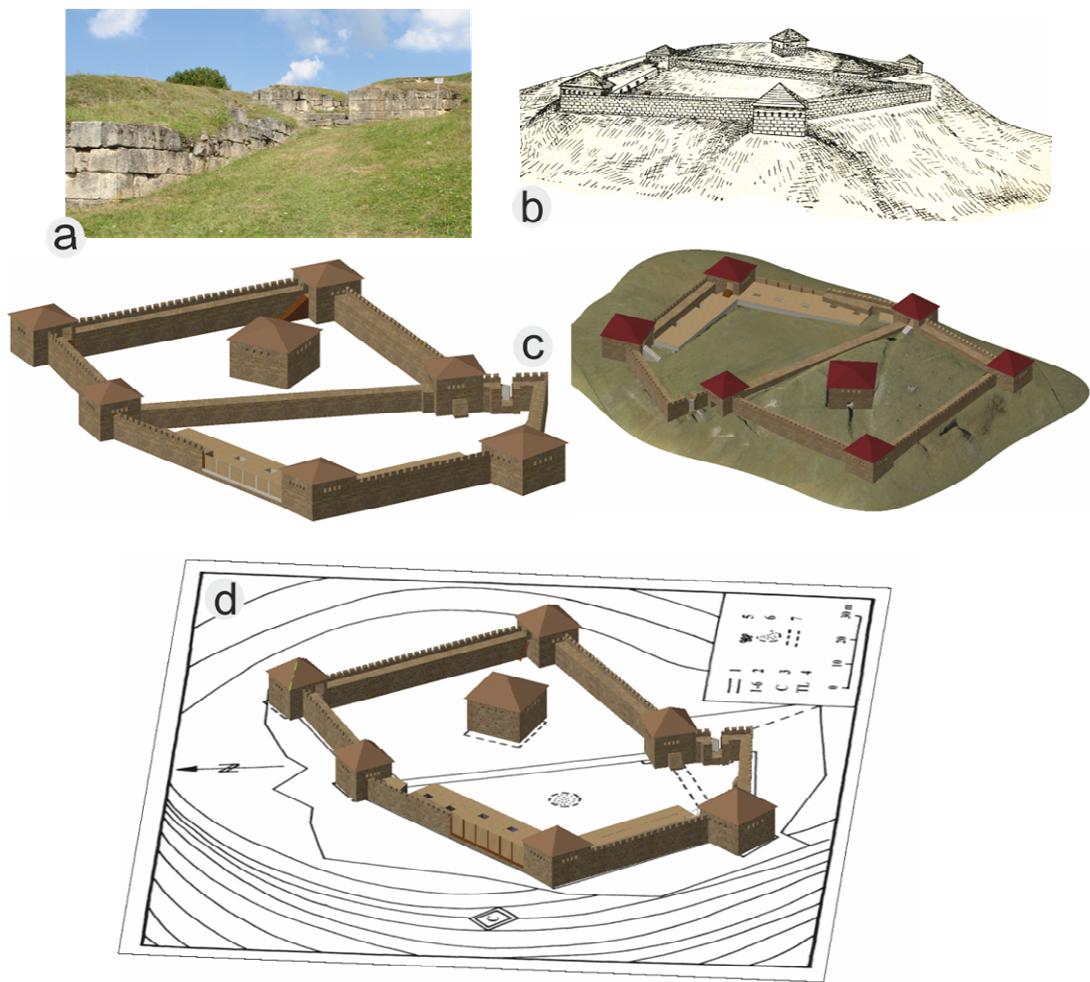


Fig. 3 - Reconstruction of Blidaru fortress :a-picture with the Dacian walls; b-classical reconstruction proposal; c-3d reconstruction proposal;d-topographic map and reconstruction proposal at 1:1 scale

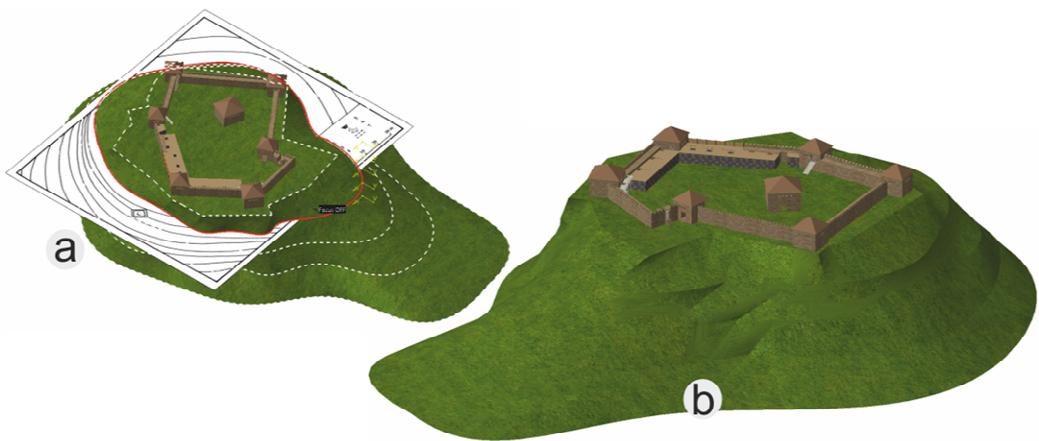


Fig. 4 - Modeling relief - Blidaru fortress: a – relief and topographic map; b- fortress on the actual relief

Starting from level curves take by a topographer on the actual relief, this can be modeled for a better recreation of the defense reinforcement, access ways and other aspects regarding the position of fortress or building.

The 3D modeling of the relief allows for the creation of a model that underlines the natural advantages of the placement of the site. After modeling of the current situation, it can be reshaped in order to bring the relief as close as possible to the initial configuration by recreating plateaus, terraces or other landscaping elements that have faded away with the passing of time.

