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The conservation and restoration of organic material (bone, antler, and teeth) discovered in the 2006 campaign at Piatra Neamț - Poiana Cireşului.

*Daniela Iamandi**

*Universitatea „Valahia" din Târgovişte, Facultatea de Ştiinţe Umaniste, Str. Lt. Stancu Ion, nr. 34-36, Târgovişte, 130105, jud. Dâmbovița, email : iamandi_daniela@yahoo.com

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Abstract: The faunal remains, weather they are bones, ivory, antler, teeth or shells, require special treatment, depending on their conservation state at the time of their recovery. This paper aims at presenting some of the most suitable methods of restoration and conservation treatment, starting from the very moment of the revealing of such items.

The researches conducted in the last few years in the prehistoric site of Poiana Cireşului, Piatra Neamț revealed the former placement of a seasonal Upper Paleolithic settlement. The ongoing archaeozooogical study identified the remains of *Rangifer tarandus, Bos/Bison, Cervus elaphus, Equus* sp., *Rupicapra rupicapra, Vulpes vulpes/Alopex lagopus, Mammuthus primigenius.*

Apart from the small bones, like vertebrae, phalanx, astragals, tarsal, carpals and scuta

Fig. 1 Complete bones

(Fig. 1), most of the bones were discovered in a fragmentary state. So far, we weren't able to fully reconstruct the big bones, due to the degradation of the broken parts, as well as the considerable extension of the settlement's surface remaining to be searched in the following campaigns. The main factor of their degraded condition would be, in our opinion, the soil's content of mineral salts, transported, solved and deposited by water.

Out of the small number of complete bones recovered we selected some representative specimens in order to exemplify the means of their restoration and conservation. They were submitted to this kind of intervention immediately after their recovery from the ground, so that further alteration would be prevented. Often, the major changes provoked by the restoration and conservation techniques (dehydration, cracking, crystallization of the mineral salts belonging to the internal structure of the bone) might destroy the piece unless carefully controlled and supervised.

The three distinctive physical properties of bone, antler and ivory (thickness, length, width) might be subjected to changes through dilatation or contraction when modifying their environmental conditions. Both such changes could lead to tensions inducing cracks and nicks. This paper presents some examples in restoring and conserving items differentiated in terms of morphological resistance and structure.

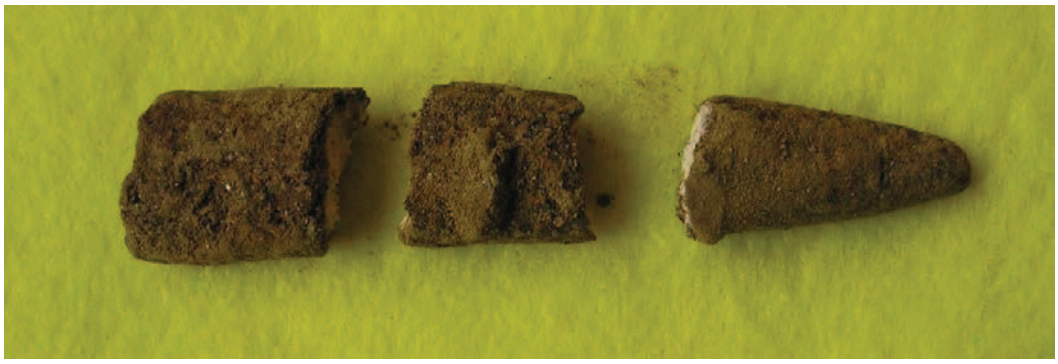

Fig.2 The baguette at the time of its recovery

Fig. 3. The baguette after the cleansing

1. Deer antler baguette

The deer antler baguette laid vertically, at 5 m of depth, having 9, 5 cm of length, 1, 5 cm of maximum width, 0, 5 cm of distal width and displaying two original fracture

surfaces, alongside two other fracture surfaces occurred at the time of its recovery (Fig. 2). A 4 mm thick loess layer covered the whole surface of the piece. In order to prevent

the loss of humidity, the piece was covered in tinfoil, as it was the case with the entire organic material, until the time of its immersion in water. Through cleansing we managed to remove the thick deposits from the surfaces, as well as the soluble mineral salts (Fig. 3).

