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PREPARATION AND CONSERVATION TREATMENTS OF THE PLEISTOCENE FOSSIL VERTEBRATE REMAINS FROM THE CAVE SITE OF TOSSAL DE LA FONT (VILAFAMÉS, CASTELLÓ, SPAIN).

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ABSTRACT

In this paper we present the preparation of some fossils from the Pleistocene levels of the cave site of Tossal de la Font. The presence of carbonated concretions, which is the main feature of these specimens, is a problem common to many remains from some calcareous caves. Treatments are based on mechanical cleaning, and intervention criteria are directed at recovering the palaeontological and archaeological information.

INTRODUCTION

The skeletal remains found in limestone caves frequently show problems related to the presence of calcium carbonate in the sediment. This product precipitates and hardens the sediment of the cave infill and, moreover, usually forms concretions that adhere strongly to the fossils. Although the problem is very common, there are few specific reports of material assemblages that illustrate the problem. In this paper we present the preparation and conservation work carried out on the remains recovered from the Pleistocene levels of the cave site at Tossal de la Font, which are representative of some problems that can be usually found at this kind of site.

THE SITE

The cave site of Cova del Tossal de la Font is located in the village of Vilafamés, 25 km north from the city of Castelló de la Plana (Spain). Research at the site in the early 1980's documented an Upper Pleistocene karstic infill with an interesting archaeo-paleontological record (Gusi et al. 1983, 1987), as well as human frequentation during the Holocene (Gusi & Aguilella, 1998). Excavations at the site were resumed in 2004 (Olària et al. 2007) and are still in progress.

The Pleistocene archaeological and palaeontological record includes the fossil remains of a variety of macromammals and a reduced assemblage of flint stone tools. Of particular note are the Neanderthal fossils discovered in the site, dated around 90,000 years ago (Arsuaga & Bermúdez de Castro, 1987, Arsuaga et al. 2001).

THE MATERIALS AND THEIR STATE OF PRESERVATION

The treated specimens are bones and teeth recovered during 2005-2008 field seasons in the Pleistocene units named I and II. Most of these remains belong to herbivores (mainly Cervidae, but also Caprinae, Bovinae, Equidae and Rhinocerotidae), and also to carnivores (Felidae), omnivores (Suidae), rodents

(Leporidae) and reptiles (Chelonia). Many of them are incomplete elements. The problems encountered when trying to conserve these materials are related to the limestone media in which they were found. Most of the treated fossils come from very compact and hard clay layers with calcium carbonate infilling. Digging up such sediment is difficult, and requires the use of chisels and other powerful tools to break it with great force. To avoid damage, some materials are consolidated, reinforced with gauze bandage or extracted by block lifting. Nevertheless, most of the fossils break during recovery.

Once recovered, the conservator is left with a material that is often fractured (sometimes into many fragments) and mostly covered by hard sediment strongly joined to the surface. This sediment can be roughly presented in two ways: first, as a thin and continuous carbonated layer with little clay (thickness less than 5mm); second, as thicker concretions, which may completely envelop the remains (made of carbonated clay including sometimes small limestone clasts).

It should be noted that approximately one quarter of the fossils recovered were not problematic because they presented only slight remains of clay sediment, fractures and loss of cohesion.

THE TREATMENTS

Criteria

The intervention criteria were focused on gathering the information present in the specimens. Therefore, we first reduced the use of both cleaning chemicals and consolidants where possible in order to respect the material and allow future research. Second, we tried to respect the bone surface so that it could be analyzed; this means that cleaning was performed with extreme care so as not to erode or scratch the surface. Finally, we had to clean and to reshape the fossils to a high degree to allow all their anatomical details to be studied. The key point was to find the equilibrium between the requirements of zooarchaeological,

taphonomical and taxonomical studies. Thus, in order to preserve the maximum information, the decisions regarding the intervention were adapted to each fossil depending on specific conditions such as its singularity or state of preservation. For example, when the fossil was deformed or broken prior to recovery (before or during the burial) we had to consider whether taphonomical or taxonomical information was more relevant. If taphonomical information was considered more relevant, then we did not reshape the specimen, whereas if we wanted to carry out a taxanomic study, we had to recover the original shape of the fossil.

General procedures

As most of the problems were related to the presence of carbonated matrix and to fragmentation, the treatments mainly consisted of cleaning and reshaping. Chemical cleaning was ruled out because of the risk of damage to the bones and because of the limited sensitivity of the sediment (which has high clay content) to chemicals. Cleaning was carried out with chisels, an ultrasound piezoelectric device, a pneumatic engraver and surgical tools (mainly scalpels) and it was sometimes done in combination with acetone, alcohol or water. Thin layers of sediment (up to 5mm) could be easily removed using scalpels or an ultrasound piezoelectric device. Thicker layers were more difficult to remove. Here, pneumatic engraving was sometimes useful, although the process was very time-consuming due to the extreme hardness of the matrix. The more powerful chisels could only be used on the largest specimens. Consequently, preparation was slow because we could not use tools as heavy as we would have liked. This meant that sediment often had to be removed by scalpel, which is very slow. In some cases, the adhesion of the bone surface to the sediment was higher than the cohesion of the bone itself: this meant that removing the matrix also meant removing a thin external layer of the bone. For this

reason, in certain cases we chose to leave the sediment instead of completely removing it. Finally, consolidation (when needed) was done with acrylic resin (3 to 10% solution of *paraloid B72* in acetone). Joining was done with cellulose nitrate adhesive or *paraloid B72*. In a few cases, we used calcium carbonate powder mixed with *paraloid B72* to fill in some voids.