### Scanning and reconstruction of an artifact

Using a special plugin like Handyscan Scanning Module (HSM) for Catia V5 (from Creaform) is possible to scan a 3D object directly in the Catia environment. After the cloud point is acquired, it can be processed using *Digitized Shape Editor* and *Shape Sculptor* for obtain the mesh. The mesh can be used directly for manufacturing the missing part from an object using CNC (Computer Numerical Control) equipment, or for generating the surface using *Quick Surface Reconstruction*. Generated surfaces can be edited with a many of instruments from the *Generative Shape Editor* module.

In Catia V5 is possible to reconstruct a broken artifact using a graphical algorithm [V. Kilikoglou, 2002]. Using the module *Imagine and Shape* is possible to work using the principle of photogrammetry. Catia V5 can work with a lot of components grouped in assemblies and subassemblies, modeled directly in Catia or imported using the most common 3D file formats.

### Rendering scenes and objects

Catia V5 offers many tools for rendering in modules like *Photo Studio* and *Real Time Rendering*; maybe they cannot be compared with similar facilities from software used in the movies and game industry, but Catia has the most important functions that also exist in these software packages.

With the *Material Library* module, the users can define their own materials with physical and visual properties that are 100% custom.

Catia V5 has a standard mode for rendering and offers the possibility to set-up a fully custom mode for the rendering engine (Figure 7).

The result can be very realistic, similar to the real environment, because users can take properties such as color, reflectivity and transparency from real objects.

### Drafting and 2D details for 3D models

2D documentation is probably as important to archaeology as it is to engineering. Once transposed in 3D format, we can generate automatically the 2D documentation for any element, showing different views, sections and details

Catia V5 offers a large number of engineering instruments for generating 2D drawings, which can be successfully used for generating the production drawings for a 3D model or for digitizing an existing drawing.

### Human activity simulation

There are many differences between animation and simulations of human activity. Using modules grouped under the name *Ergonomics Design & Analysis*, is possible to simulate the human activity with antique hand tools.

Human Activity Analysis in Catia highlights: Clash detection; Analyze Lifting/Lowering; Pushing/Pulling and Carrying; Snook & Ciriello as well as NIOSH Analysis; Repetitive motion analysis such as RULA (Rapid Upper Limb Assessment); Balance computation and Biomechanics analysis [8].

### 3Dvia and virtual reality

Through 3DVia Dassault Systèmes offers a powerful instrument that allows the import of 3D models from Catia V5 (and from the other proprietary applications) and their transformation into virtual reality applications that are compatible with most 3D projection systems, anaglyph, Nvidia 3DVision, etc. By using this instrument, virtual exhibitions and museums can be created containing all the 3D models realized with Catia V5, thus making them accessible to the public via the Internet. In this way, visualizing the on-line 3D models can be performed with minimal costs to the user (costs are incurred by the chosen 3D visualization

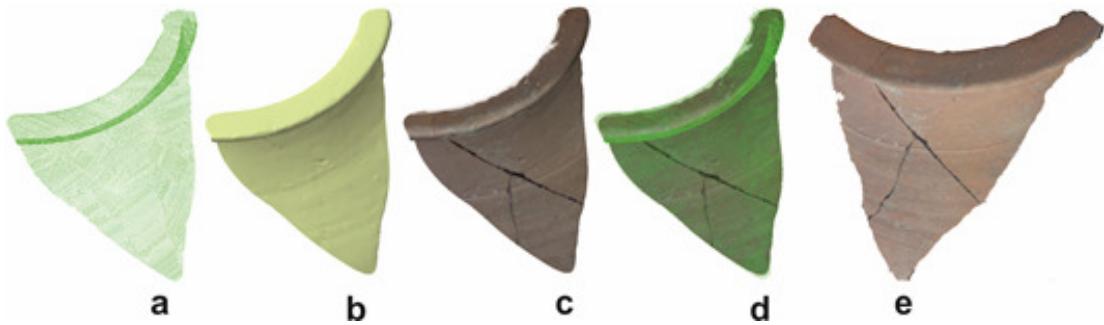


Fig.5: Digitized vessel fragment: a-point cloud; b-surface; c-textured surface; d-point cloud and textured surface overlapped; e-fragment discovered at Grădisteia de Munte.



Fig. 6 - Vessel reconstruction: left-original chiup, right-digitized vessel in Catia V5



Fig. 7 - Rendering objects-the fortress from Costesti: up-real time rendering with panorama, down-simple rendering image