Due to its spongiest structure and poor manipulative resistance, the antler had to be both externally and internally consolidated, so that further fractures facilitated by the longitudinal crack on the dorsal side (Fig. 4) would not occur. The fragments were immersed in a 10% varnish – Nitrolac and 90% acetone solution, and left to dry freely.

Fig. 4 The baguette in dorsal view

Since the internal structure in the fractured area indicated a suitable resistance and a complete morphology, showing no cavities or pulverulent detaching, the three parts were glued together with polyvinyl acetate. After coagulating, the adhesive become almost transparent and the baguette become suitable for manipulation and further studying (Fig. 5a, b).

Fig. 5a. The baguette after restoring – lateral view

2. Horse molar

When discovered, the molar (8 cm of length, 3 cm of width) was entirely covered in loess, showing a longitudinal break, and calcium carbonates spots on the surface (Fig. 6).

Fig. 5b. The baguette after restoring – frontal view

After observing the preservation state of the dentine, which had enough structural resistance, even if it showed a quite marked net of cracks, the molar was subjected to cleansing through immersion in water and slight brushing. The calcium carbonates spots on the surface were removed by carefully applied drops of 5% citric acid solution, followed by neutralization in distilled water and free drying.

Fig. 6. The molar at the time of the recovery

In order to prevent further cracking, the fragments were consolidated through immersion in 10% Nitrolac and 90% acetone solution, which conferred both internal and external resistance, as well as a natural chromatic look. The two fragments were glued with adhesive – Moment – spread on the entire breaking surface, and held together under firm pressure, resulting in a homogeneous joining (Fig. 7).

Fig. 7. The molar in the final stage

3. Reindeer antler

The small sized antler belonged probably to a young individual, whose skull was cracked, judging from the skull fragment still attached at the base of the antler (Fig. 8). The antler was found in a fragile state, largely affected by the acid environment and the content of water in the soil, with disjointed transversal cross-section fragments. When removing the soil layer covering the antler, further fragmentation seemed inherent, due to the loss in water content through evaporation, so that the antler had to be sprayed with distilled water, as its revealing went on.

Shortly after the recovery, the pieces were cleansed and consolidated, removing the thick deposits of carbonates and soil on the surface, and also the soluble mineral salts within. The removal was done by

slightly brushing the pieces immersed in water (Fig. 9).

Before the complete drying, the fragments were deepen in acetone for a total elimination of the water content, afterwards being treated in a solution of 15% varnish – Nitrolac, and 85% acetone for consolidation.

Fig. 8 The reindeer antler at the time of the recovery

Fig. 9 The reindeer antler after cleansing and consolidation

Fig. 10 The reindeer antler – final stage

This last stage stopped the degradation of the exterior surface in the median area and increased the structural resistance. The last stage of restoring was joining the fragments with adhesive – Moment – which ensured a good clutch through its short time of coagulating (Fig. 10).

4. Rib and antler incised fragments

The eight incised rib and antler fragments were discovered both during the excavation (section V, square C, at 2, 07 m of depth) and in the course of cleansing the organic material (Fig. 11). The fragments recovered so far belong to different incised items (probably pendants, judging by their rounded extremities), presenting no common fracture surfaces thus prohibiting the reconstitution of the original item. Only four fragments display clearer, deep incisions, while for the other four the incisions are less visible (Fig. 12).

Fig. 11 Rib and antler fragments at the time of the recovery

Fig. 12 Incised fragments

Fig. 13 Incised antler fragment

Most of their dimensions fall under 1 cm; the biggest has 1, 8 cm of length, 0, 7 cm of width, 0, 5 cm of thickness, triangular cross-section, oblique, less marked incisions (Fig. 13).

