## A145 Using Fourier Transform Infrared-Attenuated Total Reflection (FTIR-ATR) to Measure Bone Degradation and Crystallinity for Forensic Reconstruction

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After attending this presentation, attendees will understand: (1) how FTIR-ATR can be applied to determine bone diagenesis; and, (2) how the degree of diagenesis can aid in depositional and taphonomic reconstructions, particularly in a forensic context.

This presentation will impact the forensic science community by offering a new method for weathering estimation and reconstruction of diagenetic processes. This method for assessing the crystallinity of bone may provide a more accurate representation of diagenesis than established methods of weathering, such as the Behrensmeyer weathering estimation, Postmortem Interval (PMI), and Accumulated Degree Days (ADD), and can be used in recent contexts.

Recrystallization is directly correlated to the loss of the organic components of bone.[2-4,7,11] The relationship between bone degradation and recrystallization is important for forensic science because it focuses on the process of degradation and removes chronological time as a variable. Due to the current qualitative methods for assessing the degree of diagenesis, analyzing human remains can only provide a very broad understanding of depositional context. Quantitative approaches must be established to create a system of standardization. The goals are to provide quantitative data to support weathering observations by analyzing diagenesis and to determine if different stresses provide the same or different degrees of crystallinity and diagenesis.

Studies previously addressing the question of bone crystallinity have used the FTIR-Potassium Bromide (KBr) method, but often do not report the relationship between crystallinity and diagenetic stress. The Behrensmeyer technique also does not discern between alterations different depositional and taphonomic environments.[2] Using the degree of recrystallization to assess degree of diagenesis will provide a more detailed and empirical objective scale to be used in conjunction with other methods to reconstruct the full depositional history of any organic bone remains, which is important in forensic science reconstruction.

FTIR-ATR was used to examine the degree of recrystallization and the uptake of specific carbonates from various weathering processes to try to understand bone degradation better. In turn, the goal was to use this information to better categorize degrees of weathering and processing. The use of KBr pellets has been the historical method for FTIR preparation for anthropologists, but the limitations have often been documented in literature.[1,7-10] Benefits of KBr pellets include its ability to use smaller sample sizes, its ability to make quantitative analysis easier, and its ability to not produce interfering wavelength bands; however, serious drawbacks include extensive preparation, changes that may occur during the pressing process, possible water absorption, and possible "solid ion exchange with inorganic compounds."[6]

Preliminary data, analyzed through Multivariate Analysis of Variance (MANOVA) tests, demonstrate that there is no statistically significant relationship between the processing groups and their crystallinity index (Carbon/Phosphate ratio and Splitting Factor ratio). This suggests that the crystallinity index is not a useful measurement or factor for reconstruction, but FTIR-ATR is still a useful tool for measuring the crystallinity index.

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**Forensic Anthropology, Diagenesis, Forensic Reconstruction**



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