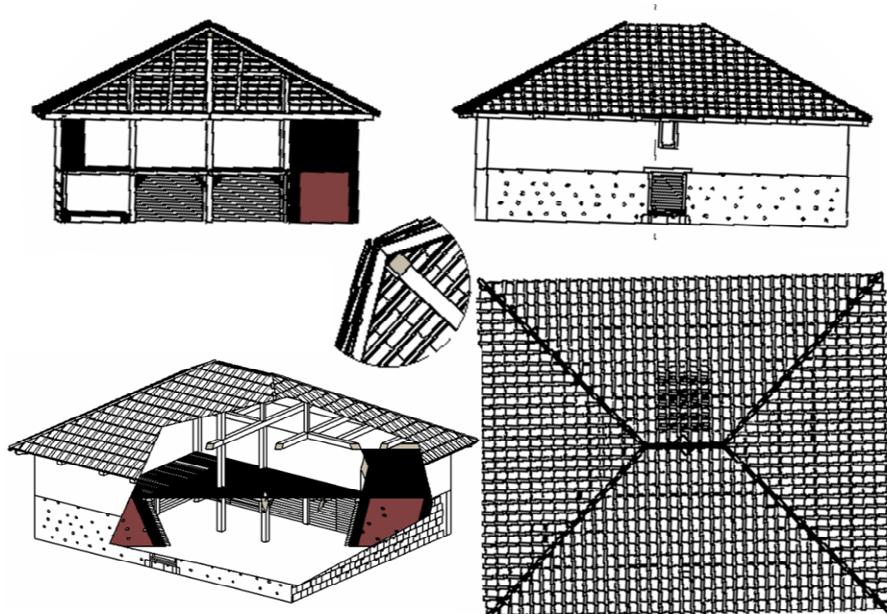


Fig. 8 - Drafting for a defense tower in Catia V5

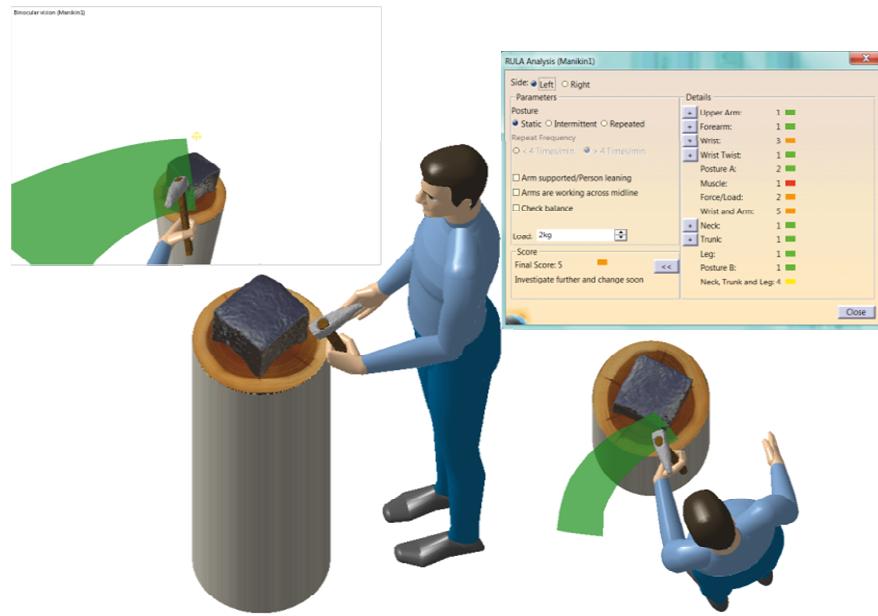


Fig. 9 - Ergonomics Design & Analysis: a-human with hammer, b-vision space, c-results of RULA analysis, d-top view with reach position analysis

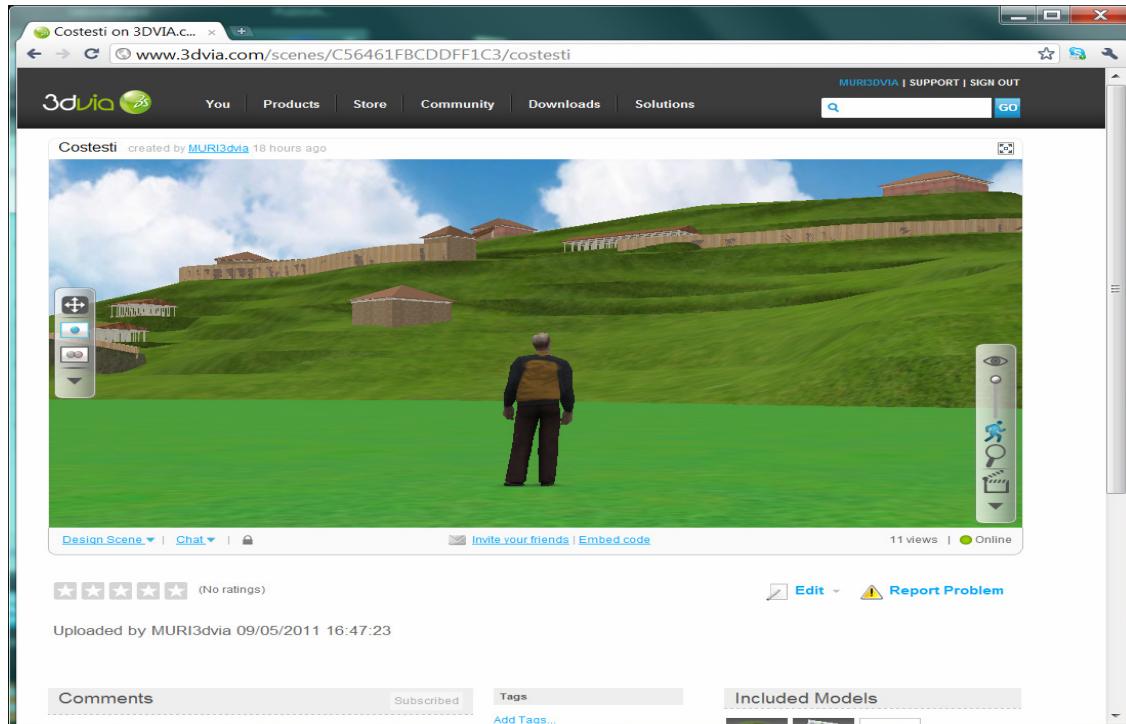


Fig. 10 - Virtual museum: Costesti fortress

system - e.g. anaglyph has costs related to the special glasses needed) by using a web browser and free plugin.

### Conclusions

The 3D digitization of some categories of archaeological information can be performed using the CAD instrument Catia V5. The areas in which it can be used start with transforming archaeological excavation documentation (generally 2D drawings) into 3D models, and continue with digitizing artifacts and reconstructing large historical sites. The degree of detail is specific to the engineering sciences and is limited only by the patience of the CAD engineer and the availability of historical information needed for realizing the 3D model.

By using specific ad-ons for Catia, entire or partial artifacts can be scanned and transformed into 3D models with a high degree of fidelity. Pottery or even entire fortresses can be reconstructed with in-depth detail, at 1:1 scale, and in this way help in the confirmation or debunking of research hypotheses, or they can even lead to the appearance of new avenues for research.

