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Experimental burning and real fire scenarios: Are they comparable in terms of chemical anthropology?

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Burned skeletal remains often undermine the anthropological methodology's reliability due to heat-induced changes (HIC). Research based on controlled experimental burnings has tried to address this problem, but may not replicate real scenarios as it employs homogeneous heating provided by an electrical furnace. In contrast, real fire situations are often more heterogeneous with intermittent heating caused by the constant on and off action of the flames. The objective of this research was to assess the value of spectroscopic analyses on dry skeletal remains depends on the type of burning event: i) electric furnace (homogeneous) and ii) open-air ignited trailer (heterogeneous). The association between organic phase pyrolysis and temperature and between the inorganic phase and individual chemometric indices was investigated in order to examine for differences. A sample of 70 right antimere belonging to the 21st Century Identified Skeletal Collection (CEI/XXI) and a sample of 30 antimeres from the Non-Identified Skeletal Collection (NISC) from the Santarem Cemetery housed at the Laboratory of Forensic Science in the University of Coimbra, Portugal were used in this study. Both skeletal collections were burned with temperatures ranging from 500 ℃ to 1050 °C. The methods used to analyze the samples are vibrational spectroscopy and inelastic neutron scattering spectroscopy. It was possible to observe through spectroscopic analyses that in the organic phase, a relation between the concentration of the chemical elements and maximum temperature was present in both samples. The same was observed for the inorganic phase and the chemometric indices. Results of this small experiment suggest that maximum temperature estimation and the individualization of commingled burned skeletal remains based on heat-induced recrystalization and diagenesis are possible in varied burning conditions. Therefore, the assessment of the parameters in real-fire settings appears to be quite promising.

Keywords Burned human remains; Forensic anthropology; Heat- induced changes

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