FINAL REMARKS

Studying the materials of Tossal de la Font site means that they have to be prepared. The main problem affecting the fossils is the kind of matrix they come from, with calcium carbonate causing sediment hardening and the presence of concretion layers on the bones. This is a characteristic situation in many cave sites located in karstic environments. In such cases, staff trained in both excavation and preparation or conservation treatments are needed to recover and save valuable information.

In short, a conservator without experience in this field should remember that, while the conservation skills described are simple, special skills and tools are required to mechanically prepare and handle certain kinds of matrices. In addition to preparation and conservation skills, the conservator should have knowledge of fossil morphology because anatomical knowledge is the best guide when the fossils are almost completely embedded in a matrix that is not easy to remove. He or she should also be aware of which aspects of the fossils are going to be investigated in any given scientific study (e.g., bone surface, exact bone length, the relevant points of a tooth, etc.).

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FIGURES

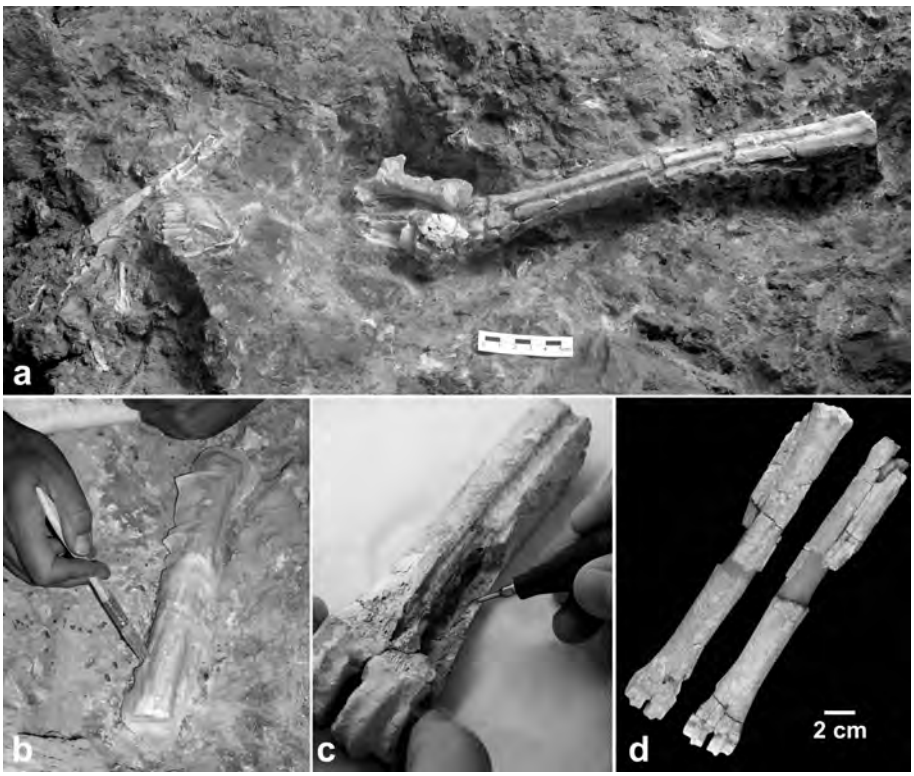

Figure 1. A deer metatarsal embedded in very compact and hard sediment **(a).** Application of a gauze bandage with consolidant prior to lifting **(b).** Removing sediment with an ultrasound piezoelectric device **(c).** Restored fossil including gap-filling **(d).**

Figure 2. A deer mandible embedded in its matrix **(a)**. The specimen and all the fragments broken during extraction **(b).** Prepared mandible **(c).**

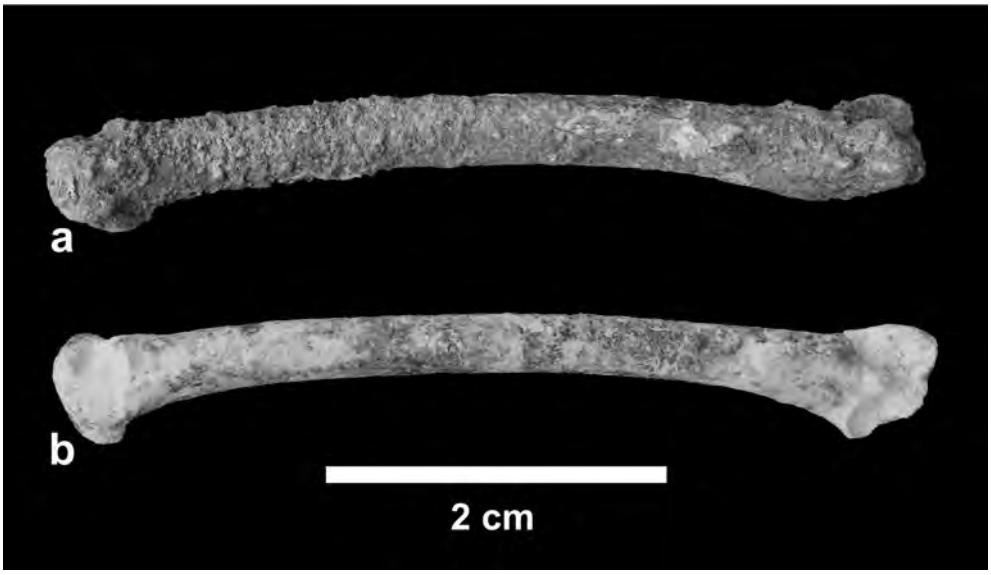

Figure 3. A wildcat metatarsal before **(a)** and after **(b)** the treatment. An example of a well-preserved fossil with a thin layer of carbonated sediment to be removed.