Using Catia V5, one can realize detailed 2D documentations for any 3D model and also create simulations of some activities with the help of a virtual manikin that duplicates entirely the characteristics of the human body.

With the help of 3Dvia, virtual reality applications can be created, that use the 3D models realized in Catia, and which can be disseminated through the web towards the public at large for promoting the national patrimony.

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***The Prehistory of Banat*** (Editors-in-chief Nikola Tasić and Florin Drašovean), I. ***The Palaeolithic and Mesolithic*** (Edited by Florin Drašovean and Borislav Jovanović), EA  
The Publishing House of the Romanian Academy, Bucharest, 2011, 245 p., 77 fig.,  
ISBN: 978-973-27-2057-8.

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The initiative of publishing a Prehistory of Banat, in several volumes, comprising the Romanian territory and northern Serbia, with Nikola Tasić and Florin Drašovean as editors in chief, is doubtlessly worth praising. The project, which will be concluded through a series of five volumes (*The Palaeolithic and Mesolithic*, *The Neolithic*, *The Eneolithic*, *The Bronze Age* and *The Iron Age*), has involved innumerable cultural institutions of Romania and Serbia, such as Romanian Academy of Sciences, the Timișoara Branch, the Museum of Banat, the Serbian Academy of Sciences and Art etc.

The first volume issued is called *The Palaeolithic and Mesolithic*, edited by Florin Drašovean and Borislav Jovanović. This work is structured in six chapters: I. Introduction, II. The Palaeolithic in Banat, III. The Paleolithic in northern Serbia, IV. The Mesolithic in Banat, V. The continuity and future research, VI. Appendix.

Even since the introduction, the authors present the difficulties encountered in the realization of this volume, due to the unequal research of the sites, to the poor knowledge of the paleogeography of the region, to the lack of absolute dating, to the insufficient information on the lithic raw matter sources "as well as the inadequate degree of publication of archaeological and palaeoecological material" (p. 17). At the same time, it is mentioned that some

research works will be published here for the first time and a special attention will be given to the transition from the Middle to the Upper Paleolithic.

The amplest part of this work is the second chapter, *The Paleolithic in Banat*, signed by Ion Cornel Băltean, which, unfortunately, also presents the biggest problems. It is divided in its turn into numerous subchapters and starts with general considerations on the period under analysis. The features of the Palaeolithic are very briefly described and, despite its title, this subchapter is rather a pleading concerning the need to carry out geomorphological and sedimentological studies. Sure, these studies are very necessary, but we were about to realize that they were totally absent from this chapter.

The following subchapter is called *Some terminological remarks on the use of quartz/quartzite as raw material in some Palaeolithic settlements in the Banat*. The need for some terminological considerations on the use of quartz and quartzite is doubtless, yet the author does not use the specialized literature of this quite difficult domain sufficiently. Only two works of Vincent Mourre (1996, 1997) are quoted, just a few aspects on the use of quartz being selected (such as the difference between cortex and neo-cortex, knapping features, particular accidents), while many other characteristic elements have been neglected. One

could have expected that the notions proposed by Vincent Mourre (1996, 1997) would be used in the analysis of the lithic material of Banat, yet, as we were about to notice, except for the use of the term of neo-cortex, they are completely missing from this work. For this reason, we wonder what the role of this subchapter in the economy of this work may be, if the notions concerning the quartz technology are not used.

The part on the geological structure of Banat region is very ample and consistently documented. Unfortunately, there is no mention of the motivation and the goal of realizing such an ample study on the geological structure when this work deals with the Palaeolithic of the area. Then a study on the type of rocks used in Prehistory follows, describing the general petrographic features of the rocks and having no connection to the Paleolithic of Banat. A necessary and well-documented chapter is the one concerning the Quaternary deposits.

After that, the history of the research and the most consistent part of the study follows: (II. 5.) *The Palaeolithic archaeological evidence in the Banat area*. This part begins with a subchapter suggestively entitled (II. 5. 1) *Pedological analyzes, sedimentological remarks on stratigraphical profiles of the palaeolithic settlements in the Banat*. According to the title, we were expecting an extremely necessary and little approached study of the Romanian archeology. Unfortunately, we realized that this title does not correspond to the content. There is no pedological analysis, and the so-called stratigraphic considerations are totally missing. This chapter is just a simple compilation of stratigraphic descriptions published in time by the authors who carried out researches in the sites of Banat. Consequently, the title of this subchapter does not agree with its content.

The following subchapter is entitled (II.5.2.) *Repertoire of Palaeolithic archaeological sites*. Considering this title, we were expecting to find a repertoire of the settlements in the area, although these sites have been catalogued recently (Sabin Adrian Luca, 2009). We were about to realize that this subchapter is the author's own study on the settlements, so again the title does not correspond to the content. This part, which was supposed to

represent in fact the author's contribution, presents innumerable irregularities. In order not to abuse of the space usually given to such an analysis, we have contented ourselves with just a few examples, each time presenting in brief the bibliographic references needed in order to identify the irregularities.

The first aspect that needs to be pointed out is that there is not one original technotypological analysis. This would not necessarily be a problem, provided a correct synthesis on the Paleolithic series had been realized. Unfortunately, all the information and the analysis of the lithic material is taken over as such and translated from Fl. Mogoșanu (1978) and Al. Păunescu (2001). In the economy of this work, a much too important part is occupied by typological tables, which are translated, without adding any supplementary information, from the above-mentioned authors. In a few cases, to avoid the impression of total imitation, the pieces whose coefficient was zero were eliminated from the tables. None of the typological tables has been provided with any explanation and the authors it has been taken from, namely Fl. Mogoșanu (1978) and Al. Păunescu (2001), under it. They are simply mentioned here and there only in the text. A minimum of scientific rigor requires that a table or graph in a scientific work should have an explanation and be numbered. For someone who does not know the Romanian Paleolithic bibliography, or for someone who does not know Romanian, this chapter may give the impression of being the labor of Ion C. Băltean. Taking over a table as such from an author, even though it may be translated into a foreign language, without explaining underneath where it has been taken from, is called *plagiarism*.

