A57 Validating Isoscaping Methods: A Study of Oxygen, Strontium, and Sulfur

Tamara Tyner, MA, Neosho Rapids, KS 66864; Daniel J. Wescott, PhD, Texas State University, San Marcos, TX 78666-4684; Nicholas P. Herrmann, PhD, Texas State University, San Marcos, TX 78666; Tiffany B. Saul, PhD, Forensic Institute for Research and Education, Murfreesboro, TN 37132*

Learning Overview: This presentation aims to inform attendees of the benefits and limitations of using isotopes as a means of geolocation or residency prior to death in a modern forensic setting.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by ensuring attendees have a better understanding of this tool, leading to an improvement of the performance of isoscaping in a modern human population.

Isotopic analysis can be a useful tool for forensic anthropologists when trying to identify unknown persons. Specifically, oxygen, strontium, carbon, and nitrogen from teeth, bone, and hair have been used to evaluate and predict geographic location and diet of human remains. By using ten individuals from the Texas State Donated Skeletal Collection with known residential histories, this study aims to provide insight on the precision and accuracy of this tool. Two samples were taken from each donor, one tooth and one portion of cortical bone from the rib, in order to evaluate childhood and adult geolocations. Oxygen and strontium analyses were completed for each sample; sulfur analysis was completed only for cortical bone samples.

Oxygen and strontium analyses were prepared for each of the 20 samples and the resulting values used to create a predictive isoscape. This map was then compared to the self-reported place of birth and end-of-life residency locations. Analyses of oxygen data have been delayed due to the COVID-19 pandemic and will be available at the time of presentation. Strontium ratios accurately predicted the location of 60% of the analyzed individuals; 15% were within a 5-mile radius of the closest predicted location and the remaining 25% were within a 30-mile radius of the nearest predicted location. This research concludes that isoscapes are an effective tool but with a broad prediction range. A multi-isotope approach should be used for more precise analysis, and caution should be taken to prevent the search from becoming too narrow. Researchers should account for modern issues such as commuting and water sourcing when creating predictive isoscapes.

Sulfur analysis was also performed on each cortical bone sample to determine if sulfur isotope ratios of human bone may be useful for geolocation purposes. The ten donors were separated into inland and coastal populations, and a *T*-test was performed for assessment of regional difference and was not found to be significant ($t(8)=2.3060$, $p=0.5275$). A visual representation was also created, but there is no visual separation between coastal and inland populations. For dietary analysis, a Pearson correlation test was performed to compare sulfur and carbon, sulfur and nitrogen, and finally carbon and nitrogen. Sulfur and carbon ($r=0.0635$, $p=0.8616$) and sulfur and nitrogen ($r=0.1528$, $p=0.6735$) were not found to be significantly correlated. Carbon and nitrogen ($r=0.6698$, $p=0.0341$) were found to be of significant relation. This research concludes that sulfur analysis of bone collagen within a modern human population is not a useful geolocation tool.

Isotopes, Isoscaping, Identification