A96 The Application of Stable Isotopes and Geostatistics to Infer Region of Geographic Residence for Undocumented Migrants

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The goals of this presentation are to: (1) determine how undocumented migrants fit into the established models by constructing coarse-grained baseline strontium and oxygen isoscape models using published data; and, (2) determine if using a probability assignment method for the dual-isotopes can aid in estimating the most likely regions of geographic residence for unidentified deceased migrants recovered along the Texas-Mexico border. Establishing residential history can reduce the potential matches for unknown cases within the National Missing and Unidentified Persons System (NamUs) database and potentially aid in generating positive identifications for deceased migrants.

This presentation will impact the forensic science community by shedding light on the issue occurring at the southern border and promoting interdisciplinary approaches to forensic and human rights problems.

Hypothesis: A dual-isotope isoscape and likelihood assignment method can be used to estimate region of origin for deceased migrants recovered along the Texas-Mexico border and improve the probability of making a positive identification.

Outcomes: This presentation will elucidate the humanitarian crisis occurring at the United States-Mexico border and promote interdisciplinary approaches to forensic identification and human rights issues. Specifically, applying methods from biogeochemistry and geostatistics to answer forensic anthropological questions will advance the field's foothold in the forensic sciences. An additional outcome is closure for the families that have lost loved ones and can finally have them returned home and laid to rest.

Synopsis/Methods: Recently developed bedrock, water catchment, and soil strontium isoscape models for Mexico, Central America, and the Caribbean are adjusted using bioavailable strontium ($^{87}Sr/^{86}Sr$) data collected from a variety of published sources. Oxygen (^{18}O) precipitation data are gathered from the Global Network of Isotopes in Precipitation online database. Digital Elevation Models)DEMs) are factored into the oxygen isoscape to account for isotopic changes in elevation for oxygen precipitation isotopes. Compiling the oxygen and strontium data in arcGIS® produced a multi-layered isoscape depicting isotopic variation in Central America, Mexico, and the Caribbean. Using the Operation Identification collection at Texas State University, dental samples (preference is given to maxillary premolars) are collected from five individuals (n=5) and analyzed for strontium and oxygen. Associated cultural material recovered with the deceased migrants are used as a predictor for region of geographic residence (e.g., an individual carrying quetzals is more likely to originate from Guatemala than Mexico). Strontium and oxygen isotope values extracted from the teeth are run through a likelihood assignment model established in previous publications to produce probability densities for the most probable regions of residence for each individual.

Results/Conclusions: The goal of the research is to map the isotopic variation. The likelihood assignment model in R studio uses probability densities to estimate most likely region of origin. After running the strontium and oxygen ratios through the model, the results consist of multiple heat maps displaying the probability densities for regions of most likely origin for each of the five individuals. Strontium isoscapes tend to be the more accurate model for provenancing migrants, while the oxygen isoscape for the region has a low accuracy rate due to the lack of precipitation data for the regions. Overall, the dual-isotope approach proves successful in narrowing the region of geographic residence for deceased migrants recovered near the Texas-Mexico border. Adding more strontium and oxygen data to each of the isoscapes will improve the method, allowing it to be applied to all migrants recovered along the United States-Mexico border and to be adapted for other regions of the world where deceased unidentified humans are recovered. The implementation of geostatistical and biogeochemical methods to investigations of unidentified human remains will improve existing techniques and increase the efficiency of current identifications.

Spatial Analysis, Forensic Anthropology, Stable Isotopes

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