In order to support the above-mentioned statements, below, we will provide, out of the countless examples (the tables for levels I, II, III from Coșava (p. 47, 48, 49) are taken over from Fl. Mogoșanu (1978, p. 80); the table for the Mousterian level from Gornea (p. 50) is copied from Al. Păunescu (2001, p. 151); the tables for levels III, IV, V, VI from Românești-Dumbrăvița (p. 57, 59) are taken over from Fl. Mogoșanu (1978, p. 72-73)), only two (fig. 1, 2).

Ord. no.	Types of pieces	No.	% %			
				1	2	3
1.	End-scrapers	2	1,81	1. Graftoir sur bout de lame	2	1,81
2.	Atypical end-scrapers	2	1,81	2. Graftoir sur bout de lame atypique	2	1,81
4.	Oval scrapers	1	0,90	4. Graftoir éginal	1	0,90
5.	End-scrapers on retouched blade	3	2,72	5. Graftoir sur lame retouchée	3	2,72
6.	End-scrapers on Aurignacian blade	3	2,72	6. Graftoir sur lame aurignacienne	3	2,72
7.	Fan shaped end-scraper	1	0,90	7. Graftoir écaillait	1	0,90
8.	End-scraper on flake	8	7,27	8. Graftoir sur éclat	8	7,27
11.	Carnated end-scraper	9	8,18	9. Graftoir circulaire	0	0
12.	Atypical carnated end-scraper	4	3,63	10. Graftoir unifforme	0	0
13.	Nosed end-scraper	2	1,81	11. Graftoir cariné	9	8,18
13a.	Atypical nosed end-scraper	3	2,72	12. Graftoir cariné atypique	4	3,63
15.	Core-like end-scraper	5	4,54	13. Graftoir à museau	2	1,81
16.	Rabot	2	1,81	14. Graftoir à museau atypique	3	2,72
27.	Dihedral straight burin	3	2,72	15. Graftoir nucéiforme	5	4,54
28.	Offset dihedral burin	1	0,90	16. Rabot	2	1,81
29.	Dihedral angle burin	3	2,72	17. Percoir atypique	0	0
30.	Burin de angle along the break	1	0,90	18. Burin dièdre droit	3	2,72
31.	Multiple dihedral burin	1	0,90	19. Burin dièdre déjeté	1	0,90
47.	Atypical Châtelperron point	1	0,90	20. Burin dièdre d'angle	3	2,72
52.	Font-Yves point	1	0,90	21. Burin dièdre sur lame cassée	1	0,90
65.	Blade with continuous retouch on one side	15	13,63	22. Burin dièdre multiple	1	0,90
66.	Blade with continuous retouch on two sides	15	13,63	23. Pointe de Châtelperron atypique	1	0,90
67.	Aurignacian blade	10	9,09	24. Pointe de Font-Yves (Krems)	1	0,90
68.	Strangled blade	1	0,90	25. Lame à retouches continues sur		
74.	Notched piece	2	1,81	un cord	15	13,63
75.	Denticulated piece	4	3,63	26. Lame à retouches continues sur		
77.	Side-scrapers	6	5,45	les deux bords	15	13,63
90.	Dufour bladelett	1	0,90	27. Lamelle Dufour	10	9,09
				28. Lamelle Dufour	1	0,80
				29. Pièce à encoche	2	1,81
				30. Pièce denticalée	4	3,63
				31. Racloir	6	5,45
				32. Lamelle	1	0,90

Fig. 1: Level I from the site of Coşava: the left table has been published by Ion. C. Băltean (2011, p. 47) and the one on the right by Fl. Mogosanu (1978, p. 80)

**Elena-Cristina Nițu**

Ord. no.	Types of pieces	Lev. III	%	Lev. IV	Lev. V
1.	End-scraper on blade	6	5,26	1	0
2.	Atypical end-scraper on blade	1	0,88	1	4
3.	Double end-scraper	1	0,88	0	1
5.	End-scraper on retouched blade	1	0,88	0	1
6.	End-scraper on Aurignacian blade	2	1,75	0	1
8.	End-scraper on flake	15	13,16	3	1
10.	Thumb-nail end-scraper	1	0,88	1	0
11.	Carinated end-scraper	7	6,14	0	1
12.	Atypical carinated end-scraper	6	5,26	1	2
13.	End-scraper à museau	2	1,75	1	0
14.	Nosed end-scraper	1	0,88	0	0
15.	Core-like end-scraper	8	7,02	3	1
16.	Rabot	6	5,26	1	3
17.	End-scraper-burin	1	0,88	1	1
21.	Piercer end-scraper	1	0,88	0	0
24.	Atypical piercer	2	1,75	0	0
27.	Dihedral straight burin	7	6,14	6	5
28.	Dihedral offset burin	3	2,63	3	2
29.	Dihedral angle burin	2	1,75	4	3
30.	Angle burin along the break	4	3,51	2	4
31.	Multiple dihedral burin	1	0,88	1	4
32.	Burin busqué	1	0,88	0	0
34.	Burin on straight retouched truncation	2	1,75	3	1
35.	Burin on oblique retouched truncation	2	1,75	4	0
36.	Burin on concave truncation	1	0,88	1	0
37.	Burin on convex retouched truncation	1	0,88	1	0
39.	Transversal burin on a notch	1	0,88	0	0
43.	Core-like burin nucleiform	1	0,88	0	0
60.	Piece on straight retouched truncation	0	0,00	2	0
61.	Blade with oblique retouched truncation	1	0,88	3	0
63.	Blade with convex retouched truncation	1	0,88	3	0
65.	Blade with continuous retouches on one side	6	5,26	0	1
66.	Blade with continuous on both sides	1	0,88	3	0
67.	Aurignacian blade	5	4,39	1	0
74.	Notched piece	1	0,88	1	0
75.	Denticulated piece	1	0,88	2	0
76.	Scalar piece	0	0,00	1	0
77.	Side-scraper	2	1,75	4	0
84.	Truncated blade	0	0,00	2	0
85.	Backed bladelets	0	0,00	0	1
89.	À coche flake	1	0,88	1	1
90.	Dufour bladelets	8	7,02	0	0
<b>Total tools</b>		<b>114</b>		<b>61</b>	<b>38</b>
Simple blades		788			
Flakes		1941			
Cores		47			
Atypical flakes		2165			
<b>General total</b>		<b>5055</b>			

