ABSTRACT

When exposed to heat, bones experience fragmentation and alterations, both interfering with their analysis. As the first step of the anthropological process, the identification of the human or non-human origin is fundamental for forensic cases and the interpretation of funerary practices in archaeology as well. In the second chapter of this thesis, a global evaluation of the histomorphometric approach was carried out by applying four methods on bone fragments of known origin. This study revealed important methodological shortcomings and decreased reliability when applied to fragments. Moreover, a better knowledge of how heat affects microstructures is necessary to optimize the use of this approach. Therefore, this work aims, in a third step, to explore in detail the histomorphometric changes of Haversian systems exposed to different temperatures. Using 736 histological cross-sections taken in mirrors of each other on human and non-human samples, it was possible to demonstrate a significant shrinkage of the osteon at 700°C, leading to the deformation of its structure and the Haversian canal. These structural modifications are in line with the major physicochemical changes observed in bone heated at high temperatures. Despite the heat-induced transformations, significant differences between human and non-human Haversian tissue from a qualitative and quantitative point of view were observed over the whole temperature range. These differences led to the development of an identification method based on a random forest algorithm that provides precision over 98%. This method was built from several sub-sections per bone to address the intra-bone variability and to be more suitable for fragment identification. A proteomic approach was also explored in the fourth part of this work. By characterizing the proteins contained in bones, it was possible to identify with certainty the taxon of unburned samples, but also those heated at 200°C for 30 and 60 minutes. This approach is extremely promising for use on bones heated at low temperatures. In the last chapter of this work, the identification of bone fragments from a domestic fire in a private residence allowed us to compare these two approaches and to identify their respective advantages and disadvantages in a forensic context. This thesis work enriches and contributes to the progress of research focused on the identification of bone remains in anthropology.

Key words: Histomorphometry, Histomorphology, Bone protein, Heat-induced modification