Their preservation state was good enough to allow cleansing through slight brushing in distilled water, affecting only the dorsal and ventral part. The recent fracture surfaces were avoided, so that the removal of other small pieces of bone or antler would be prevented.

Brushing in distilled water successfully took away the thin soil layer from their surface.

After completely drying, the fragments were consolidated through immersion in 10% varnish – Nitrolac and 90% acetone solution, which render them an increase of the structural resistance and a better visibility of the incisions (Fig. 14). Hopefully, future research in Poiana Cireşului will shed more light on the specific, no doubt spectacular, type of object to whom the fragments belong.

Fig. 14 The fragments – final stage

5. Reindeer mandible

Out of six such items discovered in the 2006 campaign, we selected for our presentation a reindeer mandible displaying the following characteristics:

- full range of dentition;
- complete horizontal branch;
- almost complete vertical branch.

Having 21 cm of length, 4, 5 cm of maximal width and approximately 2 mm of cross-sectional thickness, the mandible shows a relatively good conservation state. Still, it showed a break around the mandible angle, resulting in nine fragments, some cracks affecting both sides and also a hardly visible cortical area, due to root attacks. None of the fragments displayed recent breaks.

Fig. 15 Reindeer mandible, immediately after being discovered.

Fig. 16 Reindeer mandible, after the cleansing

Since it was discovered at a depth of over 2 m, in a highly humid environment, the mandible was picked up together with a protective layer
of soil, so that the water component of its structure wouldn't get lost (Fig. 15). Recovering the mandible in almost complete form didn't ease the cleansing operation, which was complicated by the numerous cracks on both sides susceptible of generating new ones. Consequently, the cleansing unreeled through slight brushing in distilled water, in order to smoothly remove the thick soil deposits on the surfaces and the soluble mineral salts. As for the insoluble salts, they required local treatment with drops of 5% acetate acid and repeated plugging with textile material sodden in distilled water, which insured the neutralization (Fig. 16).

Fig.17 Reindeer mandible – after consolidating and drying

Around the dentition area brushing the soil deposits would have been difficult, so we used a professional dental kit for the shallow cavities in and between the teeth. After the fragments naturally dried, they were immersed in 10% varnish – Nitrolac and 90% acetone solution, following a second naturally drying stage (Fig.17).

Restructuring the mandible proved to be extremely difficult, due to some deformations induced upon the fragments by geological processes. Therefore, after gluing together the nine fragments with synthetic adhesive – Moment, a rather important area remained incomplete (Fig. 18). The next stage in restoring the natural aspect and dimensions of the piece required filling the missing parts.

Fig.18 Reindeer mandible – the reattachment stage

Fig.19 Reindeer mandible – the final stage

The filling material came in the shape of a homogenous paste formed by mixing fine-grained bone powder with synthetic resin. The filling was progressively applied using a modeling wax print until the re-building the missing areas. Afterwards the filled area suffered mechanical interventions meant to remove the exceeding material and to obtain the finishing shape (Fig. 19). All the conservation and restoration stages ended in an increase of internal and external resistance of the mandible, as well as in obtaining an aesthetic aspect, suitable for exhibiting purposes.

Concluding remarks

All interventions on the faunal material discovered and published so far ware made through methods and techniques especially designed to the consistent recovery and preservation of this kind of material, extremely sensitive and depending on all the conservation and restoration phases.

Since the degradation processes affecting bone, antler, teeth, ivory or shells may begin in the very moment of their recovery from the ground, being rarely reversible, we feel that the phases involved in their proper preservation and restoration must become common knowledge for every member of an archaeological team confronted with such discoveries. Surely, this could be a step forward towards an important set of meaningful results in acquiring and preserving valuable organic material up to a standard close to what could be a long-lasting state.