		Niv. III		Niv. IV		Niv. V	
		Total	%	Total	%	Total	%
		1	2	3	4	5	6
0							
1.	Grattoire sur bout de lame	6	5,26	1	1,63	0	0
2.	Grattoir sur bout de lame atypique	1	0,87	1	1,63	4	10,25
3.	Grattoir double	1	0,87	0	0	1	2,56
5.	Grattoir sur lame retouchée	1	0,87	0	0	1	2,56
6.	Grattoir sur lame aurignacienne	2	1,75	0	0	1	2,56
7.	Grattoir éventail	0	0	0	0	0	0
8.	Grattoir sur état	15	13,15	3	4,91	1	2,56
9.	Grattoir circulaire	0	0	0	0	0	0
10.	Grattoir unguiforme	1	0,87	1	1,63	0	0
11.	Grattoir caréné	7	6,14	0	0	1	2,56
12.	Grattoir caréné atypique	6	5,26	1	1,63	2	5,12
13.	Grattoir à museau	2	1,75	1	1,63	0	0
14.	Grattoir à museau atypique	1	0,87	0	0	0	0
15.	Grattoir nucléiforme	8	7,01	3	4,91	1	2,56
16.	Rabot	6	5,26	1	1,63	3	7,69
17.	Grattoir-burin	1	1,87	1	1,63	1	2,56
21.	Perçoir-grattoir	1	0,87	0	0	0	0
24.	Perçoir-atypique	2	1,75	0	0	0	0
27.	Burin dièdre droit	7	6,14	6	9,83	5	12,82
28.	Burin dièdre déjeté	3	2,63	3	4,91	2	5,12
29.	Burin dièdre d'angle	2	1,75	4	6,55	3	7,69
30.	Burin dièdre sur lame cassée	4	3,50	2	3,27	4	10,25
31.	Burin dièdre multiple	1	0,87	1	1,63	4	10,25
32.	Burin busqué	1	0,87	0	0	0	0
34.	Burin sur troncature retouchée droit	2	1,75	3	4,91	1	2,56
35.	Burin sur troncature retouchée oblique	2	1,75	4	6,55	0	0
36.	Burin sur troncature retouchée concave	1	0,87	1	1,63	0	0
37.	Burin sur troncature retouchée convexe	1	0,87	1	1,63	0	0
39.	Burin transverse sur encoche	1	0,87	0	0	0	0
43.	Burin nucléiforme	1	0,87	0	0	0	0
48.	Pointes de la Gravette	0	0	0	0	0	0
60.	Lame (pièce) à troncature retouchée droite	0	0	2	3,27	0	0
61.	Lame à troncature retouchée oblique	1	0,87	3	4,91	0	0
63.	Lame à troncature retouchée convexe	1	0,87	3	4,91	0	0
65.	Lame à relouches continue sur un bord	6	5,26	0	0	1	2,56
66.	Lame à relouche continues sur deux bords	1	0,87	3	4,91	0	0
67.	Lame aurignacienne	5	4,38	1	1,63	0	0
74.	Pièce à encoche	1	0,87	1	1,63	0	0
75.	Pièce denticulée	1	0,87	2	3,27	0	0
76.	Pièce esquillée	0	0	1	1,63	0	0
77.	Racloir	2	1,75	4	6,55	0	0
78.	Raclette	0	0	0	0	0	0
79.	Triangle	0	0	0	0	0	0
84.	Lamelle tronquée	0	0	2	3,27	0	0
85.	Lamelle à dos	0	0	0	0	1	2,56
89.	Lamelle à coche	1	0,87	1	1,63	1	2,56
90.	Lamelle Dufour	8	7,01	—	—	—	—
<i>Total :</i>		114	99,98	61	99,75	39	99,91

Fig 2: Levels III, IV and V from the site of Românești-Dumbrăvița: the table on the left has been published by Ion. C. Băltean (2011), and the one on the right by Fl. Mogoșanu (1978, p. 72-73)

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The examples of plagiarism do not stop at the typological tables, but continue as well when commenting them. Here are just a few examples:

„...cele două gratoare tipice cu bot („à museau”) sănt făcute astfel: unul plat pe lamă aurignaciană, iar celălalt pe aşchie-capac de nucleu...”(Fl. Mogoşanu, 1978, p. 75)	„The two nosed end-scraper were manufactured, one on a <i>core tablet</i> , and the other on an Aurignacian blade.” (I. C. Băltean, 2011, p. 48).
Nu lipsesc nici gratoarele nucleiforme și nici gialăile („rabots”)...” (Fl. Mogoşanu, 1978, p. 75)	„One should remember the presence of the core-like end-scraper and the <i>rabot</i> type pieces..” (I. C. Băltean, 2011, p. 48)
„Pe baza acestor observații credem că este vorba despre un facies musterian în care tehnica Levallois este absentă, fără forme bifaciale dar bogat în racloare ...” (Al. Păunescu, 2001, p. 142)	„This tool points out to a Mousterian industry characterized by the absence of the Levallois technique and of the bifacial shape, but rich in scarvers”. (I. C. Băltean, 2011, p. 45).
„Indici tipologici pentru stratul inferior: IG = 39,09 IB = 8,18 IGA = 16,36 IBd = 8,18” (Fl. Mogoşanu, 1978, p. 80)	„The characteristic typological indices for this level are: IG 39.09% IB 8.18% IGA 16.36% IBd 8.18% „, Ion. C. Băltean, 2011, p. 48)

