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# **ABSTRACT BOOK**

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## Microbial life on elephant fossil bones from La Polledrara di Cecanibbio. Is it a real threat for their conservation?

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La Polledrara di Cecanibbio is one of the most important palaeontological sites of the Quaternary period in Italy. It was found near Rome in 1984 within a program of territorial surveys promoted by the "Soprintendenza per i Beni Archeologici di Roma". The palaeo-surface corresponds to a riverbed that incised the tuff sediments of the Sabatino Volcanos during the Middle Upper Pleistocene. Overlying it, an extraordinarily rich level of fossil remains was found. During more than twenty years of excavation, over 20,000 bone remains have been unearthed from the fossiliferous deposits (Anzidei et al., 2012). Thanks to the rarity of the finds and their excellent preservation, a musealization of the site was disposed by Soprintendenza per i Beni Archeologici and it is currently under way. To date a museum structure covers a palaeo-surface portion of about 900 m<sup>2</sup>, where nearly 10,000 bones are exposed.

The exposed bones mostly belong to bovids (e.g. Bos primigenius) and elephants (e.g. Palaeoloxodon antiquus), while

only few remains belong to other ungulates, such as deer, rhinoceros, horses and boar. The remains of herpethofauna, birds, small mammals, carnivores, and primates, are stored in the depository of Soprintedenza dei Beni Archeologici.

The elephant bones which have been left in situ deserve an outstanding mention, because they make La Polledrara di Cecanibbio the most important elephant site in Italy. Their scientific value requires careful conservation strategies that sometime are in contrast with the exhibition in situ. In fact, the exhibition in situ favors on the one hand the best safeguard of any taphonomic information, as well as a complete fruition of the palaeontological site in its depositional context and major tourist feedbacks; but, on the other hand, it may expose this cultural heritage to the threat of a series of potential pollutant agents, both atmospherical and biological.



Fig. 1. A rib (A), sediment (B), and a vertebra (C) of elephant exposed at La Polledrara di Cecanibbio site contamined by biofilm.



Fig. 2. Scanning Electron Microscope (SEM) image at 600 magnification (A) and Optical Microscope image (B) of cyanobacteria filaments (*Leptolyngbya* sp.)



Fig.3. SEM image at 10.000 magnification of diatoms (*Diadesmis* sp.) in vital position observed on elephant tusk surface at the site of la Polledrara di Cecanibbio.

This mostly depends on the fact that at La Polledrara museum, the instability of the inside environmental conditions, mostly influenced by changes in relative humidity, seasonal temperature, sun irradiation, as well as by the presence of people working at the excavation. These factors have been determining the development of biofilms both on the palaeo-surface of the deposit and on fossil bones (Fig.1).

The colonization and the damages of artwork of wide cultural importance by microbial activity has been described by many scholars (Crispim & Gaylarde, 2003; Albertano & Urzì, 1999; Albertano, 2003, Sterflinger, 2010) but only few researches have been dedicated to fossil bones (Jans & Kars 2002; Schoeninger et al, 1989).

Here we present the first results of a study, mostly focused on the preservation of the elephant bones of this site, aimed to:

- Assess the development of the biofilm covering both palaeo-surface and bones through a qualitative and quantitative study of its components;
- 2. Verify if the microbial activity may represent a real threat for the preservation of La Polledrara fossils in situ by analyzing the physical and chemical alterations on bone surfaces, using taphonomic and spectroscopic methodologies;
- 3. Find methods and develop strategies to reduce the proliferation of biomasses, which definitely affects the beauty of the site and limit the fruition of its cultural value.

The over one year monitoring of bones and sediment surface at la Polledrara di Cecanibbio, carried out by means of photographic documentary reports and maps, has provided the first assessment of the areas most extensively stricken by biofilm growth. A non-invasive sampling of organic material on elephant bones and the microscopic observations (optical microscope, Scanning Electron Microscope and Confocal Microscope) shows that the most extensive biofilm patina is composed of photosynthetic cyanobacteria and microalgae, often associated to fungi, mosses and diatoms which grow in the proximity of the windows and entrances (Fig. 2 and 3).

Ongoing research, the first thus far performed in Italy on fossil material exposed in situ, also intends to develop a pilot project to improve the preservation of the entirety of these types of paleontological sites, especially against biological attacks, so contributing to produce a correct balance between conservation and public fruition of these cultural heritages.

#### **References**

Albertano, P., Urzì, C. 1999. Structural Interactions among Epilithic Cyanobacteria and Heterotrophic Microorganisms in Roman Hypogea. Microbial Ecology 38, 244–252

Albertano, P. 2003. Methodological Approaches to the Study of Stone Alteration caused by Cyanobacterial Biofilms in Hypogean Environments, in Koestler R.J., Koestler V.R., Charola A.E. and Nieto-Fernandez F.E. (Eds.) Art, Biology and Conservation: Biodeterioration of Works of Art, The Metropolitan Museum of Art, New York, 302-315.

Anzidei, A. P., Bulgarelli, G. M., Catalano, P., Cerilli, E., Gallotti, R. Lemorini, C., Milli, S., Palombo, M. R., Pantano, W., Santucci, E. 2012. Ongoing research at the late Middle Pleistocene site of La Polledrara di Cecanibbio (central Italy), with emphasis on human elephant relationships. Quaternary International 255, 171-187.

Crispim, C.A., Gaylarde C.C. 2003. Cyanobacteria and Biodeterioration of Cultural Heritage: A Review. Microbial ecology 49 (1), 1-9.

Jans, M. M. E., Kars, H. 2002. In situ preservation of archaeological bone: a histological study within a multidisciplinary approach. Aechaeometry, 44 (3), 343-352.

Schoeninger, M. J., Moore, K. M., Murray, M. L., Kingston, J. D. 1989. Detection of bone preservation in archaeological and fossil sample. Applied Geochemistry 4, 281-292.

Sterflinger, K. 2010. Fungi: their role in deterioration of cultural heritage. Fungal Biology reviews 24, 47–55.

