

APPLICATION OF STABLE ISOTOPE ANALYSIS FOR PROVENANCING HUMAN REMAINS RECOVERED FROM ASIA AND THE PACIFIC

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AIMS/OBJECTIVES: Stable isotope analyses have provided novel approaches for provenancing unidentified human remains in forensic contexts. This study focuses on human bone obtained through efforts of the United State's Defense POW/MIA Accounting Agency. Stable carbon and nitrogen isotope analyses were used to determine whether U.S. remains could be distinguished from S.E. and N.E. Asian remains.

METHODS: We measured carbon and nitrogen isotope ratios of collagen isolated from over 100 human bone samples. Samples were recovered from known battles or incidents and while the identity of each individual may not be known, their origin was known – either U.S. or Asian. Mitochondrial DNA and haplogroup assignments by either the Ministry of National Defense Agency for KIA Recovery and Identification or the Armed Forces DNA Identification Laboratory were available.

RESULTS: Carbon isotope data formed a bimodal distribution, suggesting the individuals' diets contained varying amounts of C₃ and C₄ resources. There was minimal overlap in $\delta^{13}\text{C}$ values between U.S. personnel and Asians; U.S. $\delta^{13}\text{C}$ values were significantly elevated relative to Asians. Significant overlap between U.S. and S.E. Asian remains was found for $\delta^{15}\text{N}$ values, but little overlap was observed between U.S. and N.E. Asian remains. An earlier, smaller study (1) demonstrated that linear discriminant function analysis correctly classified over 95% of remains based on carbon isotope analysis alone. Using both carbon and nitrogen isotopes, this study yielded an 86% accuracy rate for discriminating U.S. and N.E. Asian samples and 100% accuracy rate for discriminating U.S. and S.E. Asian samples.

CONCLUSION: This study demonstrated the usefulness of stable carbon and nitrogen isotope analyses for estimating the provenance of human remains recovered from Asia and the Pacific. The technique can be used as a screening tool to efficiently identify probable U.S. personnel, and can indicate which remains should undergo identity testing (e.g., DNA analysis).

1. Bartelink EJ, Berg GE, Beasley MM, Chesson LA. Ann Anthropol Pract 2014; 38:124-136.