Much more serious is the association between plagiarism and forgery. For the settlement of Gornea-Dealul Căuniței, the author of the chapter enthusiastically mentions: “Although the number of typical pieces is very small and cannot be subjected to the technical-typological analysis after the Bordian method, we can still identify types such as” (p. 50). We realized with amazement that it was not the author that identified those types, but Al. Păunescu (2001, p. 151) whom once again the author “forgot” to quote. Ion C. Băltean only “has the merit” of putting the data in a table, probably in order to make it look less like the original text of Al. Păunescu (2001, p. 151) and to distract the reader’s attention from plagiarism.

It is only a page after this, when the typological table is discussed, that a footnote reminds of Al. Păunescu (2001). Below, we will quote the original text of Al. Păunescu (2001, p. 151) with the determination of the tools, from which we have excluded the types of butts identified, along with the table published by Ion. C. Băltean, p. 50.

„I. Aşchii Levallois tipice: 19 (...); Ia. Lame Levallois: 5 (...); II. Aşchii Levallois atipice: 7 (...); III. Vârfuri Levallois neretușate: 5 (...); IV. Vârfuri Levallois retușate: 3 (...); V. Racloare simplu drepte: 2 (...); VI. Racloare simplu concav: 2 (...); VII. Racloar dublu-drept: 1 (...); VIII. Racloar dublu drept-concav: 1 (...); IX. Racloar dublu convex-concav: 2 (...); X. Cuțit à dos natural : ,

Ord. no.	Types of pieces	No.
1	Typical Levallois flake	19
1a	Typical Levallois blade	5
2	Atypical Levallois flake	7
3	Unretouched Levallois point	5
4	Retouched Levallois point	3
9	Single straight side-scrappers	2
11	Single concave side-scrappers	2
12	Double straight side-scrappers	1
14	Double straight-concave side-scrappers	1
17	Double convex-concave side-scrappers	2
38	Naturally backed knife	1
42	Notched piece	1
43	Denticulated piece	1
<b>Total implements</b>		<b>50</b>

Typological structure of the lithic series according to Ion. C. Băltean (2011), p. 50

Ord. no.	Types of pieces	No.
	Non-Levallois points	21
	Non-Levallois blades	4
	Levallois core	1
	Discoidal core	1
	Quasi-discoidal core	1
	Atypical flakes	76
<b>Overall total</b>		<b>154</b>

Composition of the raw lithic material according to Ion. C. Băltean (2011), p. 51.

(...); XI. Piesă cu *encoche* clactoniană: 2 (...); XII. Piesă denticulată: 1 ..." (Al. Păunescu, 2001 p. 151).

At the end of his study, Ion C. Băltean mentions „As there no match between the total number of discovered pieces claimed by Florea Mogoșanu (147) and the number resulting from above table (154)”. This affirmation is surprising, as Fl. Mogoșanu (1978) and Al. Păunescu (2001) present the same number of tools, namely 154. The explanation of this “mystery” is simple: Mr. Băltean copies information from two authors, forgetting to mention it. In the table on page 51, he takes over as such the information on the raw material from Al. Păunescu (2001, p. 151), to which he adds a number of 76 atypical flakes determined by Fl. Mogoșanu (1978, p. 31). Subsequently, we will present the original information from Al. Păunescu (2001, p. 151) and Fl. Mogoșanu (1978, p. 31), next to the table published by Ion. C. Băltean (2001, p. 51):

„XIII. Nuclee: 3, de tip Levallois (1), discoidal (1) și evasidiscoidal (1); XIV. Așchii non Levallois: 21 (...); XV. Lame non Levallois: 4 ..." (Al. Păunescu, 2001, p. 151).

„La toate aceste piese tipice se mai adaugă și 76 de spărturi și așchii atipice” (Fl. Mogoșanu, 1978, p. 31).

This is an example of double plagiarism, but also of forgery of the structure of the lithic industry from this settlement, which is extremely serious.

We can provide as well a few examples of pieces of information taken over from Fl. Mogoșanu (1978), whom he does not cite. There are entire paragraphs synthesized based on the conclusions of the above-mentioned author:

-the typological makeup of levels I and II from Românești-Dumbrăvița (p. 56) is taken over from Fl. Mogoșanu (1978, p. 54);

-the description of the lithic series of level IV from Românești-Dumbrăvița (p. 58) is taken over from Fl. Mogoșanu (1978, p. 62), and

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level V from Fl. Mogoșanu (1978, p. 61-63); the conclusions for level VI are synthesized based on Fl. Mogoșanu (1978, p. 66)

It is useless to mention that absolutely all the settlements presented in this chapter are treated in the same way, so there is no analysis carried out by the author, and not even a synthesis of the studies of the researchers who worked in Banat. All the analyses presented have been taken over as such, without any addition, often “forgetting” to quote the authors who carried them out. The text is made up in a very confusing way so that the reader is not able to identify the authors who actually studied the material but will not completely exclude them either. We are dealing with a simple compilation of some older studies, sprinkled with plagiarisms here and there.

