



A113 Isotope Analysis in Modern Colombian Teeth: A Forensic Application

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Learning Overview: After attending this presentation, attendees will have learned the results of isotopic research in Colombia, which aims to evaluate the usefulness of a multi-isotope approach using carbon ($\delta^{13}\text{C}$), oxygen ($\delta^{18}\text{O}$), strontium ($^{87}\text{Sr}/^{86}\text{Sr}$), and lead ($^{206}\text{Pb}/^{207}\text{Pb}$, $^{208}\text{Pb}/^{204}\text{Pb}$) isotopes for the prediction of region-of-origin of skeletal remains in Colombia.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by revealing: (1) if Colombian isotopic data differs within the country and between those of other countries; (2) which isotope system can be most useful to determine if an individual is likely to be of Colombian origin; (3) if regional dietary patterns were observed; and (4) if $\delta^{18}\text{O}$ in enamel bioapatite varies according to altitude as expected.

The application of stable isotopes to human identification is a rapidly expanding field in forensic science due to the valuable information isotopes can impart about the geographic origin and geographic life history of an individual.

Currently, the country of Colombia faces a massive identification crisis because of long-term violence due to socio-political conflict and criminal activity. The government databases estimate that there are currently between 10,000 and 22,000 unidentified persons; therefore, methods that can assist in narrowing identification possibilities are needed.¹

The sample was composed of modern permanent teeth from Colombia and published Colombian data. The sample included 97 donated teeth of individuals with known demographic information from the cities of Bogota, Cali, and Neiva (approved by the Institutional Review Board of Binghamton University), as well as published data from 61 teeth from the Medellin skeletal collection from individuals with known demographic information.

Overall, carbon isotopes in the tooth enamel carbonate show a diverse range with $\delta^{13}\text{C}$ values between -14.09‰ to -2.80‰, which falls in the range of reported values from the United States. However, there are significant differences in $\delta^{13}\text{C}$ values between some Colombian cities (e.g., Cali, Medellin, and Cartagena). Oxygen isotopes in the tooth enamel carbonate show a range of $\delta^{18}\text{O}$ values between -9.64‰ to -2.74‰; a slight trend in decreasing $\delta^{18}\text{O}$ values with increasing altitude is observed, in addition to differences between individuals who live in the coast and highlands (e.g., Cartagena vs. Bogota).

Colombian tooth enamel has $^{87}\text{Sr}/^{86}\text{Sr}$ values between 0.70475 and 0.71839, which fall within the range of reported values from other regions (e.g., Mexico). However, differences between cities are observable (e.g., Cali vs. Bogota). Analysis of the lead isotopic composition is $^{206}\text{Pb}/^{204}\text{Pb}=17.972$ to 18.976 , $^{207}\text{Pb}/^{204}\text{Pb}=15.576$ to 15.683 , and $^{208}\text{Pb}/^{204}\text{Pb}=37.819$ to 38.602 . Lead isotopic data seems homogeneous; however, slight differences between Colombia, United States, and European values are observed.

This presentation will provide insights about isotope analysis in Colombia and the utility of a multi-isotope approach for determining place-of-origin of an individual. In addition, by generating a Colombian baseline for future place-of-origin predictions, it contributes to the identification and search for missing people in Colombia. The differences found between countries will be useful for forensic purposes on a continental and global scale. This Colombian data will have international applications, such as helping with identifying missing people who die crossing the border or by natural or human-made disasters.

Reference(s):

¹. Sanabria, M.C. and H. Osorio. 2015. Ciencias forenses y antropología forense en el posconflicto colombiano. *Revista Criminalidad*, 57 (3): 119-134.

Isotope Analysis, Colombia, Forensic Anthropology