



A38 Risen From the Ashes: An Exploratory Study for Developing New Methods of Analyzing Cremated Human Remains

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After attending this presentation, attendees will better understand potential new methods of recreating pertinent biological profile information, specifically the estimation of sex, of remains that have undergone cremation or burning.

This presentation will impact the forensic science community by providing results from an exploratory study of an area with little current or previous research. This presentation will add to research being conducted in the field of forensic anthropology by demonstrating how biological profile estimates are affected by a burning episode and how potential new methods may contribute to more accurate assessments of sex when human remains have undergone burning.

Reconstructing the biological profile of remains that have undergone burning or cremation often proves to be a difficult task due to the nature of damage that is incurred when bone is exposed to fire, such as warping, heat-induced fracturing, and alterations to bone shape.¹ These changes are compounded by the relatively small amount of literature available on the topic. This often forces the forensic anthropologist to rely on more traditional methods of assessing the biological profile since there are few cremation-specific methods available. While these methods can be applied successfully in many cases, it would be desirable to utilize methods designed specifically for cremated remains.

The basis of this research comes from data collected for a master's thesis in 2016 utilizing 49 cremations from the William M. Bass Donated Skeletal Collection housed at the University of Tennessee, Knoxville. Forty of the cremations were unprocessed (not pulverized after cremation) and the remaining nine cremations were processed. Each of the unprocessed cremations was carefully analyzed to determine which skeletal elements consistently survived cremation and whether they would be useful for identifying potential new methods of estimating biological profile. All skeletal elements deemed to be potentially useful were measured to determine if size sexual dimorphism was present. More traditional methods of estimating biological profile were also tested to determine which methods returned the most accurate estimates. Age was estimated for the unprocessed cremations using methods created by Brooks and Suchey, Buckberry and Chamberlain, Lovejoy et al., Meindl and Lovejoy, and Todd.²⁻⁷ Sex was estimated using robusticity of the skeleton, the heads of the humeri and femora, as well as morphological traits of the skull and pelvis.⁸ The weight of cremains was also used to estimate sex for both the processed and unprocessed remains using studies performed by Bass and Jantz, Van Deest et al., and Warren and Maples.⁹⁻¹¹ Stature was estimated using the Steele method of partial bone length reconstruction and Trotter's formulas for estimating stature from lone bone lengths.^{12,13} The estimates were then compared with known demographic data of the individuals to assess which methods returned the most accurate estimates of the biological profile.

It was determined that a total of six skeletal elements/portions displayed size sexual dimorphism and may be useful for constructing new methods of estimating sex of cremated remains. These were the heads of the humerus, femur, and radius, the mandibular condyles, the first sacral vertebra, and the ischial tuberosities. Each of these elements/portions survived frequently in the cremations studied and could be measured and/or observed for size dimorphism. After assessing the results of the traditional methods of estimating biological profile, it was determined that sex was best able to be estimated using morphological traits of the skull and pelvis. Age at death was most accurately estimated using the Lovejoy et al. and Meindl and Lovejoy methods of assessing the auricular surface, and stature was best estimated using the Steele and Trotter methods paired together.^{4,5,12,13} Ancestry was unable to be estimated for any of the cremations studied.

In conclusion, it was determined that it does appear feasible to develop new specific methods of estimating sex for remains which have undergone burning. While new methods of estimating age at death, ancestry, and stature could not be developed, it was determined that traditional methods can be used to accurately estimate age at death and stature for burned remains. This is important to the field of forensic anthropology as it demonstrates that there is potential to develop cremation-specific methods of estimating biological profile, which may lead to more accurate estimates of age at death, sex, and stature for remains which have undergone burning.

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Cremation, Human Remains, Forensic Anthropology