Although the author has no contribution whatsoever, except for the translation of some older articles and studies, he criticizes some aspects of the lithic analysis carried out by others. About the settlement of Coșava, he states: „We regret that we cannot have a view of the butt types, of the metrical variation of the support, of the frequency of the pieces that stem from the first stages of the reduction sequence as the material (nowadays in the custody of the History Museum of Lugoj), whose storing conditions render its study difficult if not even impossible with a view to reconstructing its archaeological context from which it stems has not been processed and one makes no references to the lithic implements (the same holds for the other two levels)” (p. 48). If he had known the specialized literature well, he would have noticed that for the settlement of Coșava there is an identification of the types of butts and of the metric relations carried out by Al. Păunescu (2001). Similarly, the author is discontent with the analysis of other archeological settlements as well, because of the lack of metrical and technological data and of the refittings (for example at Românești-Dumbrăvița). We are wondering, naturally, why has the author taken over the analyses carried out by others if he was discontent with them? At the same time, we do not understand why he did not make himself new techno-typological analyses, better than the older ones. Concerning the diggings of 1989 from the

settlement of Gornea-Păzăriște, the author mentions that the drawings of the published tools are irrelevant and do not respect the scientific rigors: “We would not have been so disappointed if the drawings had been carried out after the required principles of the graphic rendering of lithic material, but in the present case this thing is of little avail, too” (p. 52). After such a statement, in this chapter we would have expected to find only drawings realized according to modern graphic principles, made by the author of the chapter himself. We noticed with amazement that the drawings used are still the old ones published by Fl. Mogoșanu (1978) and Al. Păunescu (2001). Moreover, the figures made based on the old drawings do not respect even a minimum of rigor. The author does not know that when one presents the drawings of some tools, they need to be provided with a scale, too. And on top of it all, when it comes to the dimension of the tools, they are “thrown” helter-skelter on a page in a group of drawings under which it is mentioned that the tools have variable scales (!), so the reader can attribute any « variable » dimension to the items in front of his eyes.

Except for the elements signaled above, the study also misses some minimal technotypological knowledge. We find out with surprise that the presence of plane (sometimes wide) and faceted butts and of a well developed bulb are proof of the use of an “indirect percussion with hard percussor or punctiform percussor” (p. 67). In such a small sentence, which this time is the author's contribution, are included very many mistakes. First of all, there is no such thing as indirect percussion with hard percussor, these terms are totally antithetic. There is no such thing as punctiform percussor, yet there is punctiform butt. The presence of a very prominent bulb is no proof of an indirect percussion; on the contrary it is evidence of a direct hard percussion. Referring to the scrapers from the settlement of Gornea-Dealul Căuniței, the author affirms that they were made on Levallois points with “faceted convex butt, non-Levallois butt and Levallois blade butt” (p. 51). What is striking is the fact that the author does not know the types of butts, as there are no non-Levallois or Levallois butts, there are only flakes, points or blades. Out of the examples provided, there is an obvious use of certain

notions without knowing their meaning well, although these notions are elementary for a paleolithician. Reading these sentences, we understand why the author did not carry out an analysis of his own on the lithic material and why he only compiled the types of tools from a typological study.

Another quite serious element is that he is not familiar with the Romanian bibliography. For the settlement of Constantin Daicoviciu the author mentioned Octavian Popescu, personal communication, as a source. This settlement has already been published by Al. Păunescu (2001, p. 148), so it is no novelty as the author would like to suggest. Actually, the information presented is just an abstract of the text of Al. Păunescu (2001). The same thing can be noticed when it comes to the discovery of three flakes made on quartzite in the point of Curtea, where it is mentioned that the information comes from Emilian Alexandrescu, personal communication, although the materials were published by Al. Păunescu (2001, p. 181).

From a bibliographic viewpoint, the author makes a few confusions. Throughout the text, he insistently quotes Al. Păunescu, 2002, when he refers to the work *Paleoliticul din spațiul Transilvan* (*The Paleolithic in the Transylvanian Area*). It was actually published in the year 2001. At the same time, in the text, but also in the bibliography, the author quotes Al. Păunescu, 2001, *Paleoliticul și mezoliticul cuprins între Carpați și Dunăre* (*The Paleolithic and the Mesolithic in-between the Carpathians and the Danube*), while this work was actually published in 2000.

The conclusions of this chapter are in agreement with the content; they are just a presentation of the diverse cultural determinations realized by the Romanian archeologists in time, that is why we will no longer insist on them anymore.

To conclude, the author has no contribution of his own, except for rendering, more often than not in totality, the technotypological analyses made by others according to

models launched in the 1950s-1960s. If someone had wanted to see the stage of the Paleolithic research in this region, he would have been able to read without any help the works of Fl. Mogoșanu (1978) and of Păunescu (2001), without needing any « republication » of these works.

Taking into account the almost complete rendering of the work of the above-mentioned authors, it would have been more correct for this chapter to have been signed by Fl. Mogoșanu and Al. Păunescu.

The third chapter of this work is entitled *The Palaeolithic in northern Serbia*. The structure of this chapter is lighter than that of the previous one, presenting the geographic environment, the history of research, the description of the settlements and conclusions. The analysis of the sites, even though some of them are poorer in lithic materials, is quite well realized. At the same time, the lithic sets are described technologically and typologically. The conclusions are pertinent and very useful for the knowledge of the Paleolithic of this area.

Chapter IV, The Mesolithic in Banat, signed by Adina Boroneanț, is a very useful synthesis on the Mesolithic of the region. At the same time, beside the comprehensive information, the chapter also presents a rich illustration, archive images being extremely necessary for the history of the archeological research.

We are aware of the good intentions and of the effort of the editors-in-chief of this series who meant to provide a necessary and useful regional synthesis under the title *The Prehistory of Banat*. For this reason, our regret is even deeper as this enterprise was lamentably compromised by the plagiarism practiced in most of the chapter signed by I. C. Băltean, through the total lack of originality and the inutility of his signing a text that actually does not represent him except if we kindly award it the attribute of compilation.

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Geneste J-M., 1985, Analyse lithique d'industrie moustériennes du Perigord: une approche technologiques du comportement des groupes humains au Paleolithque Moyen, These presentee a L'Universite de Bordeaux I pour l'obtention du titre de Docteur, Universite de Bordeaux I, 577 p.

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