



A112 Isotopic Analyses of New York City's Unidentified Individuals: Differentiating Migrants From Local Residents in a Multicultural Metropolitan Context

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Learning Overview: After attending this presentation, attendees will understand how geolocation and dietary isotopic data are used to aid in differentiating migrants from local residents from a sample of long-term unknown individuals in New York City, a large, urban multicultural region with high residential mobility.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by improving understanding of the complexities of employing geolocation and dietary isotopic methods for decedent identification purposes in a multicultural metropolitan context.

Isotopic analyses of human remains provide geolocation and dietary information to the biological profile, furthering efforts to identify long-term unknown individuals. Geolocation isotopes including oxygen ($\delta^{18}\text{O}$) and strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) and dietary isotopes such as carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) are commonly employed to indicate geographic origins and residential mobility of unidentified decedents within the United States and globally.¹⁻³ Since an individual's isotopic values are derived from ingested food and beverages during life, the homogenization of foods via the "supermarket effect" has potential for blurring regional distinctions for geolocation purposes. Moreover, culturally influenced food traditions pose interpretative complications, especially in multicultural metropolitan regions such as New York City.

In this study, multiple isotopic systems were employed to analyze tissue sets (hair, nail, bone, enamel) of 28 forensic cases of unknown identities in the custody of the New York City Office of Chief Medical Examiner (NYC OCME) to characterize dietary practices and residential histories. Bone and enamel apatite $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ analyses of the 28 individuals and hair $\delta^{18}\text{O}$ analyses of a subset of 8 individuals were acquired from IsoForensics, Inc. Additional bulk bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values and incremental enamel $^{87}\text{Sr}/^{86}\text{Sr}$ values via laser ablation were contributed to the case profiles. Hair $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of 42 living residents of New York City were analyzed and used as a dietary comparative dataset. $\delta^{18}\text{O}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ values of unidentified remains were compared to published isoscapes based on individuals of known residence and tap water values using established conversion equations.^{2,4,5} $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were incorporated into dietary models of protein consumption and general dietary groups.⁶

Of the 28 NYC OCME forensic cases, enamel analyses yielded average imbibed water $\delta^{18}\text{O}$ values -7.6‰ , ranging from -12.9‰ to 2.0‰ , and $^{87}\text{Sr}/^{86}\text{Sr}$ values of 0.7128, ranging from 0.7067 to 0.7258. Based on enamel $\delta^{18}\text{O}$ values alone, 14 individuals resided locally during childhood years. According to combined enamel $\delta^{18}\text{O}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ data, only 3 individuals were interpreted as local to NYC during childhood years. Bone apatite $\delta^{18}\text{O}$ values suggest 19 individuals resided locally during adulthood. From the 8 hair and nail $\delta^{18}\text{O}$ values, 2 individuals were identified as local residents within months of death. Bone collagen $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values averaged -15.9‰ and 10.1‰ , respectively, and indicate a range of diets ($\delta^{13}\text{C}=-19.0$ to -12.9‰ ; $\delta^{15}\text{N}=7.3$ to 11.7‰). Modern NYC residents have lower $\delta^{13}\text{C}$ values than the case sample, indicating relatively more C_3 -based diets. Six individuals have $\delta^{13}\text{C}$ values higher than -13‰ and lower than -17‰ , which is suggestive of non-United States and/or culturally influenced dietary practices.³

Two cases are explored in depth, both of which are interpreted to have migrated into the United States. Multiple isotopic data of one individual with an identity confirmed through DNA illustrate overlapping United States and non-United States isoscapes and a C_3 -based dietary practice, which combined led to a misidentification of the individual's potential residences. Data from a second case, still pending identification, yielded a heavily C_4 -based dietary practice and an extremely wide range of $^{87}\text{Sr}/^{86}\text{Sr}$ values visible through laser ablation, which strongly suggest a non-United States residence. These two cases are used to demonstrate methodological limitations and areas of potential for determining whether an individual crossed a border in his/her lifetime.

Reference(s):

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Isotopic Analysis, Unidentified/Unknown, Forensic Anthropology