A154 Multi-Isotope Approaches for Region of Origin Predictions of Unidentified Border Crossers (UBCs) From South Texas

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The goal of this presentation is to highlight the value of using a multi-isotope approach for predicting the region of origin of UBCs found deceased in the United States. Attendees will gain a better understanding of how stable isotopes can be used as a geolocation tool for unidentified remains of suspected foreign nationals from Latin America.

This presentation will impact the forensic science community by presenting novel approaches that can assist with unidentified remains cases, especially for foreign nationals.

Since 1999, the remains of more than 6,000 UBCs have been recovered along the United States-Mexico border. While increases in border security during the past two decades have reduced the number of border crossings, this period has been marked by a sharp increase in UBC deaths as migrants are forced to travel through more inhospitable areas, often dying due to heat-related illness. In 2011, the number of deceased UBCs in south Texas exceeded that of Arizona, with the majority of the deceased representing Central American nationals. Most of the deaths in Texas occur near the Falfurrias checkpoint in Brooks County, approximately 80 miles north of the border. This high volume of deaths has resulted in a massive identification challenge. Many barriers to identification exist, including lack of documentation, decomposition of remains, lack of antemortem records, and difficulties obtaining family reference DNA samples. In 2013, forensic anthropologists began exhuming unidentified remains interred in a cemetery in Brooks County for analysis and identification. Several field seasons of exhumations have recovered hundreds of UBC remains, which are currently being analyzed and identified through the efforts of Texas State University and its collaborators.

Stable isotope analysis can aid in identification efforts of unknown decedents, including UBCs from south Texas. Carbon and nitrogen isotope ratios of human tissues reflect cultural dietary practices, which can be used to screen remains as being of likely United States vs. Latin American origin. Oxygen and strontium isotope ratios of bone and tooth enamel reflect the geographic origins of an individual based on the source inputs of water and food, respectively. Further, these isotopes can be used to predict possible regions of origin using geospatial mapping tools (e.g., isoscapes). Although baseline data are incomplete for many regions within Latin America, a multi-isotope approach can provide numerous lines of evidence for predicting region of origin of UBCs.

This study presents isotope results for 30 UBC bone-tooth pair samples from Brooks County, provided by Texas State University. Bones and teeth were prepared for mass spectrometry, including carbon and nitrogen isotope analysis of bone collagen, carbon and oxygen isotope analysis of bone bioapatite and tooth enamel, and strontium isotope analysis of tooth enamel.

The mean bone collagen $\delta^{13}C$ value is –13.3‰ (±2.4‰, 1 Standard Deviation (SD); *range*=10.2‰) and the mean $\delta^{15}N$ value is +9.1‰ (±1.1‰, 1 SD; *range*=4.4‰). The mean bone bioapatite $\delta^{13}C$ value is –7.8‰ (±2.6‰, 1 SD; *range*=9.3‰). Tooth enamel, which reflects childhood diet, exhibits an even greater range of variation, with a mean $\delta^{13}C$ value of –4.9‰ (±3.0‰, 1 SD; *range*=13‰). The mean $\delta^{18}O$ value is –6.7‰ (±1.2‰, 1 SD; *range*=5.0‰) for bone bioapatite and –5.7‰ for tooth enamel bioapatite (±1.3‰, 1SD; *range*=6.0‰). The mean $^{87}Sr/^{86}Sr$ ratio for enamel is 0.70705 (±0.00126, 1SD; *range*=0.00617).

Carbon isotope ratios of bone collagen as well as bone bioapatite and tooth enamel are consistent with previous data on UBCs from south Texas, which reveal a high dietary contribution from C_4 resources such as corn. The high degree of variation in $\delta^{13}C$ values is primarily influenced by three individuals with very low $\delta^{13}C$ values for their bone collagen and bone and tooth bioapatite. Prediction maps based on oxygen and strontium isotope ratios further suggest these individuals may be of United States origin as opposed to Latin American nationals. The other 27 individuals have $\delta^{13}C$ values consistent with a Latin American origin. Measured $\delta^{15}N$ values reveal low variation, consistent with heavy consumption of terrestrial herbivore meat by all individuals. For the majority of the 30 UBC samples, isotope prediction maps based on oxygen and strontium isotopes are consistent with a Latin American origin and often include areas within Mexico as well as portions of Central America. Future research will seek to further narrow possible regions of origin.

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